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# EFFECTS OF REMITTANCES ON ECONOMIC GROWTH IN NIGERIA

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## Abstract

*The study examines the effect of Remittances on economic growth in Nigeria. The study investigates remittances in Nigeria for a forty-year period and see how it's effect on economic growth in Nigeria. Remittances in Nigeria witnessed an upward trend in recent decades and have been driven by increased poverty and more need to support families back home by immigrant family members working abroad. This study is unique because it captures Nigeria, which has the highest remittances in Africa, it provides updated data and examines why remittances have not been driving economic growth in Nigeria. Furthermore, we use time series data with real GDP growth rate as the dependent variable and seven explanatory variables (per capita GDP, gross fixed capita formation, inflation, lending interest rate, personal remittances, real effective exchange rate and real GDP). The variables of per capita GDP, gross fixed capital formation, inflation and real GDP were statistically significant while the remaining three variables were not statistically significant in the effect of remittances on economic growth. From empirical findings, this study recommends trade liberalization, increase in capital formation and investment by public and private sectors to attract investment and strengthening of financial system regulation by monetary authorities.*

**Keywords:** Personal remittances; Real GDP; Economic growth; Per capita GDP.

## INTRODUCTION

International remittances involve money and goods that are transmitted to households by migrant workers who work outside their home countries (Adam, 2007). Remittance is important given the increasing proportion of migrant workers from developing countries who move to developed economies in search of green pastures. International remittances have been relied on following the decline in official development assistance and increase in uncertainty associated with foreign capital (Mallick & Mahallick, 2015). Report from Global Development Finance (World Bank, 2014) posit that international remittance is the second most important source of external funding for developing countries, next to foreign direct investment. Ratha (2011) asserted that the value of remittances stood at \$93million in 2003, rose to \$300million in 2012. The World bank estimates show that in

2017, official recorded remittances of low- and middle-income countries stood at \$466 billion, which corresponds to 8.5% increase compared to the 2016 figure of \$429 billion (Yoshino & Otsuku, 2020).

Further, remittances appear to have become an important source of income for households in developing countries, its rising value, its role in promoting economic performance and improving living conditions of host countries have largely contributed to its prominence. Migrant remittances are driven largely by international migration, technological advancement, financial competitiveness, and the fall in the cost of sending funds from one part of the world to another (Acosta et al., 2006). Adam (2006) posits that since 2000, remittances to developing countries have increased on an annual average of 15 percent. Research show that improvement in reporting and increase in share of remittances transmitted formally tend to lead to an increase in migrant remittance flows globally. Albeit remittances may appear less important or second to FDI, they are larger in value and more stable than FDI and portfolio investment (Zouhaier, 2019; Gupta et al., 2007).

Remittances have become an important source of foreign financing for developing countries. Theoretical studies such as Odishika et al, 2022 assert than remittances impact economies through its effects on growth and development. Studies show that remittances impact human capital development and assuage poverty (Chami et al., 2005). Remittance inflow to Nigeria has remained high, the inflows of finances are largely used as sources of improved livelihood, welfare, and finance of local businesses. Although Nigeria is the highest receiver of remittances in Sub-Saharan Africa (SSA) and eight largest in the world according to World Bank Group (2022), the nation still has a high considerable poverty rate.

Poverty is a global phenomenon that affects all nations, continents, and people differently. Sub-Saharan African countries, Latin (South) America and Asia countries experience the highest levels of poverty and hence low level of socioeconomic development, high level of violence, unrest, and low standard of living (Alfa, Otaida, & Audu, 2014). Based on the World Bank Human development report of 2018, Nigeria was ranked 157 out of 189 countries; the score was below the SSA average. The rate of poverty in Nigeria has witnessed a steady rise despite rich human and natural resources. Even though Nigeria is the largest oil producer in Africa, the country has failed to translate the resource wealth to good living state (Ikem, 2018; Okwuosa & Uroko, 2019). Nigeria Multidimensional Poverty Index (MPI) Report (2022) assert that 63 percent of the Nigerian people (133 million) live in multidimensional poverty. "Over half of the population who are multidimensionally poor work with dung, wood, or charcoal, rather than cleaner energy. High deprivations are also apparent in sanitation, time for



healthcare, food insecurity and housing. Multidimensional poverty is higher in rural areas where 72 percent of people are poor compared to 42 percent of people in urban areas" MPI (2022). In a bid to address the poverty, successive Nigerian governments have designed several anti-poverty programs, but these programs have not yielded significant improvement in Nigeria's Human Development Index (Federikumo et al., 2018).

### *Motivation of the Study*

Studies show marked significant disparities in global remittances flow (Adams, 2006; Kelbore, 2005). Since 1980s, there has been a surge in remittances flow to countries in Latin America, the Caribbean and East Asia and Pacific regions and this surge has been higher than the average for developing countries (Adams, 2006). In 2016, the top three recipients of remittances are India, China and Philippines which accounted for more than one third of remittances sent to developing countries. From the list of top ten recipients, only one (Nigeria) is in Sub Saharan Africa, while three of the countries are in South Asia (Bangladesh, India and Pakistan) Iseghohi, (2021).

Theories such as altruism, self-interest portfolio management e.tc have motivated remittances flow and driven by the need to cater for the welfare of relatives back in their home countries and communities. Johnson and Whitelaw (1974) state that altruism is a major consideration for the flow of remittances to any country. This position was buttressed by Lucas and Stark (1985) who assert that the motives for remitting money is pure altruism and care for those left behind in their home countries.

Copious theories of exchange rate especially the ones that relate to remittance have explained the motive for remittance. One of such theories is Pareto theory which opines that improving exchanges between the migrant and the household based on the services of the household members perform on behalf of the migrant. The agents (household) determine the outcome and divisions of gains based on their relative bargaining powers and their external options which is found somewhere between the market price for such services and the opportunity cost of the recipient (Rapoport & Docquier, 2006). Based on this theory, non-negatively constraint is binding, and the last unit of remittances sent by migrant to the household (recipient) is not equivalent to the agent marginal utilities of consumption, but it compensates for the services performed by the household.

Assessment of the role of remittances have been of keen interest for policy makers and economic development experts in recent decades for the economic development of Africa and other developing countries. The rise in interest rate stems from the important source of development finance in developing countries since 1980s. Given the dwindling official development assistance and inadequate capital flows, remittances are now relied upon

by many developing countries including Nigeria to complement scarce domestic resources they experience. This enables remittances promote socio-economic prospects for developing countries.

