FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

GHANA FEED THE FUTURE AGRICULTURE POLICY SUPPORT PROJECT (APSP)

AGRICULTURAL INSURANCE IN GHANA

Contract No. 641-C-14-00001

USAID
FROM THE AMERICAN PEOPLE

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Content

I. Introduction

Agriculture is a key sector for Ghana's economy. In 2013, agriculture accounted for 22% of Gross Domestic Product (GDP) and 45 % of total employment (SRID). Agricultural exports are substantial, with a share of 19.4 % of total exports in 2012 (CIA, FAOSTAT). In addition, 49 % of the population lived in rural areas as of 2010 (SRID). Unfortunately, agricultural production in Ghana is also vulnerable to major shocks caused by climatic risks (e.g., drought, excess rain, windstorms, and floods), natural perils (e.g., bush fires), and biological hazards (e.g., pests and diseases) (Stutley). The average annual combined losses to Ghana's main food crops stemming from such hazards have been estimated to be approximately 5.5 % of the total value produced (Stutley).

Because of the high exposure of Ghana's agriculture to various types of risks, combined with the strong dependence of the overall economy on the sector, finding ways to ameliorate the impact of such risks is critical to improve the well-being of a large share of the nation's population. Historically, insurance has been used by many countries to help manage risks in agriculture (Mahul and Stutley). Further, over the last two decades, innovations in technology and contract design have led to major initiatives promoting the adoption of agricultural insurance in developing countries (IFAD, Roberts). Correspondingly, agricultural insurance has been advocated in recent years as an important tool to address the risks faced by Ghanian agriculture.

Sizable resources have been devoted to developing agricultural insurance programs for Ghana over the last few years.[1] Nonetheless, insurance takeup has been disappointing. This fact provides the motivation for the present report. The main purposes of this analysis are to explore the likely reasons why agricultural insurance programs have not fared as well as hoped for in Ghana, and assess their potential for widespread adoption in the future.

[1]For example, funding for the "Innovative Insurance Products for the Adaptation to Climate Change" (IIPACC) project discussed later in Section IV amounted to 3.832 million euros (Gille).

The report proceeds by providing a brief overview of agricultural insurance in the second section. The third section reviews research studies related to agricultural insurance with specific applications to Ghana. This is followed in the fourth section by a description of recent developments and the current status of Ghana's agricultural insurance programs. The fifth section summarizes the outcomes of an informal survey of stakeholders' opinions regarding (a) the reasons for the programs' past performance, and (b) the issues to address to enhance the likelihood of future success. In the sixth section, the prospects for the successful establishment of agricultural insurance in Ghana are assessed. The seventh and final section provides concluding remarks.

II. Agricultural Insurance: Basic Concepts

Agricultural producers resort to a variety of strategies to cope with the risks they face. Some strategies are based on technical tools (e.g., irrigation, input choices, and mix of activities), whereas others rely on financial arrangements (e.g., hedging, insurance, and strategic savings/disinvestments). Agricultural insurance is a financial risk-management tool often available to farmers in developed countries, achieving in some instances substantial levels of adoption (e.g., in the United States 88 % of the eligible acres across all crops were insured in 2014 (RHIS)). However, agricultural insurance has historically been much less popular in developing countries.[2]

To a large extent, the contrast in the penetration agricultural insurance achieved in developed countries compared to developing ones is associated with the fact that the former have been much more willing to subsidize it (see, e.g., Mahul and Stutley, p. 72, Table 3.7).[3] Even

[2]In 2007, the top 4 countries by volume of agricultural insurance premiums were the United States, Japan, Canada, and Spain, with respective shares of 56.4 %, 7.4 %, 7.2 %, and 5.4 % of global volume of premiums (Mahul and Stutley, p. 72, Table 3.7). Agricultural insurance premiums accounted for 2.3 % of agricultural GDP for high-income countries, versus less than 0.3 % of agricultural GDP for middle- and low-income countries (Mahul and Stutley, p. 8, Table 1).

[3]An important reason for the popularity of subsidized agricultural insurance schemes in developed countries is that they are permitted under World Trade Organization regulations (Roberts; Mahul and Stutley). Developed countries have historically been more willing to support domestic farmers through subsidies, and subsidizing crop insurance allows them to do so without violating international trade regulations.

though examples of successful unsubsidized programs do exist (e.g., named-peril insurance schemes in Argentina, Australia, and Germany (Mahul and Stutley)), there are certain features of agricultural insurance that make it more difficult to establish than other types of insurance. More concretely, those features are the systemic nature of agricultural risks, and the information asymmetries that characterize such risks.

Risks are systemic if the underlying hazards tend to occur simultaneously across economic units. Unlike traditional (e.g., health, auto, or home) lines of insurance, whose underlying risks are idiosyncratic, agricultural insurance must deal with risks that often are systemic, such as those caused by droughts or low market prices. Systemic risks expose insurers to large losses when adverse events happen, making private insurers either unwilling to cover such risks, or willing to cover them but at premiums too high to be attractive.[4]

Information asymmetries occur when the insured has more information about his/her risks than the insurer has. Information asymmetries can be of two types, namely, adverse selection and moral hazard. Adverse selection refers to situations where (a) the farmers facing the highest risks are also the ones more likely to seek coverage, or (b) farmers are more likely to insure their highest exposures to risk (Roberts). Thus, when insurance is voluntary and adverse selection does exist, the insured units tend to be associated with greater losses than the average unit in the population. Insurers may protect themselves from adverse selection by gathering information about producers to infer their risk levels, but doing so is not always possible or may be too expensive. Alternatively, insurers may seek protection by adding loadings to the premiums, thus skewing the insured pool even further toward the highest risks, which may prevent a viable market for insurance altogether.

Moral hazard occurs if buying insurance induces farmers to increase their risk exposure, as coverage reduces their incentives to prevent losses, or to influence the indemnities claimed to their advantage. Examples of moral hazard include inadequate levels of care (e.g., by not using

[4]To protect themselves from systemic risks, private insurers typically buy reinsurance. Unsubsidized reinsurance is expensive, and adds an extra loading to the premiums charged by insurers.

pesticides or not fertilizing) and fraudulent claims. Insurers may protect themselves from moral hazard by incorporating clauses to that effect into the contracts, performing careful monitoring of farmers' activities, and inspecting losses to uncover fraud. However, preventing moral hazard can be quite costly and may render insurance premiums too expensive for widespread adoption.

There are many different types of agricultural insurance contracts. According to the type of event used to trigger the indemnities, contracts can be classified into damage-based and index-based insurance (Roberts). In the case of damage-based insurance, the amount of indemnities paid is determined by the actual loss experienced by the insured unit. In contrast, index-based insurance indemnities are based on the outcome of an index, which is less than perfectly correlated with the insured unit's actual losses.

Depending on the type of losses covered, damage-based insurance can be further categorized as named-peril, multi-peril, or revenue insurance. Named-peril insurance protects producers from output losses caused by specific events, such as hail or windstorm (Roberts). This type of insurance is the most widespread among unsubsidized schemes, because insurers effectively select the perils to be covered so as to minimize their exposure to systemic risks and information asymmetries. Hail insurance is a prime example of successful unsubsidized protection, which is not surprising because hail can induce large losses to the affected farmers, but from the insurer's perspective it is an idiosyncratic risk with essentially no exposure to informational asymmetries.

Multiple-peril insurance, also known as yield insurance, covers output shortfalls relative to some production level specified in the contract, regardless of cause (Roberts). Revenue insurance is analogous, but with coverage aimed at protecting producers from low revenues rather than low output. In both types of insurance, issuers are highly exposed to systemic risks and information asymmetries. For this reason, neither of them is usually viable without large

subsidies. Revenue insurance has been heavily subsidized in the United States over recent years, and nowadays it is the largest agricultural insurance program in the world.[5]

Index-based insurance contracts can be categorized according to the nature of their underlying index, with the most popular schemes being weather index insurance (WII) and area-based index insurance (ABYI). In the case of WII, the index used to trigger indemnities is based on the measurement of a weather-related variable (e.g., rainfall, temperature, or days without rain) at a certain weather station over a specified time interval (IFAD). The ultimate goal when designing the index is to strike an appropriate balance between simplicity and a high level of correlation with the yields of the targeted producers. WII's main advantage is that insurers do not face the problem of asymmetric information. On the downside, WII exposes farmers to basis risk, i.e., the risk of not receiving an indemnity when experiencing a loss in the insured unit (which may well occur because the index is not perfectly correlated with the insured's losses) (IFAD).

In the case of ABYI, indemnities for the insured units depend on the yield measured over a much larger area (e.g., district or county) comprising them. As with WII, ABYI has the advantage of not exposing insurers to informational asymmetries. In addition, compared to WII, at least in principle producers should face less exposure to basis risk when covered by ABYI. However, basis risk under ABYI may still be too high to warrant adoption.

