THE ANALYSIS OF THE CLIMATE CHANGE AND AGRICULTURAL PRODUCTIVITY ANALYSIS

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ABSTRACT

To low-income nations, climate change brings a host of problems, from food insecurity to forced migration to extreme poverty to seasonal joblessness. In terms of climate change, agriculture is the most at risk. Crop damage, low productivity, and high production costs caused by climate change will result in lower farmer incomes, a rise in poverty and inequality, and a decrease in the amount of time farmers spend working in agriculture. This research examines the influence of climate change on many sectors of an economy, both theoretically and empirically. Discusses the literature on the impacts of climate change on agriculture GDP, per capita GDP, per capita income, agricultural productivity and productivity of various crops in industrialised and emerging nations.

KEYWORDS: Agricultural Productivity, Climate Change Estimation Method, Developing Countries, Vulnerability

I. Introduction

Climate change and its effects on agriculture and other areas of the economy are debated by researchers. Higher temperatures might affect agricultural output patterns because of the intricate interaction between climate change and agriculture (Kukal, & Irmak, 2018). Agriculture is more sensitive to climate change than any other industry, both physically and economically (Aizen, et al. 2019). Global warming impacts every way of life, occupying 40% of the planet's arable land, using 70% of its freshwater, and impacting biodiversity on every scale (Abdalla, et al. 2019). Crop damage, low productivity, and high production costs caused by climate change will result in lower revenue for farmers, a rise in poverty and inequality, and a decrease in the amount of time farmers spend actively engaged in agriculture (Ortiz-Bobea, et al. 2018). This research also demonstrated that farmers' health will be jeopardised due to climate parameter unpredictability. Many people's lives will be made more difficult as a result of the effects of climate change, especially in underdeveloped countries where assets and insurance coverage are few.

Sections of this research are arranged as follows: In the first portion, we get a broad picture of how climate change affects agriculture, poverty alleviation, and global food security. The empirical review of climate change's effects on industrialised nations is the focus of the second part. In the third portion, we look at how climate change affects agricultural and crop productivity in emerging nations. Section four provides a comprehensive assessment of the literature on climate change and its impact on Indian agriculture. The gap in the literature that prompted us to conduct this investigation is summarised in the latter section of this paper.

II. Climate Change and Agricultural Productivity in Developed Economies

Agricultural productivity (monetary terms) and productivity of food grain and non-food grain crops (commercial crops) in industrialised nations are examined in this section of the literature study. Researchers have used a variety of methodologies to quantify the influence of climate change on agricultural output in industrialised nations. There is a large body of research utilising the Ricardian cross-section model to examine how climate change and other socioeconomic variables affect agricultural production in the United States. The Ricardian model is the most important way for including farmer-implemented adaptation methods to reduce the negative impact of climate change on agriculture. When first developed by classical economists (Panagos et al. 2018), the model was used to assess land values. It is anticipated that global warming will have an economic influence on land prices in the United States by employing a Ricardian cross section technique. As a consequence of empirical data in this study, the predicted results suggested that global warming would have a little positive impact on American agriculture. Climate change's influence on agricultural productivity in Greece and the United States was estimated using Cobb-Douglas production function model (Searchinger, et al. 2018). It was shown that in the previous three decades, temperature increases were negatively related with agricultural production in Greece (Adams, et al. 2019), but precipitation was favourably associated. According to (Kukal, & Irmak, 2018), various regions of the United States will experience varying effects from the same climate change scenarios. For agricultural productivity in rich and developing countries alike, several researchers have utilised a stochastic production function model to assess the risk of increasing or reducing inputs (related to climate and non-climatic variables) (Aizen, et al. 2019). Temperature and precipitation are risk factors for rice yield variability in Korea, according to (Agovino, et al. 2019) who found that rice mean yield was positively linked with temperature rise and negatively associated with precipitation increase. Climate change may pose a challenge to rice producers, consumers, and the Korean government, according to a new research. In the United States, heavy precipitation has a detrimental influence on peanut production (Agovino, et al. 2019), whereas temperature has a beneficial impact on peanut output (Agovino, et al. 2019). While precipitation and temperature have a beneficial impact on wheat mean yield, they also show a correlation with wheat variability (Aizen, et al. 2019), suggesting that both are risk-increasing inputs for wheat yield variability in Canada. A study by Abdalla, et al. (2019) found that climatic conditions had a substantial influence on the mean yield of maize, soybean, and winter wheat, and an increase in temperature and precipitation would lower the average yield and increase the variability of the crop. (Ortiz-Bobea, et al., 2018) used a non-linear programming technique in Swiss agriculture to assess the impact of meteorological conditions on maize and winter wheat output.