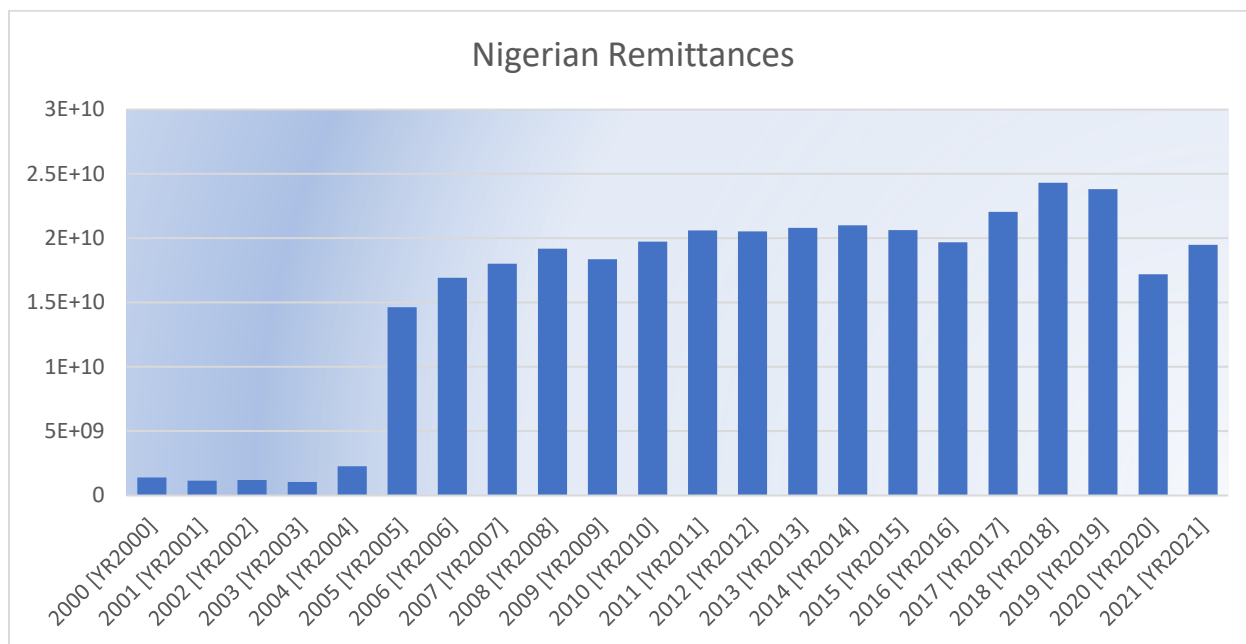
### *Contributions of the Study*

Over the years, Nigeria and developing countries have witnessed migration of their citizens to advanced countries of the world in search of greener pastures. From reports studied, we see that Nigeria contributes significantly to the upward trend of remittances within the sub-Saharan Africa and this has resulted in the continuous increase in the inflow of remittances to the developing countries as well. Although the increasing remittances inflow and their propensity of closing domestic savings-investment gap still exist, there is a little attention paid to the macroeconomic determinants of remittances for Nigeria and Sub-Saharan Africa.

Further, improved immigration between the developed and developing countries have resulted in persistent increase in the flow of remittances to developing nations. The technological advancement, improved communication technology and international transfer of payment among individuals at low cost have contributed to increasing remittances. (Meyer & Shera, 2017). Olayungbo and Quadri (2019) assert that remittances constitute a significant source of savings and capital for investments in health, education, and entrepreneurship, by that enhances productivity and employment. Hence, this leads to economic growth and poverty reduction. Remittances can increase financial sector growth given as some of the remittances are converted and deposited with banks, hence providing funds for lending to the private sector which then promotes economic growth (Bashir, 2020).

In recent decades, researchers have shown keen interest in investigating the impact of remittances on various dimensions of development in the recipient countries. The data and activities of the World Bank and International Monetary Fund are key institutions that arouse this curiosity of investigating the impact of remittances on development outcomes, especially poverty reduction. These two institutions assert that if remittances are effectively utilized, they can be a driving factor in the development and stimulation of economic growth in host countries (Zouhaier, 2019). Also, studies show that countries can effectively harness the positive externalities inherent in migrants' remittances and this will cut down poverty. The potential pathways to achieve this with remittances include human capital development, financial sector development and economic growth (Zouhaier, 2019; Anyanwu & Erhijiakpor, 2010).





Source: World Development Indicator.

### Hypothesis

Null Hypothesis:  $H_0$ : Remittances have no effect on Economic growth.

Alternative Hypothesis:  $H_A$ : Remittances have effect on Economic growth.

### Research Problem

Nigeria is the leading recipient of remittances in Africa, and this implies that more Nigerians are resident outside the country compared to other countries in Africa. The lack of sufficient opportunities and prevailing underemployment and unemployment in Nigeria have resulted in mass exodus of skilled and trained professionals and manpower to other nations in search of better life and greener pastures. The brain drain has been high, and this has led to increase in remittances inflow into the Nigerian economy. Despite the huge remittances received by Nigeria, the problem of poverty, unemployment and inequality persists (Adeagbo & Ayansola, 2014).

Some studies show no impact of remittances on economic growth while other studies show some impact of remittances on economic growth. Researchers such as Barajas et al (2009) show that remittances have no impact on economic growth. On the contrary, Ari (2020) posits that remittances can affect economic growth, geography and economic situation of different countries through multiple channels. Oluyungbo and Quadri (2019) opine that the impact of remittances depends on a country's socioeconomic condition and economic growth manifests itself in ways that are complex and country specific.

Moreover, the devaluation of the Naira (Nigerian currency) driven by external shocks especially crash in oil price at the international market led to increased production cost and rise in price of most items in the market, hence making foreign remittances effective in stimulating standard of living in Nigeria (Adejumo & Ikhide, 2019). Meng and Nazir (2019) observe that foreign remittances increase exchange rate, decrease competitiveness of export in emerging economies resulting in adverse effect on exports by the exchange rate especially among middle income group.

The research questions are:

- 1) Despite the increasing role remittances play in economic growth, their relationship with growth in Nigeria and Sub-Saharan Africa has not been adequately studied. There seems to be inconclusive research fundings on the impact of remittances inflows on economic growth in less developed countries including Nigeria. While some studies report positive relationships, others report negative relationships. Although there are some impacts of remittances on economic growth in Africa they do not lead to a consensus. What are the short -run and long run impacts of remittances on economic growth in Nigeria?
- 2) Consistent remittance inflows lessen macroeconomic shocks, output volatility, promote economic expansion and poverty reduction, impact economies through their effect on growth and development. Nigeria faces immense challenges including accelerating growth, reducing poverty, and meeting the Sustainable Development Goals. How does remittance inflow significantly affect the well-being of the people? Have remittances improved the life of the recipients?

## **LITERATURE REVIEW**

Copious literature identifies various channels whereby remittances exert impact on economic growth. Remittances boost economic growth by increasing household income (Giuliano & Ruiz-Arranz, 2005). Increase in Income provides the opportunity to boost consumer spending, accumulation of assets, investment in SMEs and promotion of self-employment. Emigration and remittances contribute to human capital accumulation. A positive impact of emigration on growth exists in developed countries, given a higher ability to transfer knowledge and skills when the emigrants return to their home country or the sending or remittances in order to create new opportunities in the private sector. A negative impact of emigration stems from the brain drain and depending solely on remittances (Fayissa, 2014). Some studies analyze whether the level of remittances to GDP ratio and growth of remittances are related to a higher level of economic growth (Bashir, 2020).



Further, Hadeel (2012) investigated the positive and negative impact remittances on economic growth in some Middle East and North Africa (MENA) countries namely Algeria, Egypt, Jordan, Libya, Morocco, Oman, Syria, Lebanon and Tunisia for the period 2000 to 2010 in a panel data analysis. He discovered that all MENA countries enjoyed major increase in remittances inflow in the last two decades. He further stated that remittances represents more than 10 percent of each of the country's GDP and also realized that remittances have both positive and significant impact on economic growth for the countries examined.

Nahia (2015) investigated the empirical evidence of the effect of remittances on economic growth in Kenya between 1993 and 2014. He utilized Granger causality and autoregressive distributed lag model to ascertain the effect of remittances on economic growth in Kenya. He discovered a positive and significant effect of remittances on economic growth in Kenya. He discovered a positive and significant effect of remittances on economic growth and therefore concluded that economic growth in Kenya was largely driven by international remittances.

Okodua (2012) examined the effects of migrant workers remittances on output growth among Sub-Saharan African countries between 2000 and 2011 utilizing System General Methods of Moments (GMM). The study discovered a negative and statistically insignificant link between remittances and output growth across the sampled countries over the period. The reason ascribed to this was the inability to channel most remittances into productive ventures. The conclusion was that remittances may not be relied upon to promote growth of SSA region, and recommendation was to enact a policy measure that ensures the use of remittance inflows for productive sector activities in the economy

Moreover, studies by Imai et al (2014) investigated the effects of remittances on the growth rate of the GDP using annual panel data for 24 Asia and Pacific countries. The results show that remittances flows have been beneficial to economic growth. In addition, the volatility of capital flows tends to be harmful to economic growth, thus remittances contribute to better economic performance. Masron and Subramanian (2018) examined the implications of remittances on poverty in 44 developing countries for the 9-year period of 2006 -2014. The result revealed that the level of poverty appears to be lower in countries with a higher flow of remittances. The conclusion drawn from that study show that the resulting outcome may be due to the increase in household income of the poor by remittances.