An alternative way of classifying agricultural insurance programs is by the level of aggregation at which policies are issued. By this criterion, insurance can be applied at the micro, meso, or macro levels (IFAD). Micro-level insurance policies are the typical ones sold to individual agricultural producers. Meso-level insurance is aimed at groups of farmers (e.g., producer cooperatives) instead of individuals themselves, or non-farm participants in the industry with high exposure to agricultural risks (e.g., agricultural lenders, input suppliers, and

[5]In 2014, revenue insurance accounted for 75 % of the total premiums paid for agricultural insurance in the United States (RHIS). In that year, the government paid 0.62 cents out of every dollar paid for agricultural insurance premiums in the United States (RHIS). Recall from footnote 2 that the United States constitutes more than half of the world market for agricultural insurance.

processors).[6] Finally, macro-level insurance is targeted at covering the exposure to adversities of an entire country's agricultural sector.[7]

III. Literature Review of Research on Agriculture Insurance in Ghana

The present section reviews the sizable volume of research that has been conducted in recent years focusing on agricultural insurance in Ghana. To organize the discussion, the studies are categorized by whether the type of insurance under analysis is index-based or damage-based. When the same study looks at both kinds of insurance (e.g., Stutley), each of them is addressed separately in the corresponding subsection.

III.1. Index-Based Insurance

Consistent with the great attention given worldwide to agricultural index insurance over the past two decades, most of the research performed in Ghana has involved index-based insurance. The next subsections review this literature, organized by the type of index used to determine indemnities.

III.1.a. Weather Index Insurance (WII)

Within the category if index-based insurance, the largest number of studies pertain to WII. By chronological order of publication, this research includes Stutley; Muamba and Ulimwengu; the Katie School of Insurance; Okine; Karlan et al. (2014); McKinley, Asare, and Nalley; and Gallenstein et al.

Stutley (2010)

[6]According to Stutley, the first meso-level program was Agroasemex's "Daños para Agostaderos con Imágenes de Satélite" WII, aimed at providing catastrophic coverage for state governments in Mexico (www.agroasemex.gob.mx/ProductosyServicios/Seguros.aspx#horizontalTab1).

[7]An example of a macro-level program is the recently established African Risk Capacity, a WII designed to protect African countries from catastrophic weather events (http://www.africanriskcapacity.org/home).

As part of the "Innovative Insurance Products for the Adaptations to Climate Change" (IIPACC) project to develop innovative agricultural insurance project in Ghana, Stutley conducted a comprehensive study of the feasibility of crop insurance for all major crops. In his assessment of the yield data available, Stutley points out several limitations. First, yield estimates at the district level are not sufficiently precise, because of the negative impact on the quality of sampling stemming from governmental budget constraints. Second, the data are not available in a consistent database format, and exhibit obvious errors. Third, political boundaries have been redefined, making it difficult to compute consistent district-level historical yield series. Fourth, yields are calculated from the area harvested rather than the area planted, thus underestimating damages when planted fields are totally lost. Finally, only historical yield data for the main cropping season exist (i.e., there are no yield data for the minor growing season in the central and southern regions).

The study finds a downward trend in annual rainfall across most of Ghana. Weather-related perils include drought in some areas of eastern, western, and southern Ghana, excess rain and floods in parts of northern Ghana, and windstorms in certain areas. Rainfall patterns vary substantially across short distances, implying that a high-density network of weather stations is required to establish successful WII products. Further, the exposure of Ghana to the effects of climate change may require additional loadings into WII premiums, to protect insurers from climate change risk.

As part of the study, the demand for agricultural insurance was assessed by conducting discussions with 10 farmer focus groups, each of them consisting of 10 to 20 farmers. Farmers ranked lack of access to rural finance as the main constraint to agricultural crop production. Other reported production impediments included marketing constraints, low output prices, lack of storage, bush fires, and pests and diseases. Unpromising from the perspective of the demand for WII, in none of the meetings was weather risk ranked among the top three constraints. However, farmers stated their willingness to purchase insurance if it helped them gain access to credit.

Based on the analysis of 18 years (1992 through 2009) of data on average yields and rainfall at the district level, Stutley concludes that drought WII would provide very appropriate coverage for corn in the Eastern Region. However, other regions are characterized by weaker correlations between rainfall and corn yields, suggesting that drought WII would not be as effective to provide coverage for shortfalls in corn yields. The correlations between rainfall and yields are also weak for other rain fed crops (e.g., rice, millet, sorghum, and groundnuts). Further, in some of the northern regions, the correlations between rainfall and yields crops are negative, indicating that yield losses are more likely due to excess rain or floods than to drought.

Overall, Stutley concludes that corn, rice, pineapples, and mango have the potential to support WII. Rainfall WII could be developed to protect corn and rice producers from drought in districts with high correlations between rainfall and yields, and with an appropriate density of weather stations. Rainfall WII could be designed to cover pineapple producers from drought in the Central Region, and to protect mango growers from excess rainfall in some districts of the Northern Region. Stutley also notes that WII might possibly be developed also for sorghum, millet, and groundnuts.

Muamba and Ulimwengu (2010)

Muamba and Ulimwengu propose a programming method to compute optimal drought insurance contracts. The contracts are assumed to pay an indemnity whenever rainfall is below a certain trigger; the indemnity increases proportionally with the amount by which rainfall is short of the trigger, up to a pre-defined stop-loss rainfall. The maximum indemnity occurs when rainfall is equal to or smaller than the stop-loss. The advocated approach consists of computing the trigger and the stop-loss values that maximize the covariance between the indemnities and the losses being insured, subject to a maximum fair premium (which is defined as the expected indemnity divided by the liability).

Muamba and Ulimwengu apply their method to calculate optimum insurance contracts for corn yields in 12 districts of Ghana's Northern Region. For this purpose, they rely upon

district-level annual yield and monthly rainfall data spanning 1998 through 2004. The estimated correlations exhibit large variability across months and districts. The largest correlations correspond to July and August, for which the average correlations across districts are respectively 0.41 and 0.35. However, in some instances correlations are large but negative, rendering them unsuitable to develop drought insurance.

After estimating the optimal contracts, the authors examine their viability by computing the correlations between the corresponding indemnities and the yield losses for premium rates ranging from 5 % to 15 %. They find that only three districts (East Mamprusi, Gushiegu Karaga, and Saboba) have significantly positive correlations at the 10 % level. Four other districts (Bole, East Gonga, Savegulu Nanton, and Tolon Kumbugu) have positive but non-significant correlations between indemnities and yield losses. Importantly, correlations for the other five districts (East Dagomba, Nanumba, West Dagomba, West Gonja, and West Mamprusi) are negative, suggesting that rainfall-based drought WII is not viable. The authors find similar results when testing the in-sample performance of the contracts (i.e., using the 1998-2004 data). Muamba and Ulimwengu conclude that corn drought rainfall insurance may not be viable for some districts, in particular those where corn yield losses are negatively correlated with the contracts' indemnity payments.

Katie School of Insurance (2011)

The study by the Katie School of Insurance explores the feasibility of index insurance products for corn and rice in Northern Ghana. It focuses on Northern Ghana because its weather patterns are more favorable to the design of simpler rain-based WII products, as it has only one rainy season (which usually spans April through September).

Data limitations posed a major challenge for the study. First, although 16 years of historical rainfall data are used for the analysis, the variability found would make it highly desirable to double the length of the time series to better assess the rainfall patterns. Second, temperature data at the district level do not exist, but temperature data at the regional level

exhibit a clear increasing trend over the last 40 years. Third, Ghana experienced a major redistricting reform in 1988/89, which established 110 districts; subsequent changes had established a total of 170 districts by 2008. As a result of redistricting, historical district-level crop production data are often not available.

Data analysis focused on the Bole and Yendi districts in Ghana's Northern Region over the period 1992-2007. An important finding is that both the frequency of rainfall and the monthly precipitation have exhibited upward trends over the period under study, which "… raise serious concerns for developing policies to address productivity of crops in Ghana." (Katie School of Insurance, p. 13). Unexpectedly, the strongest correlations between precipitation and yields have negative signs; in the Yendi district, the correlation between monthly precipitation (rainfall frequency) and corn yields equals -0.70 (-0.46). This result indicates that, at least for some districts, WII triggers would need to account for excess rainfall as well as rainfall shortages. Overall, the correlations between precipitation and yields are rather weak.

