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THE NEXUS BETWEEN GOVERNMENT AID AND AGRICULTURAL PRODUCTIVITY: A POTENTIAL POVERTY ALLEVIATION TOOL IN THE GAMBIA POST COVID-19: AN EMPIRICAL ANALYSIS (PART 1: THEORETICAL BACKGROUND)

Abstract. The global poverty distress is quite mysterious, notwithstanding the global economy's progress over the years and the massive advancement in science, technology and transport. Yet, over 10% of the world's population live in extreme poverty. While donor organisations, researchers and governments have recommended and implemented orthodox policies to solve the problem of global poverty, it is imperative to investigate the impact of government aid on agricultural productivity. This study employs an error correction model (ECM) and OLS technique to empirically analyse the nexus between government aid and productivity. Using time-series data concerning 27 years, we estimate six different regression models in determining the causal effects of the following explanatory variables: fertiliser, pesticide, land availability for agricultural activities and government aid to farmers on the six dependent variables, including vegetables, paddy rice, groundnut, maize, millet and sorghum. The results indicate a positive relationship between government aid in the form of agricultural input and productivity. However, fertiliser has a negative relation with paddy rice, groundnut, maize, millet and sorghum; this could be explained as a result of the inadequate supply of fertilisers by the government to farmers. Thus, productivity is empirically established to be affected by the quality and amount of government aid in the form of agricultural inputs. The presented article is a theoretical introduction to the discussed problematic, it is at the same time a preliminary recognition of the state of knowledge in this area and a refusal of attempts to solve the problem.

Keywords: poverty, COVID-19, agricultural investment, agricultural productivity

INTRODUCTION

Poverty continues to be an enduring hardship facing the world; notwithstanding the immense growth in the global economy in the past decade, over 700 million people worldwide still languish in extreme poverty (i.e. surviving on less than $1.90 a day). About half of these people are under 18 years of age, and 80% reside in South Asia and sub-Saharan Africa, and over a billion people live in multidimensional poverty (UNDP, 2020). Moreover,

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most individuals living in extreme poverty are susceptible to various natural disasters such as disease outbreaks and challenging climate conditions. Thus, these troublesome conditions caused a rise in inequality and social conflicts in most affected societies (Food and Agriculture Organisation, 2019).

The spread of the novel coronavirus (COVID-19) that began in late 2019 has disrupted economic activities globally. For developing countries, the severity of poverty is expected to worsen. According to Jackson et al. (2020), the recent impact of the pandemic on global economic growth is beyond anything experienced in almost a century. Projections are that the pandemic could cause a significant drop in global economic growth between 3% and 6% in 2020, with a partial recovery in 2021, assuming a vaccination is developed in time.

The World Bank report on the estimated impact of the COVID-19 pandemic on global poverty projected that the pandemic could push about 70 to 100 million people into extreme poverty in 2020. Thus, it would represent the first increase in extreme global poverty for over three decades, therefore, jeopardising the progress made in plummeting extreme poverty worldwide since the 1990s. These negative impacts of the COVID-19 pandemic pose a threat to achieving the UN Sustainable Development Goal of ending poverty by 2030. According to a World Bank Group report (2020), "the pandemic has caused an enormous magnitude of global economic shock, resulting in steep recessions in many countries. The report forecast a 5.2% shrink in global gross domestic product this year, the most global recession in eight decades, notwithstanding the unprecedented policy support. Per capita incomes in the majority of emerging market and developing economies are expected to contract this year, pushing millions back into poverty". Sumner et al. (2020) reported that, while all other things accounted for, assuming a 5% contraction in per capita incomes, we could experience a possible increase in the USD 1.90/day poverty with more than 80 million people pushed into abject poverty. If this contraction rises to 10%, it will result in about 180 million people living in poverty. However, a 20% contraction in per capita income could see an increase to about 420 million people falling into poverty.

Agricultural Growth in the Gambia

Hydara (2020) reported that about 48% of the Gambia's population lives in poverty with a very low Human Development Index. According to the World Food Programme (WFP), the Gambia produces only 50% of the food it needs, with acute malnutrition at 10.3% and 23% of underdeveloped children. As the primary economic growth driver, the agricultural sector generates about 40% of foreign exchange, contributes over 20% of the GDP and provides employment and income for over 70% of the population. The sector is dominated by crop cultivation which provides about 80% of household income for most rural residents. However, notwithstanding the sector's growth, agricultural activities are vulnerable to climate crises such as drought, floods, erratic rainfalls, inadequate farm implements, training and skills, which directly impact the availability of food (World Food Programme, 2019).