"Bollard et al., (2009) examined relationship between education and remitting behaviour using micro-data surveys of immigrants from eleven major destination countries. The

study found a mixed pattern between education and likelihood to remit and a strong positive relationship between education and the amount remitted. They thereafter opined that a combination of these two scenarios gives an overall positive effect of education on the amount remitted" Iseghohi (2021). Therefore, the level of education of the migrants was revealed as a strong enabling factor in ability to provide remittances and reduce poverty.

Lucas and Stark (1985) use their neo-classical theory on migration to show the link between remittances and poverty and hence proposed reasons why migrant workers send money home. The reasons are pure altruism and self interest motives. Lucas and Stark (1985) further stated that the motivation behind money transfer lies in the migrant selflessness and desire to help families in their home countries for welfare and consumption habits. The motives are also driven by self interest especially money transfer to home for the purchase of assets and acquire property inheritance.

### *Theoretical Literature*

Several literature and theories have explained the nexus between remittances and economic growth. The theories include development theory, the dependency theory, the two gaps theory e.t.c. The development theory of the mid-20<sup>th</sup> century assumed that developing countries can accelerate their development process through capital transfer, industrialization, and adoption of western values. The notion was that developing countries should abandon their culture, tradition and values and then embrace western culture, tradition and values and then embrace western culture because they are interested in development (Coetzee & Wood, 2001; Massey et al., 1993). These proponents posit that migration will result in the transfer of investment capital through remittances and then expose the traditional society to more liberal ideas that will bolster their development (De Hass, 2007 and 2010).

Also, the dependency theory of 1970s and 1980s holds that remittances create dependence from sending to receiving countries and receivers depend on senders (Binford, 2003). It asserts that migration depletes the human capacities of home communities/countries which subsequently leads to under development (De Hass, 2007). Preference to remittances give the impression that they encourage economic growth, but they rather lead to inequalities in areas where there is a large inflow of remittances. (Lipton, 1980) cited in Oluwafemi and Ayandibu 2014).

Moreover, Harod-Domar growth model posit that savings rate and capital-output ration determine full capacity growth of a closed economy. This position was extended to the two-gap theory and promoted by Chenery and Bruno (1962) and Chenery and Strout (1966) where they explained the introduction of foreign exchange shortage. The two-gap model accentuated the vital role of foreign transfers in determining the level of



investment in developing countries. This model asserts that development may be impeded by the existence of the savings and foreign exchange gaps in developing countries. Hence, these gaps can be filled by foreign savings represented as remittances inflows.

## METHODOLOGY

### *Data and Methods*

The study captures Nigeria as the area of study. Nigeria is a West African nation, largest country in Africa, highest population, and largest economy in Africa. Nigeria has a total geographical area of 923,768 square kilometers and population of about 220 million (NPC) as of 2022. Nigeria lies totally within the tropics along the Gulf of Guinea from the west coast of Africa. “Nigeria is bordered by Benin republic to the West, Niger state to the North, Cameroun to the East and the Atlantic Ocean. The terrain varies from coastal swamps and tropical forest in the south, to savannah and semi-desert in the North. The highest points are the Jos Plateau in the center (1,200-2000 meters above sea level) and the mountains along the eastern border. The river Niger, the third longest river in Africa reaches the sea through an extensive Delta of mangrove swamps” (Nigeria Country Report, 2012: 3).

### *Theoretical Model*

Endogenous growth theory comes to bring the source of technical progress and a sustained productivity growth within the general equilibrium framework of neoclassical growth theory (Ogujiuba & Adeniyi, 2005)). Endogenous growth theory posits that economic growth is primarily the result of endogenous and not exogenous factors as held by neoclassical and Harrod Domar growth models. Lucas (1988) asserts that investing in education leads to the production of human capital which is very crucial determinant of the development process. Additionally, Romer (1986) showed his dissatisfaction with the classical and neoclassical theories when he asserted that they were only making attempts to over simplify what is a complex process. This model suggests that developing countries such as Nigeria should engage in trade and encourage more capital inflow from other countries to enable them devise new knowledge in research and technology for economic growth.

The basic Neoclassical growth function can be represented as:

$$Y = AK^{\alpha}L^{\beta}$$

Where

Y = output/real GDP

A = Total factor productivity

K = Capital

L = Labour

While  $\alpha$  and  $\beta$  represent the elasticity of output with respect to capital and labour.

### ***Empirical Model***

The study adopts some of the empirical works of Qayyum et al., (2010) Anderson et al., (2011), Okodua (2012) to ascertain the influence of foreign remittances of economic growth in Nigeria. We specify our growth model functionally as:

$$\ln\text{GDPGT} = f(\text{rgdp}, \text{gdpc}, \text{gfcf}, \text{inf}, \text{Lir}, \text{Prt}, \text{ReR})$$
$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \mu_t$$

The econometric specification of the long-run model is presented as :

$$Y_{\text{grt}} = \beta_0 + \beta_1 \text{rgdp}_t + \beta_2 \text{gdpc}_t + \beta_3 \text{gfcf}_t + \beta_4 \text{Inf}_t + \beta_5 \text{Lir}_t + \beta_6 \text{Prt}_t + \beta_7 \text{ReR}_t + \mu_t$$

Where

Ygrt =Growth rate of real GDP (proxy for economic growth of Nigeria)

Rgdp = real GDP

gdpc =per capital GDP

gfcf = gross fixed capital formation

Inf = Inflation

Prt = personal remittances received as a % of GDP

ReR = real effective exchange rate

$\mu$  = error term

The apriori expectations are  $\beta_1 > 0$ ,  $\beta_2 > 0$ ,  $\beta_3 > 0$ ,  $\beta_4 < 0$ ,  $\beta_5 < 0$ ,  $\beta_6 > 0$ ,  $\beta_7 > 0$ .

The expected positive sign on the coefficient of remittances is based on the belief that remittances supplement investment and the consumption expenditure in the recipient country (Nigeria),there by enhancing economic growth. Hence, remittances positively affect growth (Ochara, 2015).

### ***Data***

The study uses secondary data and was sourced from the World Bank database, the World Development Indicators. The period is long and extensive to enable us to



accommodate for loss of degree of freedom. The welfare of the economy is measured by the GDP per capita and its' remains a good measure of prosperity, consumption pattern and standard of living of any country. Increase in per capita income leads to increase in consumption, increase in economic and social choices which leads to higher economic growth trajectory.

Method of Analysis

The study uses time series data for the forty-year period 1980-2020. The time series data has propensity of identifying parameters in the occurrence using measurement error and have robustness to omitted variables and the efficiency of parameter estimates. The choice of this methodology stems from the need to investigate the long run and short run dynamic effects of remittance on the economic growth in Nigeria. The estimator gives room for heterogeneous dynamics by allowing the intercept, short-run coefficients and error variance which differ freely across groups, however this imposes a homogeneous long run relationship between the dependent variable (real GDP growth) and the seven explanatory variables.

The OLS regression, Unit root, and Error Correction Model (ECM) will be applied.

RESULTS AND DISCUSSION

Analysis and Interpretation of Result

SUMMARY STATISTICS

Table with 6 columns: VARIABLE, OBSERVATION, MEAN, STANDARD DEVIATION, MINIMUM, MAXIMUM. Rows include GDP PER CAPITA, GROSS FIXED CAPITAL FORMATION, INFLATION, LENDING INTEREST RATE, LOG GDP GROWTH RATE, PERSONAL REMITTANCE, REAL EXCHANGE RATE, REAL GDP.