Okine (2014)

Okine applies a Black-Scholes option pricing framework to determine the price of WII for corn in the Tamale district, which is located in Ghana's Northern Region. The author postulates an insurance contract based on the cumulative monthly rainfall, with the payoff of a "cash-or-nothing" put contract (i.e., the payment of a certain cash amount whenever the recorded cumulative rainfall in a particular month falls below a certain trigger). Okune's analysis relies on district-level aggregate data, which is well suited to the Tamale district because it has a small area (731 km^2).

Based on data for the period 1992 through 2007, the study shows that the largest positive correlations between monthly cumulative rainfall and district-level corn yields correspond to February and March, with correlations of 0.53 and 0.50. Thus, not only are the correlations relatively low, but also they are registered before (February) or during (March) the planting season in Tamale, which severely reduces their usefulness for insurance purposes. During the

corn growing season, the only months with positive correlations between cumulative rainfall and yields are July (correlation of 0.42) and August (correlation equal to 0.24). However, due to the variability in the data, Okune notes that a much longer time series (40 years) would be needed to estimate the correlations with a reasonable level of precision.

Karlan et al. (2014)

Karlan et al. (2014) performed a multiyear randomized trial experiment in northern Ghana, aimed at assessing the extent to which capital constraints and uninsured risks affect investment by small farmers. To this end, they focused on communities where corn was the most important crop, and selected farmers who grew corn but had no more than 15 acres of land.

Karlan et al. (2014)'s econometric analysis is based on experimental data for three annual crop cycles. In the first year (2009), 135 farmers were provided free WII, 117 farmers received free cash grants, 95 farmers obtained both free WII and capital grants, and 155 farmers were set aside as controls. In the second year (2010), the sample was expanded, and WII was no longer provided free of charge, but offered at prices above and below fair and market values. In total there were 2,082 experimental subjects, with 1,095 who were offered to buy insurance, 363 who received cash grants, and 624 in the control group. In the third year (2011), WII was offered at various prices, but no cash grants were given. The total sample consisted of 1,406 farmers, with 1,095 of them receiving offers to buy insurance and 311 being assigned to the control group.

The WII product offered was different in each year. In the first year, the product aimed at covering crop losses due to drought and flood, by paying indemnities if between June and September there was a month with 8 or fewer dry days, or 18 or more wet days. In the second year, the insurance also targeted losses from drought and flood, but it was based on a slightly different indemnity schedule (e.g., payouts triggered by 12 or more consecutive dry days, or 7 or more consecutive wet days, between June and September). In contrast, the third year product was designed to cover drought only, with payouts depending on the number of consecutive dry days at different stages of the growing cycle for corn.

The most striking result from Karlan et al. (2014) is that uninsured risks have a far greater impact on investment than capital constraints. Insured farmers are found to cultivate more acres and spend more on land preparation and on inputs overall. However, the value of harvest is not significantly greater for insured farmers. Insurance is also found to be significantly associated with greater involvement in riskier enterprises, but whose risks are more likely to be covered by the insurance.

In terms of the demand for insurance, Karlan et al. (2014) find that trust and recency (i.e., whether an insurance payout was received or not in the previous year) have a significant impact on farmers' uptake. Most important from the perspective of the viability of WII in Ghana, however, is their claim that (Karlan et al., 2014, p. 601)

> "We also show that there is sufficient demand to support a market for rainfall insurance and discuss in more length the ensuing policy and market issues in Ghana. We find that at the actuarially fair price, 40% to 50% of farmers demand index insurance, and they purchase coverage for more than 60% of their cultivated acreage."

McKinley, Asare, and Nalley (2015)

McKinley, Asare, and Nalley discuss the critical issues hampering the development of WII for cocoa in Ghana. The main problems identified are:

1. The lack of historical yield data.
2. The perennial nature of cocoa trees, which not only results in yields that vary with the age of the tree, but are also negatively autocorrelated (i.e., high yields are followed by low yields, and vice versa).
3. The determination of adequate rainfall and temperature values triggering indemnities.

The authors argue that computing rainfall and temperature triggers is especially challenging, because cocoa yields suffer if there is either too much or too little rainfall, and if temperatures are excessively high or excessively low.

In addition, McKinley, Asare, and Nalley perform a preliminary assessment of the feasibility of WII for cocoa in Ghana. They use farm-level yield data for 1,200 cocoa producers covering 109 villages, 19 districts, and 5 regions, spanning the period February 2011 through August 2012, together with geo-referenced precipitation data with a resolution of approximately 9 km^2. For insurance purposes, a key finding from their study is the identification of pod maturation as the critical stage for rainfall. Using simulations, the authors estimate that the probability of receiving an indemnity payment for a 50 % (70 %) coverage ranges between 15.9 % and 28.8 % (28.6 % and 40.0 %). The authors attribute the large probability of payouts to the lack of appropriate data to adequately calibrate their simulation model. If the actual payout probabilities are as high as estimated by McKinley, Asare, and Nalley, WII would not be seem viable for cocoa producers in Ghana.

Gallenstein et al. (2015)

Motivated by the low demand for unsubsidized WII found in many instances where it has been tried, Gallenstein et al. investigate the potential demand for WII tied to loans in the Upper East, Upper West, and Northern Regions of northern Ghana. In those regions, the market for agricultural loans is dominated by 16 rural and community banks. Those banks provide microfinance loans to farmer associations rather than to individual farmers, focusing exclusively on joint liability loans.

Given the structure of the agricultural credit market in northern Ghana, Gallenstein et al. surveyed 258 farmer associations, out of almost 800 farmer associations listed by the banks as existing or potential customers. The associations surveyed were the ones that met a set of criteria, including being in good standing, belonging to low rainfall districts, having corn as their primary or secondary crop, comprising 7 to 15 members, and borrowing less than GH¢ 10,000. The focus on the demand from farmer associations rather than individual farmers, and on existing (73 %) or potential (27 %) loan customers is a distinguishing feature of the study.

Within each association, three randomly selected farmers were interviewed, which resulted in the collection of 780 surveys in total. Surveys were conducted in February 2015.

The surveys inquired about the farmers' willingness to pay (WTP) for agricultural loans with three alternative types of insurance policies, namely:

1. Policy held by individual farmers, with indemnities based on rainfall at a nearby weather station and paid directly to farmers.
2. Policy held by the bank, with indemnities based on rainfall at a nearby weather station and paid to the bank, which then applies to repay farmers' outstanding loans.
3. Policy held by individual farmers, with indemnities based on rainfall at farmers' plots and paid directly to farmers.

The authors consider as potentially viable only the first two types of policies, but they also included the third policy in the questionnaire to quantify the amount of basis risk. Note, however, that the third policy payouts are triggered by shortages in rainfall rather than yield, which means that it also involves basis risk (because individual farmers' yields need not be perfectly correlated with rainfall at the farmers' plots). In addition, the survey included questions about farmers' strategies to cope with drought, and about demographic characteristics and other variables that, according to the literature, are associated with the demand for insurance.

By far, the main mechanism to cope with droughts for the farmers in the sample is selling livestock or other assets (53 %). Borrowing money (17 %) and spending savings (11 %) are respectively the second and third most popular strategies to cope with drought.

Regarding the estimated demand for insured loans, 56 % of the sampled farmers are willing to have individually insured loans as described above in item (1) at market-viable prices for the insurance component. The analogous figure for the loans with insurance held by the bank (specified in item (2) above) is very similar (54 %). The authors also estimate that the WTP to avoid rainfall basis risk is large (equal to 4 % of the loan principal) and statistically significant.

Although the aforementioned demand for insured loans seems high, it must be recalled that 73 % of the farmers in the sample are existing borrowers. Hence, the data suggest that the

number of borrowers would greatly decrease if all of the loans offered by banks were insured at market-viable prices (although, of course, the resulting banks' loan portfolios would be protected against the risk of drought). In other words, the number of borrowers would fall by a large amount if loan insurance were made mandatory.

III.1.b. Price Index Insurance

Agricultural insurance schemes based on market price indices were investigated by Sarris, and Karlan et al. (2011).

Sarris (2002)

Sarris (2002) develops a theoretical model to quantify farmers' WTP for price insurance, and applies it to analyze the potential demand for price insurance by cocoa producers in Ghana. The proposed contract can be categorized as price-index insurance, because it relies on the market-level price, rather than the specific prices received by the insured farmers for their crop.

Sarris considers the case of a minimum price on a fixed amount of crop (determined before production takes place), as well as the case where the minimum price applies to the total amount produced (which is uncertain at the time the insurance is purchased). He estimates that actuarially fair premiums for the insurance are smaller than the premiums for analogous put options available at organized exchanges. In addition, Sarris estimates that the WTP for price insurance typically greatly exceeds the actuarially fair premiums and the premiums on exchange-traded put options, especially for producers who derive most of their household income from cocoa, are risk averse, and have more difficulties smoothing consumption. He also finds that the WTP for the price insurance on a fixed crop amount is very similar to the WTP for price insurance on the total output produced.