The growth in the agricultural sector is about half of the national target because of insufficient investment and inadequate output, which is aggravated by persistent gender inequalities in accessing farm inputs and inadequate storage facilities. As a result, the most exposed people are regularly at the peril of being unable to procure sufficient food. The World Food Programme (2019) reported that the drought in 2017 led to a 26% fall in crop production, resulting in an upsurge in market prices, causing issues for vulnerable households, who spend most of their income on food. Thus, the intervention of government and allies in a specific-target investment approach in the agricultural sector of the Gambia will bring about a drastic improvement in the living standards of the people and poverty reduction in general.

Research Objective

To highlight the relationship between government aid and agricultural productivity.

Research Question

What is the impact of government aid on agricultural productivity in the Gambia?

Research Hypotheses

The following hypotheses are constructed for the empirical testing and quantitative analysis of the nexus between agricultural investment and productivity as modelled in the methodology.

H_0: Government aid has a negative impact on agricultural productivity.

H_1: Access to government aid has a positive effect on agricultural productivity.

LITERATURE REVIEW

The impact of agricultural productivity in alleviating poverty in sub-Saharan African countries, especially the Gambia, cannot be overemphasised. The majority of households in sub-Saharan Africa depend on subsistence agriculture for their livelihood. However, the striking poverty level in these regions impedes their ability to realise the full potential of agricultural productivity. Hence, enhancements of farm activities like mechanisation, higher quality improvement in farming techniques and crop yields will significantly impact the lives of these indigenous since the majority of them are involved in providing food for their families (Hydara, 2020).

Empirical Evidence of Poverty Alleviation through an Upsurge Agricultural Productivity

Agricultural productivity has been defined as a measure of total output per hectare, per unit of input, yield or worker. Hydara (2020) points out that researchers such as Mellor (1999) reported empirical studies that support the idea that enhancements in agricultural productivity are vital for poverty alleviation. In addition, Schneider and Gugerty (2011) identify numerous routes through which an improvement in agricultural productivity can mitigate poverty by creating employment that can positively impact household income and reduce food prices. However, the lack of initial capital, technology, and constraints to access the market may all inhibit the ability of the poorest to participate in the gains of agricultural productivity growth.

Hydara (2020) also reports on authors whose works empirically supported that agricultural productivity significantly reduces poverty. Datt and Ravallion (1996; 1998; 2007), Byerlee et al. (2005), and Timmer (1995) all conducted studies on the impact of agricultural productivity on poverty alleviation using a variety of productivity measures, and all the results point to a significant reduction in poverty. Irz et al. (2001) show that a percentage of growth in agricultural productivity reduces the poverty headcount ratio by about 1–2%. Similarly, Irz et al. (2001) reported in Gallup et al. (1997) that every 1% increase in the agricultural gross domestic product leads to a 1.61% increase in the incomes of the poorest quintile. Thorbecke and Jung (1996) also concluded that the majority of poverty reduction is due to massive growth in agricultural productivity.

According to Mellor (1999), an increase in agricultural production (output) leads to lower food prices. An increase in farmers' income results in increased demand for the goods and services produced by the non-farming rural poor leading to a multiplier effect. Thirtle et al. (2003) also mentioned that agricultural growth by increasing both production and employment gives rise to

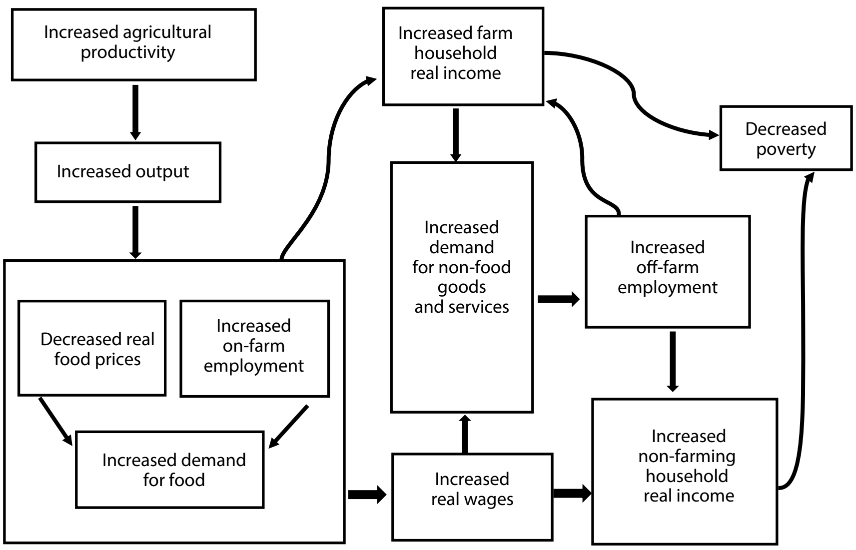

Fig. 1. The Multiplier Effect of Agricultural Productivity
Source: Schneider and Gugerty (2011).