ORDINARY LEAST SQUARE (OLS) REGRESSION

VARIABLE	COEFFICIENT	PROBABILITY
GDP PER CAPITA	0.0150*** (0.00407)	0.0008
GROSS FIXED CAPITAL FORMATION	-0.3625*** (0.0575)	0.0000
INFLATION	-0.10241*** (0.0348)	0.0060
LENDING INTEREST RATE	0.16661 (0.1850)	0.3757
PERSONAL REMITTANCE RECEIVED	-0.6444 (0.3483)	0.0732
REAL EFFECTIVE EXCHANGE RATE	-0.00467 (0.0073)	0.5268
REAL GDP	-7.51E -11 (1.56E -11)	0.0000
OBSERVATION	41	
ADJUSTED R <sup>2</sup>	0.6615	

*Robust standard errors clustered by country in parentheses\* p < 0.1\*\*, p < 0.05\*\*\* p < 0.01*

## Interpretation of Regression Result

### *Log GDP growth rate*

The real growth rate of GDP in Nigeria tells us the measure of economic growth from one period to another while adjusted for inflation or deflation. This reveals the change in value of all goods and services produced by the economy of Nigeria while accounting for price fluctuations. The real GDP growth rate is the dependent variable a useful measure than the nominal GDP growth rate because it captures the effect of inflation on economic data. The Nigeria's real economic growth is important for government policy makers when making fiscal policy decisions, and these decisions can be applied to spur economic growth or control inflation. The real GDP growth rate is also useful for investors and businesses. An organization looking to expand into new markets can utilize GDP data to better understand and diversify growth opportunities in the countries, especially emerging markets.

### *GDP per capita*

The per capita GDP coefficient of 0.0150 is statistically significant at 5% level and we reject the null hypothesis. There is a positive relationship with the real GDP growth rate. From the result, if the per capita GDP increases by one unit, then the real growth GDP increases by 0.0150 units while holding other variables constant. The per capita GDP informs us of the economic output per person. The per capita GDP tells us how prosperous a country is and based on their economic growth. GDP per capita also help analyze and monitor the productivity of a country (Nigeria) in comparison with others and how much





economic production value that can be attributed to each individual citizen. The Nigerian government can use the GDP per capita to understand how the economy is growing with its population on a national level and can provide insights into Nigeria's domestic population influence.

### ***Gross fixed Capital Formation***

The gross fixed capital formation has a coefficient of -0.3625 and it is statistically significant at 5% level, and we reject the null hypothesis. This shows a negative relationship with the real GDP growth rate. If the gross fixed capital formation increases by one unit, then the real GDP growth rate decreases by 0.362. The gross fixed capital formation tells us the total accumulation of capital goods such as equipment, tools, transportation assets etc. This is not in consonance with economic theory. Based on economic theory, the higher the capital formation of an economy, the faster the economy can grow its aggregate income.

Nigeria and other countries accumulate capital through generating savings and investment from household savings or based on government policy. The gross capital formation is defined as outlays on additions to fixed assets and net change in inventories as defined by the World Bank. Nigeria needs capital goods to replace the older ones especially when they are used to produce goods and services.

### ***Inflation***

Inflation has a coefficient of -0.1024 and it is statistically significant at 5% level, and we reject the null hypothesis. If inflation increases by one unit, then the real GDP growth rate will reduce by 0.1024 while holding other variables constant. Inflation tells us how much of a return an investment needs to be made to maintain a specific standard of living. The inflation number is important because it represents the rate at which the real value of an investment is eroded and the loss in purchasing or spending power over time. The inflation number informs investors how much a return on their investment is needed to make for them to maintain their standard. The negative relationship between inflation and real GDP growth is in consonance with economic theory. The lower value of inflation contributes to higher economic growth and causes individuals and businesses to hold fewer liquid assets. Government can contribute to low inflation by implementing wage and price control.

### ***Lending Interest rate***

The coefficient of Lending interest rate is 0.1661 and it is not statistically significant at 5% level, hence we fail to reject the null hypothesis. This means that when the lending interest

rate increases by one unit, then the real growth rate increases by 0.1661 while holding other variables constant. There is a positive relationship between the lending interest rate and real growth rate.

This is the amount of money a lender or financial institution receives for lending out money and the interest can also refer to the amount of ownership a stockholder has in a company. The interest lending rate is largely associated with mortgages, car loans, credit cards, savings accounts etc. and highly dependent on macroeconomic policy put forward by the Central bank of Nigeria. The lending interest rate explains the amount of interest a person must pay, and this is tied to their credit worthiness, the length of the loan, or nature of the loan. There is a positive relationship between the interest and risk because interest and interest rates are higher when there is greater risk especially as the lender faces a greater risk in the borrower not being able to make their payment.

### ***Personal remittance rate***

The coefficient of personal remittance is -0.6448 and not statistically significant at 5% level and we fail to reject the null hypothesis. This means that when the personal remittance increases by one unit or dollar, the growth rate of GDP reduces by 0.6448 while holding other variables constant. There is negative relationship between real GDP growth rate and personal remittance rate.

The personal remittance rate, which is usually given to relative and family members back in Nigeria, is important in the economies of developing countries because they play an important role in disaster relief, help to raise the standard of living for people with low income and combat global poverty. Remittances can help those recipients open bank accounts and help promote economic development.

Studies show that most recipients of remittances use the money for consumption and welfare. Very little is used for production or investment, and this does not drive economic growth. Therefore, the negative relationship between personal remittance rate and real GDP growth rate is in consonance with the economic reality of Nigeria.

### ***Real Effective Exchange Rate***

The coefficient of the real effective exchange rate is -0.004670 and it is not statistically significant at 5% level, hence we fail to reject the null hypothesis. This means that if the real effective exchange rate increases by one unit, then the real GDP growth rate reduces by 0.0046 while holding other variable constant, hence there is a negative relationship between the GDP growth rate and the real effective exchange rate.

Since real effective exchange rate (REER) is the weighted average of country's currency in relation to basket of other currencies. The weights are determined by comparing the relative trade balance of Nigeria's currency. An increase in Nigeria's REER shows that



exports are becoming more expensive and making imports cheaper. This leads to a loss in trade competitiveness and the international competitiveness of Nigeria when compared with its trade partners. The relationship between REER and real Economic growth is in consonance with economic theory. Generally, the REER is used by Economists to evaluate a country’s (Nigeria) trade flow and analyze the impact that factors such as competition and technological changes are having on Nigeria’s economy.

**Real GDP**

The coefficient of the real GDP is -7.51E-11 and it has a negative relationship with the real GDP growth rate. It is highly statistically significant at 5% level, and we reject the null hypothesis. The coefficient of -7.51E -11 means that if the real GDP increases by one unit or one dollar, then the real GDP growth rate decreases by 7.51E -11 while holding other variables constant.

The real GDP which measures the total economic output of a country adjusted for changes in price in the inflation – corrected GDP and expressed in base year prices. The real GDP represents a macroeconomic statistic which measures the value of the goods and services produced by an economy in a specific period, usually one year and then adjusted for price changes. Government agencies use real GDP as a criterion for analyzing economic growth and purchasing power overtime. GDP deflator is used to measure changes in prices for goods and services and the real GDP uses the nominal GDP and adjust it for price changes. The real GDP of Nigeria accounts for changes in prices levels and this provides a more accurate figure of economic growth. Also, the real GDP provides a better groundwork for assessing long term national economic performance than the nominal GDP.