Karlan et al. (2011)

Karlan et al. (2011) conducted a randomized trial experiment in the Eastern Region of northern Ghana in 2007, which involved loans with price insurance protection to eggplant and corn farmers. The provision of price insurance was motivated by information gathered at focus group meetings, which revealed price variability to be a major risk for farmers in the region, whereas rainfall variability did not seem large enough to pose a major risk.

A total of 169 farmers participated in the experiment. A subset of them was assigned to the control, receiving only an offer of uninsured loans. The rest of the farmers were placed in the treatment group, and were offered only crop-price indemnified loans at the same interest rate as the (uninsured) control loans. The loan insurance was supplied at no extra charge, and consisted of forgiving 50 % of the loan if the average market price at harvest fell below a certain threshold (equal to the 10^{th} and 7^{th} percentiles of historical prices for eggplant and corn, respectively).

The average loan size was large, representing between 13 % and 38 % of the average annual income for a typical farmer. Farmers who borrowed tended to be older, to have higher cognitive scores, to be more likely to have borrowed before, and to be more averse to ambiguity. The takeup of loans was very high and not significantly different across the control (86 %) and treatment (92 %) groups. Defaults were also quite high (58 % after 1.5 years), and the same for the two groups.

Because of the high loan takeup, it was very difficult to discern the effects of the price insurance. In particular, essentially no impacts were found of price-indemnified loans on investment in inputs. However, the price insurance induced changes in the marketing of crops: compared to farmers with uninsured loans, farmers with indemnified loans were significantly more likely to sell to market traders than to farmgate sellers. This is interesting, because farmgate sellers typically buy at a discount in exchange for locking in prices.

III.1.c. Price-Weather Index Insurance

To address the fact that farmers' revenues are affected by the combination of both output and price realizations, Keyzer, Molini, and van den Boom; and Molini et al. analyzed insurance based on a composite of price and weather indices.

Keyzer, Molini, and van den Boom (2007)

Keyzer, Molini, and van den Boom develop a theoretical framework for insurance contracts based on the realizations of market prices and weather variables, and whose indemnities are aimed at preventing farmers' total (i.e., farm plus non-farm) income from falling below the poverty level. Keyzer, Molini, and van den Boom's proposed insurance relies on subsidies for the poorest farmers, either from outside sources, or from the better off farmers in the insurance pool. They show how to compute the indemnities as functions of the weather and price data, so as to minimize the risk of income realizations below the poverty level, and subject to self-financing up to a certain amount of external subsidies.

The authors apply their method to Ghana. To this end, they construct a pseudo-panel of representative agents using data from the 1987/88, 1988/89, 1991/92, and 1998/99 Ghana Living Standards Survey, and the 1970, 1984, and 2000 Population Census. They also use the length of the growing period as the weather index, the market prices for 6 cash and staple crops, and the per-capita farm size to compute indemnities for individual farmers. When optimal indemnities are restricted to be linear functions of the length of the growing period, prices, and farm size, the insurance is estimated to reduce poverty by only 4 % (from 47 % to 43 %). The authors also estimate that allowing for more flexible indemnity schedules would reduce poverty by an additional 5 % to 10 %.

Molini et al. (2007)

Using the method proposed by Keyzer, Molini, and van den Boom, Molini et al. calculate the indemnity schedule for farmers in the three northern regions of Ghana (Upper East, Upper West,

and Northern). They estimate that the premium required to eliminate the risk of falling into poverty is approximately 50 % of income, which renders the insurance scheme impractical in the absence of subsidies. The advocated insurance scheme is estimated to reduce the poverty incidence by about half, from 63 % to somewhere between 39 % and 27 %, depending on the flexibility allowed in the indemnity schedule.

Importantly, Molini et al. raise in issue rarely discussed by the index insurance literature, namely, that crop insurance in the absence of other safety net policies may exacerbate food crises induced by crop failures. This may happen if, for example, indemnities received in a bad crop year allow insured farmers to outbid uninsured ones for the food available, and in the process greatly worsen the conditions for the farmers without insurance. The authors argue that if food crises are to be avoided when crop failures occur, food deliveries must be managed together with cash indemnifications.

III.1.d. Area-Based Yield Insurance (ABYI)

Area-based yield insurance (ABYI) is often advocated, because it relies on an index (area yield) that is typically more highly correlated with individual farmers' yields than weather indices are. Stutley, and Katie School of Insurance analyze ABYI for Ghana.

Stutley (2010)

Stutley finds that corn and rice are crops for which ABYI could most likely be designed. ABYI might also be suitable to cover sorghum, millet, and groundnuts. However, he conditions the feasibility of such insurance products on (a) historical series at the district level being of sufficient quality and long enough, (b) average yield estimates meeting minimum precision standards, and (c) a minimum level of acres being planted in the insured area (district).

Katie School of Insurance (2011)

The study by the Katie School of Insurance, already discussed in connection with WII, also addresses the potential for ABYI to overcome the limitations faced by WII due to the relatively poor estimates of the correlations between rainfall and yields. The study finds that ABYI corn premiums for the Bali and Yendi districts are very sensitive to the yield probability distribution assumed for the computations, but particularly so for Yendi. For typical coverage levels, the estimated premiums would be commercially viable for Bali, but too expensive for Yendi. In addition, corn yields are found to be negatively correlated across the two districts, which the study argues would facilitate risk reduction for financial institutions willing to diversify their loan portfolios geographically.

III.2. Damage-Based Insurance

Stutley; and Kwadzo, Kuwornu, and Amadu study traditional damage-based agricultural insurance in the context of Ghana.

Stutley (2010)

Based on his comprehensive feasibility analysis, Stutley concludes that windstorm insurance is technically feasible for rubber, large-scale banana plantations, and possibly small-holder producers of plaintains. He also determines that catastrophic insurance against aggregate damage in cocoa plantations due to the Cocoa Swollen Shoot Viral Disease could be designed and implemented.

Kwadzo, Kuwornu, and Amadu (2013)

Kwadzo, Kuwornu, and Amadu estimate the WTP for multi-peril crop insurance by farmers in the Kintampo North district, located in Ghana's Brong Ahafo Region. The district under study is between the forest and northern savannah zones, and agriculture provides most of the household income in the area. The authors collected data from a representative random sample of 120

farmers (12 farmers per community across 10 communities), by conducting face-to-face interviews in 2010.

The data obtained allow the authors to assess the frequency and severity of various perils faced by the farmers. The perils more often cited by farmers as affecting crop production are bushfires (98 %), drought (91 %), windstorms (91 %), grazing livestock (61 %), theft (61 %), and flood (47 %). In terms of perceived effects, farmers rank bushfires as the top peril, followed in decreasing order by drought, floods, windstorms, theft, and grazing livestock. According to the farmers' reported frequency of occurrence over the previous 5 years, bushfires is the most frequent peril (100 %), grazing livestock (80 %) and theft (80 %) are next, followed by windstorms (60 %), and finally drought (40 %) and flood (40 %). Based on the data, the authors classify bushfires and windstorms as high-effect-high-frequency perils, livestock grazing and theft as low-effect-high-frequency perils, and drought and flood as high-effect-low-frequency perils. By far, the crop most affected by the various perils is corn.

The survey also included questions regarding the strategies used by farmers to manage risks. Crop diversification and sharecropping are typical risk management strategies used by farmers in the area. Other risk-driven strategies reported by farmers in the sample are selling or liquidating farm productive assets (42 %), adding on or shifting to other businesses (39 %), varying crop practices (e.g., by intercropping, adopting drought resistance varieties, staggering planting, or using low-risk inputs) (8 %), borrowing from friends and family (5 %), and resorting to the use of family labor (5 %).

For the sample analyzed, the WTP for an insurance product covering GH¢ 1,000 of hypothetical losses in farm income ranges from a minimum of GH¢ 5 to a maximum of GH¢ 80.00, with an average of GH¢ 24.43 (i.e., the WTP averages only 2.4 % of hypothetical losses, with a minimum of 0.5 % and a maximum of 8 %). The likelihood of purchasing crop insurance is significantly positively correlated with family size and farm size, and significantly negatively correlated with the level education, the diversification by means of livestock production, and land ownership. One additional family member dependent on the farm is associated with a 10 %

higher probability of insuring, and one additional farm hectare corresponds to a 7.5 % greater likelihood of purchasing insurance. In contrast, farmers with formal education are 51 % less likely to buy crop insurance, and farmers who diversify via livestock enterprises are 40 % less likely to purchase insurance. Similarly, land ownership is associated with a 33 % reduction in the probability of buying insurance. Overall, the authors conclude that "The major policy implication revealed by this study is that farmers who have the ability to self insure generally are not interested in market-based crop insurance and therefore lead to high levels of exposure by insurance firms if care is not exercised." (Kwadzo, Kuwornu, and Amadu, p. 18).

