Extended Abstract
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Paper/Poster Title	To Adopt or Not to Adopt ? Examining the Impact of Climate-smart Seeds Varieties on Production Risks

Abstract prepared for presentation at the 97th Annual Conference of the Agricultural Economics Society, The University of Warwick, United Kingdom

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Abstract	***200 words max***
While many studies have examined the yield-increasing impacts of adoption of climate-smart seed varieties, little is known about whether the adoption of these varieties has the potential to reduce farmers' exposure to production risk. Using a nationally representative dataset collected from 2,216 maize-farming households in Nigeria, we fill this knowledge gap by analysing the treatment effects of adoption of drought-tolerant maize varieties (DTMVs) on production risk, measured by expected yield, yield variance (variability), and yield skewness (downside risk). We employ an endogenous switching regression model to sufficiently tackle selectively bias that may arise from observed and unobserved factors. Our findings reveal that DTMVs adoption raises maize yield by 26.61% and reduces the variance and downside risk exposure by 95% and 164%, respectively. Policy measures that seek to tackle dissemination constraints, such as promotion of informal seed sector, may help enhance the adoption of climate-smart seed varieties that will eventually improve farm performance and reduce farmers' exposure to climate-related production risk.	

Keywords	Climate-smart Agriculture, production risk, maize yield, endogenous switching regression, and Africa.
JEL Code	C31, C52; D81; Q16 see: www.aeaweb.org/jel/guide/jel.php?class=Q)

Introduction	***100 – 250 words***

One of the greatest challenges facing agricultural production systems in sub-Saharan Africa (SSA) is climate change and variability due to the incidence of high temperature, erratic rainfall regimes and low adoption of improved technologies (Wheeler & Von Braun 2013). As a result of climate change, droughts have become more severe, longer, and more frequent (Hyman et al. 2008). According to FAO (2013), the economic losses that are drought-related as a percentage of gross national income were about 4.7% in the year 2013, tend to be higher in SSA than any other regions of the world. Consequently, efforts have been made by different research and development agencies to develop adaptation strategies, including the drought-tolerant maize varieties (DTMVs) with the overarching aim of providing a viable pathway to bolster productivity and livelihood outcomes, coping with negative externalities and fostering farmers' resilience to drought shocks (Olagunju et al. 2020).

In this paper, we evaluate the impacts of DTMVs adoption on yield and exposure to risk from maize-farming households in Nigeria. We offer two main additions to literature

and agricultural policy development. Firstly, we provide the first attempt to estimate the impact of DTMVs adoption on production risk proxied by expected yield, yield variance, and yield skewness (exposure to downward risk) in Nigeria. From policy perspective, findings from our study will provide evidence base for the role which DTMVs adoption can play as a viable risk coping management strategy against exposure to production risk among smallholder farmers in Nigeria and SSA.

Methodology	***100 – 250 words***

The procedure to achieve the study objective involves two stages. In the first stage, we use a moment-based production function model to estimate our three production risk measures – expected yield, yield variance and yield skewness. We then apply an Endogenous Switching Regression(ESR) approach to analyse the impacts of DTMVs adoption on the estimated moments.

Our measurement of production risk relies on a flexible moment-based approach involving a sequential estimation procedure in which output (e.g., yield) is regressed on a vector of production inputs based on a translog function. In specific, the values of the first moment is the expected maize yield; the yield variance is calculated by taking the square of the residual term. When the residual is raised to the third power**,** the third moment indicating exposure to the downward risk (yield skewness) is obtained.

Estimating the treatment effects of DTMVs adoption on the three outcome variables is done using the ESR model. The ESR is a two-stage econometric model which fits a treatment function, usually a dichotomous model, (that is, DTMVs adoption equation) and two continuous outcome models (one for adopters and the other for non-adopters), and subsequently applies the estimated coefficients to estimate the average treatments effects (ATT) of DTMVs adoption. This model addresses sample selection bias stemming from observed (e.g., farmers age, experience *etc.*) and unobserved (e.g., beliefs, managerial experience, skills *etc.*) factors.

The data employed in this study was obtained from the farm household survey conducted between November 2014 and February 2015 in Nigeria. In total, the number of farming households that form the observations is 2,216 farmers with 509 adopters and 1,707 are non- adopters.

Results	***100 – 250 words***

Our results show that the DTMVs adoption likelihood is positively and significantly influenced by household size, number of years resided in the village, experience of drought in the past, and Awareness of DTMVs while gender and distance to seed source has a negative and significant relationship.

Our results also reveal that DTMVs adoption has a positive treatment effect on expected yield. It shows that DTMVs adoption raises maize yield by 26.61%, meaning that maize yield of adopters would have been lower by 26.61% should they not have adopted.This is in line with Lunduka *et al.* (2019) for Eastern Zimbabwe and Ahmed *et*

al. (2017) for Ethiopia. The ATT estimates also reveal that the impact of DTMVs adoption significantly reduces yield variance by 1.32, corresponding to reduction in variability of maize yield by 96%. The mean yield variance reduces from 1.38 to 0.06 as a result of DTMVs adoption. The downward risk proxied by yield skewness declined as a result of DTMVs adoption. Specifically, the average yield skewness changes from negative (-5.58) to positive (1.03) due to DTMVs adoption. Hence, the adoption of DTMVs reduces downward risk by 168%. Conclusively, the results suggest that DTMVs adoption is relevant for enhancing farm performance as well as ameliorating farmers exposure to yield variability and uncertainty.

Discussion and Conclusion	***100 – 250 words***

Results show that variables, including gender, household size, number of years resided in the village, distance to seed market, regional dummies and awareness of DTMVs are the significant factors that influence likelihood of DTMVs adoption. The empirical results also show that DTMVs adoption significantly increases expected yield by 26.61% and reduces yield variability (variance) by 95% and downward risk (skewness) by 168%.

Our study offers relevant policy implications appropriate to facilitating farm sustainability. In general, the yield-enhancing and production risk- reducing effects of DTMVs adoption, as established in this study suggest that policy reforms that seek to encourage climate-smart seed varieties dissemination should be promoted. This is particularly relevant for Nigeria and many other developing economies where exposure to climate-related production risk constitute a serious threat to farm sustainability, food security and livelihood of many farming households. Finally, our results also help identify strategies that can help to facilitate DTMVs adoption. Specifically, the results highlighted these two major constraints: limited awareness about climate-smart seed varieties and distance from seed source. Hence, taking full advantage of the benefits of adoption requires interventions targeted at alleviating these constraints. For example, the promotion of informal seed sector may help improve access to a variety of information and input markets for climate-smart seed varieties at affordable prices at the right place and time.