**EMPIRICAL TESTS**

*Augmented Dickey Fuller*

$$\Delta Y_t = \alpha + \delta Y_{t-1} + \delta_1 \Delta Y_{t-1} + \delta_2 \Delta Y_{t-1} + \delta_3 \Delta Y_{t-1} + \delta_4 \Delta Y_{t-1} + \delta_5 \Delta Y_{t-1} + \delta_6 \Delta Y_{t-1} + \delta_7 \Delta Y_{t-1} + \delta_p \Delta Y_{t-p} + \epsilon_t$$

Null Hypothesis:  $H_0 : \gamma = 0 \qquad \beta = 1$

Alternative Hypothesis:  $H_A: \gamma < 0$

The preference for Augmented Dickey Fuller (ADF) from Economists stems from the impression that many of the cycles have lags. The result for the first difference of the Augmented Dickey Fuller is below

Null Hypothesis:  $H_0$ : There is unit root and variables are non-stationary.

Alternative Hypothesis:  $H_A$ : There is stationarity among the variables. No unit root.

Augmented Dickey Fuller	Coefficient	T - Statistics	Probability
DLNGDP GRT (-1)	-1.374742	-10.79943	0.0000
DGDP PER CAP (-1)	-0.720739	-4.999800	0.0000
D GROSS FCF (-1)	-1.007021	-6.332164	0.0000
D INFL (-1)	-0.924342	-5.681423	0.0000
D LENDING IR (-1)	-1.247665	-7.797716	0.0000
D Personal remittance rate (-1)	-1.317465	-8.397386	0.0000
D Real EER (-1)	-0.677520	-4.374542	0.0001
D RGDP (-1)	-0.913968	-5.61860	0.0000

All the variables under ADF test were found not to be stationary at levels, hence tests on all variables were carried out at first-order difference to avoid spurious regression and confirm their stationarity.

With the first differencing, the unit root was removed, and the variables became stationary. Augmented Dickey Fuller made the variables stationary. The estimated ADF test statistics reject the null hypothesis at 1% and 5% significant levels when it is compared with corresponding critical values as tests show that there is stationarity of each variable at the same order of integration .

### **Vector Error Correction Model**

$$\text{VAR (1): } Y_t = \phi + \phi Y_{t-1} + \epsilon_t$$

$$\text{VECM: } \Delta Y_t = \phi + \alpha\beta' Y_{t-1} + \epsilon_t$$

$$\Delta Y_t = \phi + \alpha\beta'_{11}Y_{t-1} + \alpha\beta'_{12}Y_{t-1} + \alpha\beta'_{13}Y_{t-1} + \alpha\beta'_{14}Y_{t-1} + \alpha\beta'_{15}Y_{t-1} + \alpha\beta'_{16}Y_{t-1} + \alpha\beta'_{17}Y_{t-1} + \epsilon_t$$

Variable	Error Correction
DGDP per Cap (-1)	-0.827318 (1.17768) [-0.70250]
DGDP per Cap (-2)	1.387746 (1.15251) [1.20411]
D Gross FCF (-1)	0.394078 (0.39648) [0.99395]
D Gross FCF (-2)	0.253869 (0.40732) [0.62326]
D INFL (-1)	0.298722 (0.16884) [1.76923]



D INFL (-2)	0.217150 (0.19821) [1.09556]
D Lending Interest rate (-1)	-0.195406 (0.21891) [-0.89262]
D Lending interest rate (-2)	-0.510926 (0.24289) [-2.10355]
D LnGDP GRT (-1)	-0.555487 (0.36528) [-1.52071]
D Ln GDP GRT (-2)	0.062848 (0.31970) [0.19659]
D Personal remittance rate (-1)	-0.253660 (0.57062) [-0.44453]
D Personal remittance rate (-2)	0.121284 (0.31112) [0.38984]
D Real EER (-1)	0.558974 (0.18023) [3.10141]
D Real EER (-2)	0.100904 (0.21797) [0.46293]
D RGDP (-1)	2.632440 (1.32545) [1.98607]
D RGDP (-2)	-1.944957 (1.40546) [-1.38386]
R-squared	0.484194

From the broader table Gross FCF, inflation, lending interest rate, personal remittance rate and real GDP are statistically significant. Since Vector Error Correction model is a multivariate time series, it consists of differenced response variable on cointegrated VAR first difference model. The Vector Error Correction Model (VECM) establishes a short-term relationship between the variables that propel economic growth while correcting with the deviation from long-term co-movement of prices.

If the variable responds to disequilibrium between two economies, then the t-statistics ratio not significant at  $e_{t-1}$ . The VECM model is useful in analyzing cointegrated variables or cointegrating relationships and it provides a good mechanism to understand the long-run and short run behavior of the variables that influence economic growth in Nigeria.

In response to research question 1, the impact of remittances on economic growth in Nigeria between 1980 and 2021 employed OLS, Augmented Dicker Fuller approach and found a negative impact in personal remittances as a percentage of GDP, and there was no impact between remittances and economic growth in the long run and there was no bidirectional causality between remittances and growth in the short run. The result was not statistically significant, and we fail to reject the  $H_0$  of no effect. The negative sign on the coefficient of remittances assumes that remittances do not supplement investment and enhance economic growth even though it supplements and promotes consumption.

Given that personal remittances as a percentage of GDP is negatively related to real economic growth, this implies that personal remittances negatively affect economic growth in the long run. This can be associated with adverse growth effect of brain drain emanating from emigration which constitute the basis for the remittances. This could also be attributed to undermining productivity and growth especially as the remittances is often spent on consumption than on productive investment. The negative effect could also be attributed to income inequality, reduction in labor supply and tendency to engage in voluntary unemployment.

In response to research question two on the macroeconomic shocks, we observe that real exchange rate was statistically insignificant at all levels and had negative relationship. The exchange rate negatively influences economic growth in the short run. There are multiple macroeconomic shocks experienced in Nigeria and increase in vulnerabilities. The result confirms the devaluation of naira and how it brought enormous hardship on the people of Nigeria especially through the increase in cost of production and prices of goods without a corresponding increase in aggregate demand in the economy (Urama, Edeh & Urama, 2019). The devaluation of naira precipitated a decrease in aggregate manufacturing index, reduction in average capacity utilization in industrial sectors remarkable deficit in terms of trade, decelerated growth, and increased poverty.

## **CONCLUSION**

This paper contributes to the analysis of the effects of remittances on economic growth in Nigeria. The study incorporates the structure of financing, real GDP growth rate, personal remittances, regression results of variables, error correction method and its effect on economic growth in the 40-year- period. The regression result shows that some variables (GDP per capita, gross capital formation, inflation, real GDP) were significant



while some other variables (lending interest rate, personal remittances, and real effective exchange rate) were not significant in making a strong impact on economic growth.

Further, we observe a reduction in the exchange rate which has made foreign remittances impact the lives of the recipient especially in their consumption and welfare. While foreign remittances improve the performance of the Nigerian economy, but not growth, the exchange rate has been impaired and overvaluing of the naira can improve the situation of the naira. Migrant remittances positively affect economic growth in Nigeria in the short run but exert a negative effect in the long run. This can be caused by reduction in labor supply, brain drain effect, income inequality and the expense of remittances on consumption.

Based on these results, we propose the following recommendation:

- 1) The Nigerian government should provide incentive like tax exemption for Nigerians in diaspora to encourage them invest a certain portion of their foreign earned income in the industrial sector to promote an increase in capital investment which will boost economic growth.
- 2) Channeling remittances received by families into productive investment and less of consumption as this can promote economic growth.
- 3) Increase in capital formation and investment by public and private sectors because it will increase attractiveness of investment in the country.
- 4) Monetary authorities should strengthen their financial system regulation procedure which will promote deepening of the financial system and raise its level of development.
- 5) Adopt trade liberalization, utilize instruments of monetary policy to reduce the lending rate.