IV. Recent Developments and Current Situation

Agricultural insurance has had very little development in Ghana, and most of the progress has occurred over the last decade. Before then, the only experience with agricultural insurance was in the 1970s, when Ghana's State Insurance Agency in association with Barclays Bank used to provide damage-based insurance for rice producers. The program was successful for some time, but eventually fraudulent claims led to sizable losses to the insurer,[8] which stopped operating the scheme. The negative experience had a galvanizing effect, and for a long period agricultural insurance was a shunned business in Ghana.

Interest in agricultural insurance issues has surged over the last decade in Ghana. In 2007, the non-governmental organization Innovations for Poverty Action (IPA) started funding the aforementioned study by Karlan et al. (2011), aimed at examining the effects of crop price insurance (IPA undated-a). Two years later, IPA started sponsoring the project by Karlan et al. (2014) discussed earlier in the literature review, which focused on the impact of WII on farmers' investments (IPA undated-b). Both studies were noteworthy because, consistent with IPA's approach, they relied upon randomized trials to obtain data. Farmers in the treatment groups purchased actual WII contracts.

[8]Producers harvested the rice fields and then set them on fire to demand indemnity payments.

In 2009, a major initiative promoted by the German Federal Ministry for the Environment, Nature Conservation, and Nuclear Energy culminated in the establishment of the IIPACC project. IIPACC, funded by the aforementioned German Ministry, and implemented jointly by Ghana's National Insurance Commission (NIC) and the German Gesellschaft für Internationale Zusammenarbeit (GIZ), was scheduled to last until June 2013 (Appenteng-Mensah and Gille). As suggested by its name, IIPACC's main goal was to assist in the development and implementation of economically sustainable innovative agricultural crop insurance products in Ghana, aimed at protecting farmers from adversities in agricultural production related to extreme weather (Appenteng-Mensah and Gille).

IIPACC was instrumental in the establishment of the Ghana Agricultural Insurance Programme. The Programme consisted of a steering committee in charge of setting policy and advocacy, and the Ghana Agricultural Insurance Pool (GAIP) in charge of governance and management. The steering committee was chaired by the NIC, and had members representing the public and private sectors, a state-owned reinsurance company, and development partners. GAIP was supported by 19 of the 22 non-life insurance companies in Ghana, and its day-to-day operations were conducted by a technical management unit staffed by three individuals (Appenteng-Mensah and Gille).

The process leading to the creation of GAIP raised awareness about agricultural insurance in Ghana, encouraged dialogue among potential stakeholders, and resulted in regulatory changes. GAIP was launched in 2011, and in that same year it introduced its first product, a corn WII for 3 regions in northern Ghana. The policies were sold to three banks (which used them to cover their loan portfolios) and IPA, resulting in the coverage of over 3,000 farmers for a total of 5,045 acres (Appenteng-Mensah and Gille). Significantly, GAIP's WII was adopted by Karlan et al. (2014) for their third-year treatment group; as a result, their experiment accounted for approximately one third of all farmers covered by GAIP's WII in 2011 (Appenteng-Mensah and Gille).

In 2012, GAIP expanded its portfolio by offering WII to cover corn and soybeans over 6 regions (Gille). In 2013, GAIP offered named-peril insurance for rubber producers, ABYI for corn, and WII for corn, soybean, and sorghum, extending its reach to seven regions (Gille). Notwithstanding the expansion in the types of products offered, coverage decreased relative to 2011: only 490 farmers for a total of 769 acres were covered in 2012, and 435 farmers for 939 acres in 2013 (MoFA).

The 2013 pilot ABYI trial was quite disappointing, and it was discontinued thereafter. Takeups for WII continued to be quite limited in 2014. The most successful GAIP products in 2015 were named-peril insurance for rubber producers (with 713 acres covered) and accidental mortality insurance for poultry producers (Katu ACII, personal communication). The portfolio of products offered by GAIP in 2015 includes WII for a number of crops (including corn, soybeans, sorghum, millet, groundnut, and cocoa), as well as named-peril insurance for eligible commercial producers of various crops, livestock, or poultry.[9] In a concerted effort to increase its market penetration and reach a target of 600,000 subscribers, GAIP has recently greatly expanded its staff, by incorporating a marketing manager and 13 marketing officers who sell policies in the field. This has been achieved with funding support from organizations such as ADVANCE II and FINGAP. The GAIP board is expected to take very important decisions on the way forward after the results from the 2015 season become available.

There are two major research projects currently under way involving agricultural insurance, namely, "Disseminating Innovative Resources and Technologies to Smallholders" (DIRTS) and "Promoting Adoption of Improved Production Technologies among Smallholders in Ghana via Coupled Credit and Index Insurance Contracts" (OSU/ACET).[10] Both projects involve collaborations with GAIP. DIRTS started in January 2014 and will finish in December 2015, whereas OSU/ACET begun in August 2013 and will last until mid-2016. One of DIRTS's

[9]The indemnity-based products are advertised as "multi-peril" insurance by GAIP (GAIP), but they fall under the named-peril insurance category discussed in Section II.

[10]Two of the leaders of DIRTS, Professors Karlan and Udry, are co-authors of the Karlan et al. (2014) study. Likewise, two of the leaders of OSU/ACET, Professors Miranda and Sam, are co-authors of the study by Gallenstein et al. discussed earlier.

stated objectives is to implement and evaluate commercial drought index insurance (Udry et al.). OSU/ACET is aimed at assessing the effect of index-insurance-contingent loans on the provision of credit and other agricultural-related issues (Miranda et al.), and the study by Gallenstein et al. discussed earlier is an early outcome of the project. Results from these two projects should provide valuable insights about WII in Ghana and its potential for scaling up.

V. Opinions of Major Stakeholders

In May 2015, interviews were conducted with individuals representing major stakeholders of agricultural insurance in Ghana (see list of interviewees at the end of the present document). The goals of the interviews were threefold. First, to learn about the individuals' opinions regarding the possible explanations for the failure of recent efforts at establishing a large agricultural insurance program. Second, to sense whether stakeholders are optimistic about the likelihood that agricultural insurance programs will succeed in Ghana. Finally, to uncover the factors stakeholders deem most critical for the widespread adoption of agricultural insurance in Ghana.

The next subsections discuss the main results stemming from the informal survey. The discussion is supplemented by the opinions of stakeholders expressed in recent presentations by Gille and Appenteng-Mensah, and publications by Nunoo and Acheampong, and Appenteng-Mensah and Gille.

V.1. Reasons for Limited Adoption

The following list provides a summary of the main reasons brought forward at the interviews for the poor performance exhibited by the WII programs:

- <u>Expensive Premiums:</u>

  In the opinion of several interviewees, the high cost of WII deterred its widespread adoption. WII was sold at premiums in the order of 7 % to 10 % of farmers' production costs, with actual costs ranging from 4 % to 25 % of production costs depending on soils, geographic regions, and other production factors.

- Lack of Awareness/Financial Literacy:

  Insurance in general has low penetration in Ghana (e.g., insurance premiums accounted for 1.06 % of Ghana's GDP in 2011 (NIC)). Further, there is no tradition of agricultural insurance, and WII is a new concept unknown to many farmers. Clear evidence of this issue was provided at the interview with officers of the Ghana National Association of Farmers and Fishermen, as they were not aware of the agricultural insurance programs offered in recent years or currently in place.

- Insufficient Commitment by Insurance Companies:

  As pointed out in the previous section, the initial insurance programs were established largely under the leadership of GIZ. For this reason, it is perceived that there was an undue emphasis on WII products, and that insurance companies were insufficiently committed to make the programs successful. Management of the agricultural insurance program was the responsibility of GAIP. However, for a long period GAIP was staffed by only three employees, which severely impaired its ability to devote the amount of resources needed to adequately educate farmers about insurance and, more importantly, market insurance products in the field.

- Lack of Trust by Farmers:

  Some respondents stressed that it is critical for farmers to trust that they will be paid back. In some instances, the failure of susu schemes has made farmers lose trust in financial arrangements, thus hindering their willingness to buy insurance. In other instances, farmers may simply not have had enough trust in the providers of WII to purchase insurance.

- Poor Infrastructure:

  Some of the interviewees deemed the network of weather stations as not adequate to reduce basis risk to acceptable levels. The density of stations was not sufficiently high, and the existing stations were often old and/or inefficient. Even though some weather stations were added to the network to provide support for the WII program, more stations were needed, especially in the Central Region.