III. Climate Change and Agricultural Productivity in Developing Economies

Agricultural productivity and yields of food and cash crops in developing nations are strongly influenced by climate change. When it comes to climate change and crop yields in poor nations, previous academics have used a variety of strategies. Crop yield and yield variability may be estimated using a variety of models including the Ricardian model, Cobb-Douglas model, the stochastic production function model, and the agro-ecological zone model, and the agro-ecological zone model. First, we looked at the studies that employed the Ricardian cross-

sectional model to evaluate the impact of climate change on agricultural production in emerging nations. When temperatures rise in the summer and winter, crop net income per hectare land in Nigeria decreases dramatically, but when precipitation increases in the spring, crop net revenue per hectare rises significantly (Panagos, et al. 2018). Furthermore, the study found that climate change will diminish the net revenue per hectare of land in 2020, 2060, and 2100 under all SRES models. According to (Kompas, et al. 2018), in Nigeria, a rise in temperature reduces net revenue from dry land rice farms whereas a rise in temperature increases net revenue from irrigated rice fields. In Egypt, Eid et al. (2006) found that a rise in temperature will have a detrimental impact on agriculture revenue. Increases in temperature have been shown to have a detrimental impact on agricultural profits, whereas increases in precipitation have been shown to have a favourable impact. Although global warming affects both small and big farmers equally in terms of land value, (Kukal, & Irmak, 2018) discovered that if biomass diversity is taken into consideration, then there might be varying effects on land value depending on the farm size category in Brazil. Climate change has a negative influence on sugarcane output in South Africa, say researchers (Kukal& Irmak, 2018). (Kukal, & Irmak, 2018) shown that climate change reduces land productivity and farm income, and estimations predict that agricultural productivity and farm income fall by 15 to 20% and 5 to 20%, respectively, if temperatures rise by 10C in Africa. Using a Ricardian model, (Kukal, & Irmak, 2018) predicted agricultural production in 11 African nations by 2020. Climate change is expected to have a significant detrimental impact on dry and hot areas by 2020, according to a new study. It's possible that dryland crop net incomes might grow by 51% if future warming is mild, while dryland crop net revenues could decline by 43% if future climate is hot and dry. Variability in climatic conditions makes African agriculture more susceptible (Kukal, & Irmak, 2018) (Kukal, & Irmak, 2018) found that climate change affects land value and net revenue. Using empirical data, the study found that Latin American rainfed farms are more vulnerable to temperature than irrigated ones are.

IV. Climate Change and Indian Agriculture

The effects of climate change on Indian agriculture are examined in this section. Numerous studies in India have indicated that the agricultural productivity of key food grains and commercial crops is negatively affected (in terms of quantity and monetary value) by climate change. As an example of a Ricardian cross section model (Kukal, & Irmak, 2018). On a macro level, climate change is expected to reduce agricultural farm earnings by 9 percent in 16 Indian states, according to (Kukal& Irmak, 2018). Studying climate change impacts on cultivated area and production in the Godavari River Basin has been done by (Kukal, & Irmak, 2018). (India). Climate change has had a substantial impact on the area of rice and maize crops, according to estimations. Paddy yields are influenced by both rainfall and temperature, while maize yields increase as temperatures rise. According to the findings, the severity of the effects of climate change differs by area. If the temperature rises by 2% to 3%, it is estimated that the overall agriculture net revenue in India will decrease by between 9 and 25%. In the words of (Kukal, & Irmak, 2018): To determine the influence of climate change on agricultural productivity, researchers used the ARDL and ECM models from the Auto Regressive Distributed Lag (ARDL) literature. Climate change has a detrimental influence on agricultural production and economic growth in India, according to a research that included CO2 emissions in its analysis. Cobb-Douglas production models were used to assess the influence of climate change on rice, sorghum, and millet crop productivity in India's most agriculturally intensive states (Kukal& Irmak, 2018). This was done at the macro level. Researchers found that the yields of

rice, sorghum, and millet may be reduced as a result of climate change. Orissa's Gross Farm Revenue per Hectare was examined by using a similar technique by (Kukal, & Irmak, 2018). Low rainfall, according to the findings, has decreased gross agricultural income per hectare and poor farmer income. Finally, it was shown that irrigation improvements increased agricultural revenue. According to (Kukal& Irmak, 2018), rainfall in Andhra Pradesh has no substantial effect on the sugarcane production.

V. Conclusion

Per capita GDP (GDP), per capita income, agriculture GDP (Agriculture GDP), agricultural productivity and yield of different crops in a cross-country analysis are all examined in this study. It has been shown that climate change has a large and negative impact on all sectors of economy (GDP, per capita income, agricultural productivity, and food security at a global level) in the theoretical and empirical research covered in the first section. A portion on the influence of climate variables on agricultural production in wealthy nations was presented in the second segment, while a piece on empirical research in emerging economies was presented in the third section. In the fourth section, we present the empirical findings that estimate the impact of climate change on Indian agriculture. Existing research suggests that agriculture is particularly vulnerable to climate change across the world, and it's a finding that makes sense. Research shows that climate change has a negative impact on agricultural output and net revenue in India, other developing nations and industrialised countries. 'Increasing food shortages and job losses due to climate change might lead to a rise in poverty in India. According to a number of research in India, climate change has an impact on a variety of crops. Studies reveal that climate change has reduced agricultural production or net revenue for several food grain crops in India's diverse locales. However, we were unable to locate a research that evaluated the influence of climatic conditions on the average yield and variability of all main food grains and commercial crops in India at the macro level. As a response to this gap in existing research, we plan to perform a new study that investigates the impact of climate conditions on the crop's mean yield and variability throughout two time periods (sowing and growing time of each crop).

VI. References

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