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## APPENDIX

Dependent Variable: LNGDP\_GRT

Method: Least Squares

Date: 05/05/23 Time: 15:26

Sample: 1980 2020

Included observations: 41

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.902970	7.303214	1.219048	0.2315
GDP_PER_CAP	0.015019	0.004078	3.682849	0.0008
GROSS_FCF	-0.362555	0.057508	-6.304470	0.0000
INFL	-0.102416	0.034844	-2.939303	0.0060
LENDING_IR	0.166145	0.185036	0.897903	0.3757
PERSONAL_REMIT_				
R	-0.644480	0.348306	-1.850326	0.0732
REAL_EER	-0.004670	0.007301	-0.639716	0.5268
RGDP	-7.51E-11	1.56E-11	-4.813969	0.0000
R-squared	0.720761	Mean dependent var		3.055069
Adjusted R-squared	0.661528	S.D. dependent var		5.387712
S.E. of regression	3.134481	Akaike info criterion		5.295984
Sum squared resid	324.2240	Schwarz criterion		5.630339
Log likelihood	-100.5677	Hannan-Quinn criter.		5.417737
F-statistic	12.16832	Durbin-Watson stat		1.781301
Prob(F-statistic)	0.000000			



Vector Error Correction Estimates

Date: 05/05/23 Time: 19:02

Sample (adjusted): 1983 2020

Included observations: 38 after adjustments

Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
GDP_PER_CAP(-1)	1.000000
GROSS_FCF(-1)	-31.21854 (2.30090) [-13.5680]
INFL(-1)	6.089266 (1.07961) [ 5.64027]
LENDING_IR(-1)	-70.43752 (4.91527) [-14.3303]
LNGDP_GRT(-1)	-54.23787 (4.69737) [-11.5464]
PERSONAL_REMIT_R(-1)	-25.88639 (7.90434) [-3.27496]
REAL_EER(-1)	-3.441833 (0.18986) [-18.1281]
RGDP(-1)	-6.09E-09 (2.6E-10) [-23.5078]
C	2694.910

Error Correction:	D(GDP_PER_C AP)	D(GROSS_FCF)	D(INFL)	D(LENDING_IR )	D(LNGDP_GRT )	D(PERSO NAL_RE MIT_R)	D(REAL_EER)	D(RGDP)
CointEq1	-0.012126 (0.15058) [-0.08053]	0.019802 (0.00918) [ 2.15717]	-0.022660 (0.01337) [-1.69527]	0.005367 (0.00331) [ 1.62380]	0.004486 (0.00470) [ 0.95383]	-0.002430 (0.00250) [-0.97110]	0.149914 (0.06597) [ 2.27245]	-8316579. (4.2E+07) [-0.19758]
D(GDP_PER_CAP(-1))	-0.827318 (1.17768) [-0.70250]	0.178673 (0.07179) [ 2.48867]	-0.046285 (0.10454) [-0.44273]	-0.005777 (0.02585) [-0.22348]	-0.020347 (0.03679) [-0.55309]	-0.044420 (0.01957) [-2.26953]	-0.225904 (0.51597) [-0.43783]	-4.63E+08 (3.3E+08) [-1.40690]
D(GDP_PER_CAP(-2))	1.387746 (1.15251) [ 1.20411]	-0.148658 (0.07026) [-2.11584]	0.076324 (0.10231) [ 0.74601]	-0.005043 (0.02530) [-0.19934]	0.011949 (0.03600) [ 0.33190]	0.039715 (0.01915) [ 2.07347]	-0.363457 (0.50494) [-0.71981]	3.96E+08 (3.2E+08) [ 1.22781]
D(GROSS_FCF(-1))	3.187758 (6.50364)	0.394078 (0.39648)	-1.617725 (0.57733)	-0.191286 (0.14276)	-0.441947 (0.20316)	0.099564 (0.10809)	0.949056 (2.84937)	2.28E+09 (1.8E+09)

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	[ 0.49015]	[ 0.99395]	[-2.80208]	[-1.33991]	[-2.17538]	[ 0.92115]	[ 0.33308]	[ 1.25405]
D(GROSS_FCF(-2))	-5.501680 (6.68151) [-0.82342]	0.253869 (0.40732) [ 0.62326]	1.066772 (0.59312) [ 1.79858]	-0.012404 (0.14666) [-0.08458]	-0.119166 (0.20871) [-0.57095]	-0.076450 (0.11104) [-0.68847]	7.636912 (2.92730) [ 2.60886]	-1.33E+09 (1.9E+09) [-0.71459]
D(INFL(-1))	-0.556502 (1.90202) [-0.29259]	0.076393 (0.11595) [ 0.65884]	0.298722 (0.16884) [ 1.76923]	-0.042809 (0.04175) [-1.02535]	-0.198979 (0.05941) [-3.34899]	0.022181 (0.03161) [ 0.70169]	-0.569029 (0.83331) [-0.68285]	50344484 (5.3E+08) [ 0.09469]
D(INFL(-2))	3.659807 (2.23282) [ 1.63909]	-0.290746 (0.13612) [-2.13598]	0.217150 (0.19821) [ 1.09556]	0.089910 (0.04901) [ 1.83444]	0.001366 (0.06975) [ 0.01958]	0.093642 (0.03711) [ 2.52348]	-1.077349 (0.97824) [-1.10131]	9.07E+08 (6.2E+08) [ 1.45332]
D(LENDING_IR(-1))	16.40589 (9.97284) [ 1.64506]	-1.115638 (0.60797) [-1.83502]	-0.938079 (0.88529) [-1.05963]	-0.195406 (0.21891) [-0.89262]	0.742512 (0.31153) [ 2.38345]	0.009078 (0.16574) [ 0.05477]	4.510044 (4.36930) [ 1.03221]	3.83E+09 (2.8E+09) [ 1.37288]
D(LENDING_IR(-2))	-17.80489 (11.0651) [-1.60911]	0.851187 (0.67456) [ 1.26185]	-3.497952 (0.98225) [-3.56116]	-0.510926 (0.24289) [-2.10355]	-0.488972 (0.34565) [-1.41466]	-0.195016 (0.18389) [-1.06048]	-2.048966 (4.84783) [-0.42266]	-3.58E+09 (3.1E+09) [-1.15777]
D(LNGDP_GRT(-1))	2.852175 (11.6936) [ 0.24391]	0.342397 (0.71287) [ 0.48031]	-0.552166 (1.03804) [-0.53193]	0.135130 (0.25668) [ 0.52645]	-0.555487 (0.36528) [-1.52071]	0.255848 (0.19434) [ 1.31649]	3.117616 (5.12319) [ 0.60853]	3.26E+09 (3.3E+09) [ 0.99755]
D(LNGDP_GRT(-2))	-0.443179 (10.2344) [-0.04330]	0.857927 (0.62391) [ 1.37507]	-0.832190 (0.90851) [-0.91600]	0.178629 (0.22465) [ 0.79514]	0.062848 (0.31970) [ 0.19659]	-0.065985 (0.17009) [-0.38794]	5.499374 (4.48388) [ 1.22648]	-2.87E+08 (2.9E+09) [-0.10015]
D(PERSONAL_REMIT_R(-1))	-34.22339 (34.3346) [-0.99676]	3.370970 (2.09312) [ 1.61050]	-4.510177 (3.04789) [-1.47977]	-0.616401 (0.75367) [-0.81787]	-1.256793 (1.07253) [-1.17180]	-0.253660 (0.57062) [-0.44453]	3.835154 (15.0427) [ 0.25495]	-5.90E+09 (9.6E+09) [-0.61485]
D(PERSONAL_REMIT_R(-2))	16.35108 (18.7200) [ 0.87345]	-0.002058 (1.14122) [-0.00180]	-0.610108 (1.66179) [-0.36714]	-0.398811 (0.41092) [-0.97053]	-0.318900 (0.58477) [-0.54534]	0.121284 (0.31112) [ 0.38984]	11.56427 (8.20162) [ 1.41000]	3.12E+09 (5.2E+09) [ 0.59655]
D(REAL_EER(-1))	0.275303 (0.41138) [ 0.66922]	0.006070 (0.02508) [ 0.24202]	-0.154040 (0.03652) [-4.21817]	-0.009701 (0.00903) [-1.07428]	0.020587 (0.01285) [ 1.60201]	0.000113 (0.00684) [ 0.01656]	0.558974 (0.18023) [ 3.10141]	61365377 (1.1E+08) [ 0.53362]
D(REAL_EER(-2))	-0.173099 (0.49750) [-0.34794]	0.038069 (0.03033) [ 1.25518]	-0.045615 (0.04416) [-1.03286]	-0.007064 (0.01092) [-0.64685]	-0.016584 (0.01554) [-1.06710]	-0.005059 (0.00827) [-0.61183]	0.100904 (0.21797) [ 0.46293]	-11315951 (1.4E+08) [-0.08137]
D(RGDP(-1))	6.66E-09 (4.7E-09) [ 1.40465]	-8.18E-10 (2.9E-10) [-2.83018]	1.80E-10 (4.2E-10) [ 0.42812]	1.35E-11 (1.0E-10) [ 0.12995]	7.54E-11 (1.5E-10) [ 0.50937]	1.67E-10 (7.9E-11) [ 2.11531]	8.74E-11 (2.1E-09) [ 0.04207]	2.632440 (1.32545) [ 1.98607]
D(RGDP(-2))	-7.97E-09 (5.0E-09) [-1.58479]	6.06E-10 (3.1E-10) [ 1.97643]	-1.98E-10 (4.5E-10) [-0.44289]	-5.95E-12 (1.1E-10) [-0.05395]	-1.19E-10 (1.6E-10) [-0.75510]	-1.58E-10 (8.4E-11) [-1.89272]	1.65E-09 (2.2E-09) [ 0.74787]	-1.944957 (1.40546) [-1.38386]
C	27.31792 (27.0656) [ 1.00932]	-0.068414 (1.64999) [-0.04146]	0.086127 (2.40263) [ 0.03585]	-0.025368 (0.59411) [-0.04270]	0.178608 (0.84547) [ 0.21125]	0.303429 (0.44981) [ 0.67456]	-1.035654 (11.8580) [-0.08734]	7.32E+09 (7.6E+09) [ 0.96710]