- Low Participation of Lenders, Input Suppliers, and Processors:

  WII can be used by financial institutions to protect their portfolios of agricultural loans. In the case of Ghana, however, lenders seem to care mostly about the default risk of individual loans rather than the overall risk of their loan portfolios. Thus, the few lenders who decided to insure tried to pass along the cost of the policies to farmers by charging higher interest rates on their loans, which rendered them too onerous for potential borrowers. Input suppliers and processors are other agricultural industry participants who may find WII potentially attractive to manage the risks they face, but they did not participate in the programs offered.

- Basis Risk:

  An issue raised at some interviews was the basis risk inherent in WII, which makes it less appealing than damage-based insurance. It was pointed out that problems arise when a farmer has a bad crop but the index realization does not trigger an indemnity payment, because then s/he gets a sense of paying for nothing.

In addition to the above explanations given for the low popularity of the WII programs, the following contributing factors were also cited during the interviews:

- Alternative Mechanisms to Cope with Risks:

  Insurance is not the only way to cope with risks, and it need not be the most attractive alternative for the majority of farmers.

- Complexity of WII Contracts:

  WII contracts need to be very simple if they are to appeal to most farmers. Contract complexity is likely to deter many farmers from buying insurance.

- NGO Handouts:

  One individual noted that the pervasiveness of handouts from NGOs has made many farmers reluctant to pay for a product like insurance, which is less tangible than standard goods (and pays out in times of need, which are also the occasions when NGOs are more likely to provide aid).

- Insufficient Number of Products:

The WII products offered covered only a handful of crops, which may have limited their market.

There was a clear consensus among interviewees with respect to the key reasons for the failure of the ABYI program, namely:

- Unreliable Yield Data:

  The system set up by government agencies to estimate crop yields, based on crop cuts, resulted in very poor data. In many occasions, estimated yields did not appropriately reflect actual yields.

- Lack of Farmers' Trust in the Yield Data:

  Because of the poor track record of the yield data underlying the ABYI program, farmers perceived that it was not credible enough to warrant purchasing ABYI.

Reasons for the slow progress of agricultural insurance have also been made public by Appenteng-Mensah (manager of IIPACC), Acheampong (affiliated with GIZ), Gille (agricultural insurance advisor of GIZ), and Nunoo (affiliated with the Department of Economics at the University of Cape Coast). Table 1 below summarizes their views in this regard.

Table 1. Factors Explaining Slow Progress of Agricultural Insurance in Ghana According to Named Sources

Factor	**Nunoo and Acheampong**	**Appenteng-Mensah**	**Appenteng-Mensah and Gille**	**Gille**
Expensive premiums	X	X		X
Lack of awareness	X	X	X	
Ownership				X
Poor infrastructure			X	

Basis risk				X
Low government involvement	X	X		X
Severe data limitations	X		X	
Negative image of insurance	X			

V.2. Prospects and Recommended Actions

The individuals interviewed were generally optimistic about the potential for agricultural insurance in Ghana. In particular, they felt ongoing projects involving agricultural insurance are worth pursuing, as they may provide useful information to eventually render it successful.

Given the opinions expressed in the interviews, the following actions emerged as crucial to improve the likelihood that agricultural insurance programs will succeed in Ghana:

- Bolster Marketing Efforts:

  There is a perceived need to have a much more active presence of marketing officers to sell policies in the field than in the past. To this effect, this year GAIP incorporated six full-time marketing officers in the field, funded by grants. The marketing efforts should cater to groups/associations of small farmers, farmer cooperatives, and large farmers. In addition, lenders should be enticed to buy agricultural insurance to protect their loan portfolios.

- Obtain Government Support:

  Stronger government support appears to be essential for the success of agricultural insurance. It was mentioned that the government could provide support in various ways, such as helping with product research and development, subsidizing the purchase of agricultural insurance by the rural poor, and requiring farmers to have insurance to receive loans from banks. It is felt that, even though the government participated in the private-public partnership that led to the creation of GAIP, the government is not seriously committed to backing agricultural insurance. As an example of this concern, some interviewees pointed out that the 2014

"Budget Statement and Economic Policy" presented by the Finance Minister to the Parliament states that the government will help pooling funds from the private and public sectors to scale up the agricultural insurance program (Terkper 2014, p. 50), but the actual budget contains no allocation to that effect.

- Promote Education/Awareness:

  Most farmers are not aware of the potential advantages of using insurance to manage their risks. Current efforts to educate farmers include broadcasting campaigns to promote agricultural insurance, and providing free agricultural insurance for farmers' demonstration plots, both activities supported by means of ADVANCE grants. There is also a concerted effort to create awareness through the extension system, by giving seminars about insurance targeted at extension agents. In addition, seminars are being provided aimed at educating lenders and input dealers on the use of agricultural insurance in their operations.

- Expand the Number of Agricultural Insurance Products:

  Having a larger portfolio of products is seen by some individuals as critical to ensure a widespread adoption of agricultural insurance. The expansion in the number of products may be achieved by targeting a wider variety of agricultural activities (e.g., production of mango, cocoa, rice, vegetable crops, cash crops, and livestock) and alternative types of coverage (e.g., multi-peril crop insurance, or even revenue insurance). In the latter regard, some interviewees feel that GAIP should reduce the past emphasis on WII. One individual pointed out that products should be developed aiming at the entire value chain, rather than only farm output (e.g., drought/flood insurance is of no help if prices drop precipitously in a year with excellent weather). The portfolio of products offered by GAIP now includes multi-peril crop insurance for rubber production, and accidental mortality insurance for confined poultry production.

- Reduce Basis Risk:

  The interviews revealed the need to have smaller basis risk to make WII products appealing to farmers. The density of weather stations should be increased, especially in some regions

(e.g., the Central Region). The possibility of supplementing the data from the weather stations with satellite data (or a vegetation index) is worth considering. Further, implementing a system which allows farmers to independently receive in real time the weather data associated with WII would be highly desirable, as it would boost farmers' trust in the system. Some actions have already taken to reduce basis risk; in particular, weather stations have been recently added, and GAIP has acquired satellite data for areas poorly covered by weather stations.

Additional actions that some individuals felt might help at establishing a sound agricultural insurance program include the following:

- Change the Form of the Insurance Pool:

  When GAIP was first established, the insurance companies and NIC agreed that no company would enter the agricultural insurance market alone. At the time, it was felt that an insurance pool was the best arrangement for at least two reasons. First, no individual insurance company seemed to have the expertise or the resources to be able to pursue agricultural insurance on its own. Second and more important, the insurance companies wanted to avoid agricultural insurance fail as a result of cutthroat competition (i.e., firms undercutting each other's premiums to the point where the premiums collected would not be enough to pay indemnities). However, a pool need not provide the best incentives to develop innovative insurance products. In addition, more aggressive marketing of agricultural insurance products might occur by allowing individual companies to market them. One of the interviewees felt that GAIP should be chartered following the model of the Nigeria Agricultural Insurance Corporation.[11]

- Modify the Composition of the Agricultural Insurance Steering Committee:

  In the opinion of one of the interviewees, the current composition of the steering committee for agricultural insurance does not provide an adequate representation of the sector's

[11]It is worth pointing out that Aina and Omonona (2012) discuss problems associated with the Nigeria Agricultural Insurance Corporation, and point out that its most recent reported loss ratio was equal to 4, which implies a substantial level of subsidies.

stakeholders. In his view, making the steering committee more representative of the parties with an interest in the success of agricultural insurance would go a long way toward establishing a successful program.

To compare with the actions favored by the individuals participating in the informal survey, a summary of views made public by other stakeholders is reported in Table 2.

Table 2. Recommended Actions to Establish Agricultural Insurance Programs in Ghana According to Named Sources

Factor	**Nunoo and Acheampong**	**Appenteng-Mensah and Gille**	**Gille**
Obtain Government Support	X		X
Promote Education/Awareness		X	
Provide damage-based products	X		
Improve infrastructure		X	
Improve data	X	X	
Build capacity	X		
Make premiums more affordable			X
Establish cost-effective dist. channels		X	

VI. Potential for Widespread Adoption of Agricultural Insurance

The IIPACC-led initiative and the programs that followed it involved an unprecedented effort to promote agricultural insurance in Ghana. However, despite the sizable resources devoted so far, the results have been disappointing. The present section discusses the potential for widespread

adoption of agricultural insurance in Ghana, given the evidence from the studies reviewed earlier in Section III and other relevant literature, and the information obtained from stakeholders.