a significant benefit for poor farmers, landless labourers and the rural poor through the non-farm economy.

Schneider and Gugerty (2011) explained that this multiplier effect of an increase in agricultural productivity on the respective stakeholders and the economy, in general, could alleviate poverty, as illustrated below.

The illustration depicts that increased agricultural productivity leads to increased output, which causes a decrease in real food prices, triggering a higher demand for food that will require more on-farm employment. On-farm employment will increase farm household real income, creating availability of income to demand non-food goods and services, giving rise to off-farm employment. Therefore, the increase in non-farming (off-farm) household real income would increase real wages and eventually decrease the level of poverty. In the Gambia, this multiplier effect would result in an increase in both on-farm and off-farm employment with an increase in real income, thus, empowering farmers to provide food for the family and take care of the medical and educational bills of their children.

Possible Negative Impacts of Agricultural Activities

Although global agricultural trade has experienced significant growth in recent decades in the 2000–2016 period, an annual growth rate of about 6% was recorded. Agricultural products saw substantial growth of 3.1% annually, and in 2008–2018 there was an aggregate increase of 36% (FAO, 2018). However, with the rapid growth of the world population, agriculture faces challenges in keeping pace. The rise of cross-border trading in agricultural goods has also caused unsustainable environmental concerns. Hence, this massive demand for farm goods and the rise in cross-border trading of agricultural produce may indirectly cause adverse effects on the environment by way of polluting and degrading the land and other natural resources due to overgrazing and using inorganic chemicals for large scale production.

Therefore, the negative relationship between agriculture and economic development is indirect. Hence, the negative impact arises due to trade liberalisation in the agricultural sector, resulting in removing restrictions or barriers that prevent and regulate some of these negative externalities of cross-border trade. These negative impacts of agricultural trade resulting from continuous and massive overproduction may hinder economic development, especially in developing countries. Lee and Zhang (2009), Schmitz et al. (2014) and Flachsbarth et al. (2015) all cited that liberalising trade would lead to increased environmental pressures in some regions across Latin America. DeFries et al. (2014) and Henders et al. (2015) mentioned in their studies the impact of production and export of forest-risk goods and the increasing influence of global markets in deforestation, land-use change and carbon emissions. Iriarte et al. (2014) reported that the main contributors to the carbon footprint are on-farm production and international transport of produce. Walters (2017) inferred in his studies that restrictions on banana trade were favourable to the environment. Chaudhary and Kastner (2016) reported a total species loss of 17% due to domestic consumption and the consequence of trade on biodiversity. The study also mentioned that industrialised countries with higher per capita GDP are more inclined to be the leading importers of biodiversity, especially from developing countries.

Chakravorty et al. (2007) conducted a study on livestock production in developing countries and the nexus between agricultural industrialisation and the environment. They found environmental degradation is caused by industrialising agriculture by the intensity in production with poor public health conditions in developing countries. Therefore, they proposed that developing countries implement social control mechanisms to minimise the adverse effects of trade on the environment. Hence, there is at least an established indirect relation between the negative impacts of agricultural activities. Mostly, concerning environmental effects causing economic implications related to the extinction of biodiversity, soil degradation and erosion, deforestation and carbon emission, etc., which may, in turn, hinder the continual agricultural activities as a result of erosion, soil infertility and drought. Therefore, it is imperative to have an integrated and inclusive approach to agricultural and environmental policy formulation to find a solution for sustainable agriculture.

METHODOLOGY
THEORETICAL MODELS

Theories of Agricultural Development

Agricultural development does not concern changing a stationary farming sector into a new dynamic industry but stimulating the growth rate of output and productivity uniformly, including the growth of other sectors of a developing economy. Likewise, a theory of agricultural development should offer insight into the dynamics of agricultural growth and altering sources of economic growth, ranging from those in which output is growing at a rate of 1% or lower to those in which farming output is growing at a yearly rate of 4% or more (Ruttan and Hayami, 1971). Hence, the introduction of agricultural development models such as the Conservation Model, Urban-Industrial Impact Model, Diffusion Model and the High Payoff Input Model. In this research paper, we are only interested in the last one (i.e. the High Payoff Input Model) as this is the closest concept to the research objectives.