R-squared	0.484194	0.528583	0.677573	0.635169	0.618236	0.538491	0.635636	0.428202
Adj. R-squared	0.045758	0.127879	0.403510	0.325062	0.293736	0.146209	0.325927	-0.057826
Sum sq. resids	305629.2	1135.852	2408.416	147.2635	298.2309	84.41619	58665.22	2.39E+22
S.E. equation	123.6182	7.536087	10.97364	2.713517	3.861547	2.054461	54.15959	3.46E+10
F-statistic	1.104367	1.319136	2.472327	2.048227	1.905196	1.372713	2.052363	0.881023
Log likelihood	-224.7780	-118.4732	-132.7533	-79.65778	-93.06502	-69.08495	-193.4180	-963.8276
Akaike AIC	12.77779	7.182798	7.934384	5.139883	5.845527	4.583418	11.12726	51.67514
Schwarz SC	13.55349	7.958496	8.710083	5.915582	6.621226	5.359117	11.90296	52.45083
Mean dependent	18.96967	-1.557821	0.146007	0.108014	0.131819	0.104445	-5.513043	9.74E+09
S.D. dependent	126.5474	8.069703	14.20853	3.302940	4.594918	2.223423	65.96625	3.36E+10

Determinant resid covariance (dof adj.)	2.30E+30
Determinant resid covariance	1.36E+28
Log likelihood	-1662.122
Akaike information criterion	95.48012
Schwarz criterion	102.0305
Number of coefficients	152

Group unit root test: Summary

Series: GDP\_PER\_CAP, GROSS\_FCF, INFL, LENDING\_IR, LNGDP\_GRT, PERSONAL\_REMIT\_R, REAL\_EER, RGDP

Date: 05/05/23 Time: 19:14

Sample: 1980 2020

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0

Newey-West automatic bandwidth selection and Bartlett kernel

Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections
Null: Unit root (assumes common unit root process)			
Levin, Lin & Chu t*	-15.4948	0.0000	8
Null: Unit root (assumes individual unit root process)			
Im, Pesaran and Shin W-stat	-16.8269	0.0000	8
ADF - Fisher Chi-square	207.434	0.0000	8
PP - Fisher Chi-square	191.592	0.0000	8

\*\* Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

# TRAJECTORY OF COVID-19 IMPACTS ON FOOD SECURITY IN ETHIOPIA: A PANEL DATA APPROACH

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## **Abstract**

COVID-19 affects food security of households through different pathways. Studies from developing countries show that the pandemic had heterogeneous impacts on food security across various groups of households. This study aims to examine the trajectory of and differential impacts of the early days of the pandemic on food security in Ethiopia along households' location, ownership of assets and varying livelihoods and income sources. Using the World Bank's harmonized panel data on households drawn from the high frequency phone survey, the study undertakes fixed effects regressions. The results indicated that COVID-19 pandemic had a statistically significant impact, but a declining trend, on overall food insecurity in Ethiopia. Households in urban areas have faced a higher chance of being severely food insecure than those in rural, while those households that rely more on the agriculture have a lower odds of being food insecure. Ownership of livestock decreases probability of being severely food insecure. Besides, households whose income source was rental and wage employment were significantly exposed to food insecurity due to the pandemic. Moreover, the results identified significant heterogeneity of the impacts between households with and without receiving remittance and assistance. This suggests the important role of social protection in guarding households from food insecurity during the pandemic in the short term. Overall, the paper determined that living in rural/urban, ownership of land and livestock, rental income, remittance, assistance and wage employment are statistically significant indicators of heterogeneity in the pandemic's impacts on food insecurity.

**Keywords:** COVID-19 pandemic; Impacts; Food insecurity; Heterogeneity; Trajectory.

## **INTRODUCTION**

The COVID-19 pandemic brings an unprecedented social and economic disruption in the world. One of the most striking observations during these difficult times has been the extremely diverse performance across countries in containing the pandemic and the economic outcomes that have ensued (Penas et al., 2022). Amare et al. (2020) indicated that the World Bank had forecasted that COVID-19 pandemic was highly likely to push more than 49 million people into extreme poverty in 2020 and beyond. Among this figure, greater than 45 % of these people are in Sub-Saharan Africa, implying that the region would be hit hardest in terms of increased extreme poverty. The World Food Programme (WFP) had estimated that the number of people globally facing acute food insecurity would almost double by the end of 2020 (about 135 million people before the crisis), due to income and remittance losses, and disruption





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of food systems associated with the pandemic (WFP, 2020a, 2020b).

COVID-19 could affect food security of households through different pathways. For instance, lockdowns and social distancing measures can adversely affect incomes by reducing economic and livelihood activities, which directly affect food security. Several studies in different countries show that the pandemic has had heterogeneous impacts on various livelihood options and sectors (Amare et al., 2020). For instance, livelihoods and sectors that can operate on a remote basis with limited personal interactions or those functionally dependent on the internet are likely to be less affected, relative to those involving personal interactions (Abay et al., 2020). Similarly, some livelihood options and sectors are likely to experience a relatively higher disruption in economic activities. For instance, government-imposed mobility restrictions and shutdowns often disrupt supply chains, which may prove the most challenging for small businesses with smaller stock. Thus, those households relying on non-farm business activities are likely to experience disproportionately higher impacts associated with disruptions in value chains caused by the pandemic and related mobility restrictions (Amare et al., 2020).