Succinctly, the prospects for WII programs in Ghana --and in particular for those aiming at smallholders-- are dim unless they are heavily subsidized. The basic argument in support of this assessment is that, despite the vast number of ingenious index-based insurance schemes that have been tried around the world, there is no record of any being economically self-sustainable on a large scale (see, e.g., Burke, de Janvry, and Quintero; and Carter et al.). Binswanger-Mkhize performs an in-depth analysis of index-based insurance programs, which leads him to state that poor farmers (Binswanger-Mkhize, p. 187)

> "… are cash/credit constrained and, therefore, cannot advance the money before sowing time to buy insurance that pays out only after the harvest. Index insurance, therefore, cannot be scaled up. Even if a few farmers purchase it, governments still will need to run relief programmes for the uninsured. Standard ways suggested to improve the index insurance, such as reducing basis risks, educating farmers and improving weather data, do not improve the ability of small farmers to purchase insurance and may not improve product design sufficiently to be competitive with self-insurance of the better-off farmers."

In a study examining the records of index-based agricultural insurance for 15 developing countries in which policies are held by individuals, and 22 countries where policies are held by institutions, Burke, de Janvry, and Quintero conclude that "**The current gap between high promise and low takeup suggests a promising research agenda to learn lessons from current programs and to experiment with alternative approaches on both the supply and demand sides of individual and institutional products.**" (Burke, de Janvry, and Quintero, p. 3, emphasis of theirs). Quite significantly, they also argue that "The benefits of investment in index insurance need to be weighed carefully against the alternative risk reduction and risk

management approaches available at both the household and the organizational levels." (Burke, de Janvry, and Quintero, abstract, underlining of ours).

Even though a large number of index-based agricultural insurance schemes have been tried in many countries over the last 15 years, the vast majority of them never left the pilot stage because of difficulties encountered when attempting to scale them up. The National Index-Based Insurance Schemes in India, ACRE in East Africa, the R4 Rural Resilience Initiative in Ethiopia and Senegal, and the Index-Based Livestock Insurance Project in Mongolia are among the handful of index-based agricultural insurance programs that have achieved a large scale. These programs are also held as the prime examples of success by advocates of index-based agricultural insurance (e.g., Greatrex et al.). As such, they can provide useful insights about the potential viability of other index-based programs, and this is the reason why they are the focus of the case study by Greatrex et al. The evidence from their analysis is clear: all four of them rely on subsidies.[12]

The following excerpt from Carter et al., written upon examination of a large number of index-based insurance schemes implemented in developing countries, provides an up-to-date summary of the experience regarding the uptake of index-based agricultural insurance (Carter et al., p. 11, underline of ours):

> "**3. The puzzle of low uptake**
>
> Uptake is a battle in progress, with successes and failures, but results have to this date been generally disappointing. The few cases where index insurance has been implemented were either free or heavily subsidized, or offering insurance along with other benefits such as subsidized credit and heavy technical assistance. In extensively

[12]In the case of India's programs, the government typically pays between 60 % to 75 % of the premiums. ACRE has relied on donors to fund its establishment (e.g., for feasibility studies and salaries), and to pay for premium subsidies. The scheme in Ethiopia and Senegal allows farmers to pay premiums with labor instead of cash, through the government's Productive Safety Net Programme in Ethiopia, and the World Food Program's Food For Assets initiatives in Senegal. Finally, subsidies in Mongolia's program take the form of the government paying for catastrophic losses, and for subsidized reinsurance and other supporting services.

studied cases in Malawi (Giné, 2009) and India (Cole et al., 2013), take up was only 20-30% with adopters hedging only a very small fraction of agricultural income. Take up among farmers not explicitly targeted in these programs was much lower. There are, however, recent exceptions, with Karlan et al. (2012) reporting a 40-50% take up at fair price plus a 50% loading in Ghana, and insurance inducing an increase in investment in cultivation. In this case, experiencing insurance payouts either oneself or through social networks was an important determinant of demand. In general, however, low uptake is still the norm and it requires addressing the issue of the reasons why this is the case."

The quote above is important because it indicates that the relatively high uptake of index-based insurance found by Karlan et al. (2012) is an exception. The published version of Karlan et al. (2012) (Karlan et al., 2014) was reviewed in Subsection III.1.a of the present report. However, it is revisited next because of its high relevance, with a special focus on the potential for the commercial scaling up of its experimental setting.

There are several features of Karlan et al. (2014)'s experiment that call into question the replicability of its results on a large-scale commercial setting, namely:

- Farmers' trust
- Local infrastructure
- Farmers' knowledge about agricultural technology
- Farmers' program awareness
- Farmers' knowledge of contract specifications

In terms of trust, farmers offered insurance by Karlan et al. were told that the program was a research project being conducted by the non-governmental organizations IPA and Presbyterian Agricultural Services. Both organizations are well-known by the farmers for their services in the local communities; hence, it is safe to assume that farmers trusted the insurance offering (Osei-Akoto, personal communication). In addition, Karlan et al.' experiments were performed in an area where farmers had been exposed to substantial agronomic advice from prior development

programs, and infrastructure had been improved by the Millenium Challenge Account program funded by USAID (Osei-Akoto, personal communication). Thus, conditions were likely better than in many other areas of Ghana to respond to the offer to buy insurance.

In regards to farmers' awareness and knowledge of the contract specifications, Karlan et al. (2014) devoted vast resources to ensure that each subject in the insurance treatment group was aware and had a proper understanding of the product. Marketers paid individual visits to the farmers offered to buy insurance. In the visit, the marketer explained the insurance product and its price, left a copy of the policy with the farmer, and informed him/her that s/he would have about two weeks to decide whether to purchase insurance. Since (a) the individualized marketing used for the treatment group would be very difficult to achieve on a commercial setting because of its high cost, and (b) the takeup rates reported by Karlan et al. (2014) are computed relative to the treatment group, it is obvious that Karlan et al.'s takeup rates overestimate the takeup rates achievable on a commercial scale.

In connection with the scalability of the levels of farmer awareness and product knowledge, it must be noted that Karlan et al. (2014) continued the experiment for a fourth year. The corresponding results are not analyzed in the article, because several changes occurred in the experimental setting. However, one of the ways in which the fourth year differed from the previous three years was that "(ii) Marketing was done to entire communities with interactive sessions (thus avoiding the costly one-on-one marketing that was used in the first years of the study)." (Karlan et al. (2014), p. 647). Interestingly, WII takeup in the fourth years was only 5 %, i.e., it was drastically smaller than in previous years.

Inferences about the potential scalability of the high takeups reported by Karlan et al. (2014) should also consider the (lack of) representativeness of the weather realizations in the first two years of their experiment, in conjunction with the significant recency effects[13] found by them. The reason for this assertion is that the weather index realized in the first and second years

[13]That is, that the probability of a farmer purchasing insurance on a given year is highly positively correlated with him/her receiving an insurance payout in the previous year.

of the experiment led to unsustainably large payouts.[14] Consistent with sizable recency effects, the second and third years were characterized by high participation rates. In contrast, the weather index realizations in the third year resulted in zero indemnities. The fourth-year results were not analyzed econometrically in the study, mentioning that "The year 4 product (i.e., after the results reported herein) differed, and only 5 % of the farmers purchased." (Karlan et al. 2014, p. 647). However, the dramatic drop in participation observed in the fourth year is also consistent with strong recency effects. More importantly, it also suggests that the high takeups found by Karlan et al. (2014) may have been largely driven by the unusually large payouts in the first two years of the experiment.

The distinction between demand for insurance at actuarially fair premiums versus demand at market premiums is an additional caveat to consider when drawing inferences on commercial scalability from Karlan et al. (2014). Although they find the quantity demanded at actuarially fairly premiums encouragingly high (takeup rates of 40 % to 50 %, with about 40 % to 50 % of cultivated acres covered per insured farmer), it must be recognized that such premiums are not commercially viable because they do not include servicing costs. The quantity demanded at "market" premiums (defined for the study as the actuarially fair premium plus a 50 % load), which would be more realistic for a commercial setting, is much lower (takeup rate of 11 %, with less than 35 % of cultivated acres covered per insured farmer).

Absent subsidies, the amount of basis risk associated with WII products in Ghana seems to pose an unsurmountable impediment to their widespread adoption. According to the WII research reviewed in Subsection III.1.a of the present document, the correlation between rainfall and yields at the district level is typically weak (e.g., Muamba and Ulimwengu; Katie School of Insurance; Okune), thereby implying substantial district-level basis risk. Moreover, the actual

[14] In the first (second) year 74 % (40 %) of insured farmers received payouts, consisting of \$85/acre (\$51/acre on average). Back-of-the-envelope calculations yield average realized payouts of \$62.9 per insured acre (= 0.74 × \$85/acre) for the first year and \$20.4 per insured acre (= 0.40 × \$51/acre) for the second year. Such payouts were unsustainable, because they substantially exceeded the respective actuarially fair premiums of \$47.50/acre and \$10/acre.

basis risk faced by individual farmers is even higher, because district-level correlations overestimate farm-level correlations. In this regard, the findings by Kwadzo, Kuwornu, and Amadu suggest that individual farmers' basis risk is much greater than the district-level basis risk.[15]

Some of the stakeholders interviewed argued that one way to contribute to the diffusion of agricultural insurance is to require that agricultural insurance for farmers borrowing from banks. Similarly, Nunoo and Acheampong state that "Agricultural insurance coverage could be made mandatory for financial institutions that provide agricultural loans and credits." (Nunoo and Acheampong, p. 243). However, the evidence from Gallenstein et al. indicates that such proposals should be viewed with skepticism. The study by Gallenstein et al. suggests that requiring insurance for lending might create major distortions in the market for agricultural credit, because their data imply a large drop in the number of borrowers associated with mandatory loan insurance.