The High Payoff Input Model

The insufficiency of the conservation, urban-industrial impact, and diffusion models to formulate effective agricultural policies, led to the birth of the high payoff input model in the second half of the 20th century. This model suggests that 'investment to make modern high-payoff inputs available to farmers in poor countries is the key to transforming a traditional agricultural sector into a productive source of economic growth'. The position and assumption of the high payoff input model are consistent with the hypotheses and research question of this study, which investigates the impact of government aid on agricultural productivity as a potential tool for poverty alleviation. The high payoff input model, as identified by Schultz (1964) in his book *Transforming Traditional Agriculture*, mentioned two specific types of agricultural investment: (1) '[investment] in research to develop and adopt new agricultural inputs and techniques, and (2) [investment] in various types of education and training to improve the human capital of farmers so that they could use the new inputs better'. Hence, the theoretical foundation of this model. The model suggests that economic growth from the agricultural sector of a developing country principally depends upon the supply and affordability of contemporary high-payoff inputs; hence, once these countries thrive at manufacturing and distributing these fashionable and industrial agricultural factors (fertilisers, higher-yielding seeds, technology, human resource) cheaply, investment in agriculture becomes profitable, thus, the theoretical foundation of this research paper.

According to Ruttan and Hayami (1971), the acceptance of the High Payoff Input Model registered some substantial success in contributing to the efforts of developing high-yielding modern grain varieties suitable for tropics (e.g. Mexico in the 1950s and the Philippines in the 1960s) and rapid diffusion of technical knowledge in the form of new varieties among farmers in several countries in Africa, Latin America and Asia. The formulated policies founded on the model look capable of producing sufficiently high rates of agricultural development to provide a basis for economic growth matching the increasing modern population and income requirements in developing countries. However, the high payoff input model developed by Schultz remains incomplete as a theory of agricultural development. The mechanism by which resources are allocated to education, research, and other alternative public and private sector economic activities are not incorporated fully into the model.

The Augmented High Payoff Input Model (AHPIM)

In this paper, the Augmented High Payoff Input Model (AHPIM) is employed, which incorporates all the High Payoff Input Model components and further augments it to include the impact of investment in agricultural education, enabling farmers to adapt to new and efficient farming methods. Moreover, such farming methods can preserve the quality of land used for agriculture for a very long time. The model also incorporates the supports and education either by policy or design so farmers can secure a market for their products, which is facilitated by government agencies acting as an intermediary in the marketing of agricultural products.

Such agencies have equipment and expertise in the marketing of agricultural goods. In the model, they are constrained to see the farmers have a successful harvest because only then they can receive a contribution of the proceeds from the produce harvested by the farmers. Such organisations are given a single mandate, either by policy or legislation, to supervise the farmers amid cultivation and facilitate the marketing of agricultural products post-harvest. In addition, these organisations can receive subsidies from the government. However, this model does not incorporate the issue of the given right to agricultural land and other social problems attached to it in developing countries. Including it in the model would be unrealistic, as land tenure rights, especially regarding farmers, are still not well defined in developing countries. Thus, the Augmented High Payoff Input Model (AHPIM) specifies agricultural productivity as a function of availability and affordability of modern high payoff inputs, investment in agricultural education via government aid and mechanisation, and government facilitation ease the marketing of the agricultural products by farmers.

DATA SOURCE

The data were sourced from the Ministry of Agriculture (MOA) of the Gambia, Food and Agriculture Organisation (FAO) and the World Bank data banks. The information on agricultural inputs like fertilisers, pesticides, land use for agricultural purposes, land use for cereal production, agricultural land equipped for irrigation, and outputs (in tonnes) of main crop (rice, maize, millet, sorghum, groundnut and vegetables) production harvested yearly across the country was collected. The data cover the period of 27 years, i.e. from 1990 to 2017. Missing data were identified for a single variable (fertiliser) for the last six years (2012–2017). Thus, we use the extrapolation technique to generate values for the missing six years.