The consensus opinion that failure of the ABYI pilot program was largely due to the unreliability of the yield estimates produced by the government suggests that, unless major corrective actions are taken to ensure the integrity of the underlying yield data, the prospects for ABYI are poor. Unfortunately, even if the quality of yield data could be improved to adequate levels in the near future, implementation of ABYI would still be hampered for years to come. This is true because the weakness of the historical data poses severe challenges for the computation of actuarially far rates.

Finally, in regards to the prospects for damage-based insurance, the key problems to be solved for it to be viable concern moral hazard and adverse selection. It does not seem feasible to design policies that do not expose insurers to moral hazard and adverse selection, marketed at premiums that are both economically sustainable for insurers and sufficiently attractive for small

[15]Recall that in their study, farmers reported that, over the previous 5 years, the frequencies of perils were 100 % for bushfires, 80 % for theft, 80 % for grazing livestock, 60 % for windstorms, 40 % for drought, and 40 % for flood.

farmers.[16] However, as demonstrated by the damage-based programs currently offered to rubber and poultry producers, niche opportunities are likely to exist to develop economically self-sustained damage-based insurance schemes targeting commercial-scale farms (see also Stutley). Unfortunately from a social welfare standpoint, such programs would reach only a tiny -- and the least economically vulnerable -- fraction of Ghana's farm population.

Interestingly, the majority of the stakeholders interviewed proved to be cautiously optimistic about the prospects for agricultural insurance in Ghana. Such view contrasts with the recent experience with WII in the country, and with the evidence elsewhere regarding index-based and multiple-peril agricultural insurance programs (which strongly indicates that adoption is very limited in the absence of subsidies or mandates). Hence, it seems a worthwhile undertaking to explore in greater depth the rationale for the optimism expressed by stakeholders, to determine the extent to which it is justified.

Given the information gathered at the interviews, we speculate that some possible explanations for the stakeholders' optimism are the following:

- Rent seeking: Insurance companies stand to earn rents if they succeed at obtaining subsidies for agricultural insurance, making ag insurance mandatory for borrowers, or extracting similar types of concessions at the expense of the government or other sectors. To the extent that efforts to maintain such hopes alive are subsidized (e.g., by funds from development organizations), insurance companies will stay interested in pursuing them.
- Misinformation: The recent focus on the development of agricultural insurance was largely driven by the development community (e.g., IPA and GIZ). A review of the information materials put forth by the development community reveals an overwhelming emphasis on the positive aspects of agricultural insurance and why it "has to be" successful. As a result, stakeholders may have been misled into believing that agricultural insurance has a much better chance of success than it actually has.

[16]For example, the cost of a farm visit to verify damages is largely the same regardless of the size of the farm, which puts smallholders at a distinct disadvantage.

- Poor (or lack of) business plans: It is unclear to what extent GAIP and other stakeholders have prepared sound business plans, showing the market penetration levels needed to achieve profitability, and appropriately assessing the costs of the efforts required to achieve such levels of penetration. Without high-quality business plans, it would be difficult for stakeholders to appropriately assess the likelihood of achieving success.
- Overconfidence: According to the Financial Times (http://lexicon.ft.com), overconfidence is, "In business or trading, an overestimation of one's abilities and of the precision of one's forecasts." Numerous recent studies in behavioral economics have focused on overconfidence, because it is a cognitive bias that can explain common "irrational" behaviors. In the present context, if stakeholders are overconfident about their skills to make agricultural insurance succeed, or put undue weight on the favorable forecasts while discarding unfavorable evidence, they would exhibit unwarranted optimism.

Each of these tentative explanations can reconcile the stakeholders' optimism with the existing evidence on agricultural insurance. However, the list is not exhaustive, and further research is needed to determine whether the above explanations reflect reality or not.

On the positive side, current initiatives undertaken by GAIP focus on outgrower/nucleus farmer arrangements being promoted by MoFA. The focus on outgrower/nucleus farmers should result in a more efficient use of GAIP's resources. Because of the larger acreage controlled by individual outgrower/nucleus farmers, delivering agricultural insurance to them should be less expensive on a per-acre basis, thus enhancing the chances of success. In addition, outgrower/nucleus farmers could help organize and promote insurance education among their farmers, and provide the trust that smallholders need to buy into insurance schemes.

In addition, the macro-environment is generally improving, providing conditions more favorable toward the provision and adoption of agricultural insurance. For example, the mobile telephone network operator is in discussions with MoFA to improve agriculture information dissemination, including weather data, to farmers through use of standard handsets. Also, the liberalization of the financial markets has resulted in the establishment of many more insurance

companies in the country over the last decade, which has increased competition in the industry and generally driven down premiums.

VII. Concluding Remarks

The present report reviews the research that has been conducted on agricultural insurance in Ghana, and examines recent developments and prospects regarding agricultural insurance programs for that country. As part of the study, numerous stakeholders were interviewed to gather their opinions about the possible reasons for the disappointing takeups that have been observed, and their suggestions for improving the likelihood that agricultural insurance will become more widely adopted.

According to the stakeholders surveyed, the extremely limited adoption of the WII insurance programs in Ghana was largely due to (a) expensive premiums, (b) lack of awareness and financial literacy, (c) insufficient commitment by insurance companies, (d) lack of trust by farmers, (e) poor infrastructure, (f) basis risk, and (g) low participation of lenders, input suppliers, and processors. In addition, the consensus among interviewees was that the ABYI program failed because of unreliable yield data, and lack of farmers' trust in the yield data. In the opinion of stakeholders, important actions that need to be taken to improve the likelihood of a wider adoption of agricultural insurance include: (a) bolstering marketing efforts, (b) obtaining government support, (c) promoting education/awareness, (d) expanding the number of agricultural insurance products, (e) reducing basis risk, (f) changing the form of the insurance pool, and (g) modifying the composition of the agricultural insurance steering committee.

Absent large subsidies, the prospects for agricultural insurance to become a major risk management tool in Ghana are not encouraging. Elsewhere, named-peril has been the only type of insurance that has succeeded without relying on subsidies. But, as indicated by its designation, named-peril insurance only covers a limited range of risks. Further, named-peril insurance is typically too expensive to deliver to small holders, which implies that it is unlikely to be economically viable without subsidies for most of Ghana's producers. Multi-peril and revenue

insurance, while providing better protection for farmers, have proven to be unsustainable in the absence of heavy subsidies. As per index-based insurance, which in the last two decades has been advocated as the most promising way to provide coverage to small farmers in developing nations, it is highly unlikely that it will be widely adopted without resorting to substantial subsidies. Index-based insurance has been piloted in many countries, including Ghana. However, no index-based program has been successfully scaled up without subsidies, and there is little evidence that Ghana will prove to be an exception.

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Appendix: Interviews

Interviews were conducted between May 5, 2015 and May 8, 2015, with the following individuals:

- Kwam-Gazo Agbenyadzie, Chief Executive Officer; MET Insurance
- Michael K. Andoh, Head of Supervision; National Insurance Commission (NIC)
- Ebenezer K. Asante, National Administrator; Ghana National Association of Farmers and Fishermen
- Joseph Boamah, Chief Director; Ministry of Agriculture
- Emmanuel Dormon, Chief of Party; Advance, A USAID Feed the Future Initiative
- Alhajj Ali Muhammad Katu ACII, General Manager; Ghana Agricultural Insurance Pool (GAIP)
- Kwame Ntim Pipim, Marketing Manager; Ghana Agricultural Insurance Pool (GAIP)
- Isaac Osei-Akoto, Senior Research Fellow & Head, Statistics and Survey Division; Institute of Statistical, Social, and Economic Research (IISSER), University of Ghana
- Fenton B. Sands, Senior Food Security Officer, Office of Economic Growth; U.S. Agency for International Development (USAID)
- Eric Sosu, Protocol Officer; Ghana National Association of Farmers and Fishermen
- Branko Wehnert, Project Manager, Insurance Services; German Agency for International Cooperation (GIZ)