ECONOMETRIC MODELS

The Error Correction Model (ECM)

This study assumes an equilibrium relationship between the dependent variables and the explanatory variables in all the six models estimated. It implies that at some random time interval, the relationship between the dependent variable and the explanatory variables might be off equilibrium; however, there is a stable equilibrium relationship in the long run. This relationship allows us to employ nonstationary variables integrated at order 1 in estimating the relationship between the dependent variables and the explanatory variables. This method is ideal as it allows us not to difference the variables before estimating the empirical model. Differencing a time series variable could cause the loss of some essential dynamics in the data.

To formally determine whether there is an equilibrium relationship, we estimated the OLS regression of the dependent variables and the explanatory variables and saved the error term. This error term is, on average, expected to be zero, but at some random time interval, it might not be zero. Thus, a cointegrating relationship is confirmed if the error term is integrated at a level or stationary. Thanks to that, an error correction model can be employed that looks at both the long- and short-run relationship between the dependent variable and the explanatory variables. The long-run relationship is captured by the OLS regression between the dependent variable and the explanatory variables. The short-run relationships are determined by computing the impulse response function (IRF) and the forecast error variance decomposition (FEVD). In this study, only the long-run relationship is our interest; thus, it is the only results reported.

Technique Estimation

The empirical model is estimated by regressing the multiple dependent variables on the factors mention in the AHPIM. It allows us to determine whether such factors and policies are sector-specific and help decide policy guidelines for agricultural productivity either at the macro or micro level. If a one-size-fits-all policy is adequate, we expect all the factors and policies to affect all the dependent variables in the same direction and relative magnitude. Thus, the government agency can design a one-size-fits-all policy for all sub-sectors. Then this is an ideal condition because setting policies for each sub-sector comes with additional cost and constraints.

A contradicting effect on the dependent variables would require policies to be designed at the micro-level or independently for each agricultural sub-sector. Production of variety is essential and at the core of this research. As production of various products has both a direct and multiplier effect on the marketability of the agricultural products, including both farming goods that are complementary and substitute goods. Substitute goods enhance competition at the micro-level and can increase the quality of the final agricultural products. Similarly, complementary goods create the possibility of marketability of one type of goods is directly related to the marketability of the complementary goods. Then this makes the production of both goods closely linked together, which is an ideal condition for the government agency because it can create a one-size-fits-all policy in such a condition. The long-run empirical model is given by:

$$\text{Agric} - \text{Output} = \beta_0 + \beta_1\text{Fert} + \beta_2\text{Pest} + \beta_3\text{av} - \text{land} + \beta_4\text{land use} - \text{CerealP} + \beta_5\text{Irr} - \text{land} + \beta_6\text{PGovaid} + u$$

Brief Description of Variables

Where Agric-output entails each of the following products: paddy rice, maize, millet, sorghum, groundnut and vegetables, the dependent variables are common to each regression and are as follows: [Fert] is the use of fertiliser and its availability in agricultural activity, [Pest] is the availability of pesticides for agricultural activity, [av-land] is the availability of land used for agricultural activity, [land use-CerealP] is the availability of land use for cereal crop production, [Irr-land] is the availability of irrigated land for agricultural activity and [PGovaid] is the policy for government aid to the farmers in terms of fertilisers and pesticides.

NOTE

This Article is continued with the research findings in the subsequent section.

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ZWIĄZEK MIĘDZY POMOCĄ RZĄDOWĄ A WYDAJNOŚCIĄ ROLNICTWA: POTENCJALNE NARZĘDZIE OGRANICZANIA UBÓSTWA W GAMBII PO COVID-19: ANALIZA EMPIRYCZNA (CZĘŚĆ 1: ZARYS TEORETYCZNY)

Abstrakt. Globalny problem ubóstwa jest wciąż nierozwiązany, niezależnie od postępu gospodarki światowej na przestrzeni lat i ogromnego postępu w nauce, technologii i transporcie. Ponad 10% ludności świata żyje w skrajnym ubóstwie, podczas gdy organizacje dobroczynne, naukowcy oraz rządy zalecają i wdrażają surowe zasady w celu rozwiązania problemu globalnego ubóstwa. Dlatego konieczne jest zbadanie wpływu pomocy rządowej na produktywność rolnictwa. Prezentowany artykuł stanowi teoretyczne wprowadzenie do omawianej problematyki, jest jednocześnie wstępnym rozpoznaniem stanu wiedzy w tym zakresie oraz omówieniem prób rozwiązania problemu.

Słowa kluczowe: ubóstwo, COVID-19, inwestycje rolne, wydajność rolnictwa