Immediately after the first COVID-19 case was observed in mid-March 2020 in Ethiopia, the government of Ethiopia has put in place a range of measures to mitigate the economic impact of the COVID-19 pandemic, while aiming at containing transmission. Right after the first few cases of COVID-19 were detected, the government implemented a state of emergency, and adopted a comprehensive COVID-19 national emergency response plan to ensure that efforts to fight the crisis are comprehensive and well-coordinated. Specifically, it implemented surveillance at borders, conducted contact tracing, established designated quarantine facilities, ensured the supply of drugs and protective equipment, and embarked on several communication efforts to raise awareness on how to deal with the virus (Batana et al., 2021).

Also, the government has taken various measures in order to contain the transmission of the pandemic. It put measures such as restrictions within country travel, restriction on international travel, limit on social gatherings, curfew or lockdown, closure of non-essential businesses, and closure of schools and universities, among others. To mitigate impacts on people and firms, authorities announced several economic measures, including additional expenditure on healthcare, provision of emergency food to the vulnerable, tax and social security payment deferrals, and liquidity injections and extension of forbearance measures in the financial sector (Bundervoet et al., 2021).

The COVID-19 pandemic has brought devastating economic impacts to low - and middle - income countries. The containment measures implemented by the

governments to prevent the spread of the virus, such as the orders of lockdowns, the closure of non-essential businesses, and social distancing, have resulted in employment and income loss among people with limited coping strategies. Moreover, COVID-19 exacerbated existing inequalities and those who were disadvantaged before the pandemic, such as women, youth, and low-skilled workers, have experienced even greater challenges (Bundervoet et al., 2021).

According to (WFP, 2020a) cited in Amare et al. (2020), these lockdowns and restrictions are expected to be disrupting food supply chains and community services, and social protection programs, which ultimately positively affect food prices. Decreased import of basic stuffs due to restriction of international travel could raise the price process and be an added financial burden that directly affects food security of households. Besides, the same study mentioned that national and state-level restrictions and lockdowns would affect food transportation within the country, with clear implications on food supply and consequently, on food prices. Obviously, this would bring significant repercussions on food insecurity in the country, particularly in poorer and vulnerable urban households (Amare et al., 2020).

One of the most salient features of the economic impacts of the pandemic and respective policy interventions is the asymmetry along several dimensions. The actions taken by agents and policymakers have resulted in very different economic effects across sectors and regions (Cerezo et al., 2021). Studies have revealed that the impacts of the pandemic on household incomes, food security and welfare have been uneven across space, gender, livelihood options. It has been widely observed that the pandemic more severely affected urban households, many of whom are informal, self-employed, or casual workers, in many low- and medium-income countries (Batana et al., 2012; Bundervoet et al., 2021). In Uganda and Kenya, economic effects of such a pandemic disproportionately impact members of the society, depending on their socio-economic status, livelihood strategies, access to markets, etc. Thus, it is important to understand the household level impacts and support mechanisms that can be enhanced to ensure income smoothing (Kansiime et al., 2021).

In Ethiopia, the COVID-19 pandemic has affected economic activity with significant adverse effects on employment, particularly at the onset of the pandemic (Batana et al., 2021). The same study has also shown the existence of spatial heterogeneity on impacts of COVID-19, in which households in large towns faced a higher chance of reduced labor incomes. The pace of recovery among female-headed households has been slow in terms of labor incomes, particularly in large towns. The study has also mentioned that self-employed households experienced severe income loss in earlier rounds, but they recovered fast in terms of the probability of further reducing labor incomes both in small and large towns. Also, poor Ethiopian households experienced severer income shocks in the early rounds, and those in larger towns still had a higher probability of income loss even in the future.



Ravallion et al. (2020) also argued that the pandemic is likely to disproportionately exacerbate food insecurity in those areas or household with preexisting vulnerabilities to food security likely to be magnified. Impacts are expected to be most severe for poorer households in both rural and urban areas (Ravallion et al., 2020). Additionally, the impact is expected to vary across livelihood options, with those activities that require face-to-face interactions likely to experience a significant loss in demand (Abay et al., 2020; Amare et al., 2020). Furthermore, value chain disruptions may extend deeply into rural areas, affecting both input supply and output demand for farming households and affecting the income of those employed in both forward and backward agricultural value chains (Amare et al., 2020; Reardon et al., 2020a). As cited in Amare et al. (2020), Barrett (2020) and Devereux et al. (2020) mentioned that closure or disruption of informal food markets, where the poor obtain the majority of their food, may be more severe in extent and food security impacts.

Beside the limited number of studies conducted in Ethiopia on the impacts of the pandemic, those available are skewed to analyzing its household level income and macroeconomic effects. Also, less is known about the asymmetric effects of the pandemic on Ethiopian households' food security situations. It is, therefore, against to these background that this study is motivated. It intends to shed light on the issue using a household level survey panel data. In particular, the paper aims to explore the potential heterogeneity in the impacts of COVID-19 on households' food security in Ethiopia along various socioeconomic characteristics of households and location dimensions. It also aims to examining the trajectory of the impacts of COVID-19 pandemic on households' food security situation in Ethiopian.

## LITERATURE REVIEW

Since the onset of the COVID-19, many researches have been conducted and published on the multi-dimensional impact of the disease in the developed and developing countries. For the purpose of substantiating the rational of making this study and also informing development of methodology for this study, a brief review of few empirical literatures on the impacts of the pandemic at international, regional and national level is conducted.

Bundervoet et al. (2021) combines data from high-frequency surveys with data on the stringency of containment measures to examine the short-term impacts of the COVID-19 pandemic on households in developing countries. Using data from 34 countries, it runs logistic regressions of four main indicators (stop working, income loss, food insecurity, or continued learning) on a set of explanatory variables and country or region dummies. The findings show that in the average country, 36% of respondents stopped working in the immediate aftermath of the pandemic, over 64% of households reported decreases in income, and over 30% of children were unable to

continue learning during school closures. Pandemic-induced loss of jobs and income translated into heightened food insecurity at the household level. The same study mentioned that the pandemic's effects were widespread and highly regressive, disproportionately affecting vulnerable segments of the population. It asserts the existence of heterogeneous impacts of the pandemic across women, youth, and lower-educated workers, who are significantly more likely to lose their jobs and experience decreased incomes. Self-employed and casual workers bore the brunt of the pandemic-induced income losses.

Using China's household finance survey data, Liu et al. (2020) explored the impact of COVID-19 on Chinese household consumption through ordinary least square (OLS) method. Several household and individual level control variables are included in the estimation. To capture the impact of inherent differences or heterogeneity (such as cultural environment, regional consumption habits, and savings preferences) at the regional level on household consumption, the study controlled for the city-level fixed effect. It finds that there was a significant decline in household consumption during the outbreak period. Heterogeneity analysis shows that the pandemic suppresses consumption in urban households, and rural households are, however, less affected.

Through a computable general equilibrium model-based simulation, Kabir et al. (2021) assesses the gender dimensions of the impact of COVID-19 on economic outcomes, that is, labor force participation, employment, wages, and earnings. Using the 2020 high-frequency phone survey in Chad, the study applied a probit model to determine if differences in income reduction exist between female and male-headed households. It finds that the COVID-19 pandemic brings disproportionately higher negative impact on women in urban areas. The situation is potentially dire, especially in service sectors, where most women are employed in urban areas. Moreover, the pandemic has notably impacted the households' income from enterprises and suggests that this negative impact is more prevalent for female-headed households. Female-headed households in rural and urban areas have been more reliant on aid from family and friends and less reliant on savings, credit, or the sale of assets.

Consolazio et al. (2021) assessed the role of five area level indicators in shaping the risk of contagion in the provinces of Milan and Lodi (Lombardy, Italy), namely: educational disadvantage, unemployment, housing crowding, mobility, and population density. Data on COVID-19 patients from the integrated data warehouse were used and matched with aggregate-level data from the National Institute of Statistics. Multilevel logistic regression models were used to estimate the association between the census block-level predictors and COVID-19 infection, independently of age, sex, country of birth, and preexisting health conditions. All the variables were significantly associated with the outcome, with different effects before and after the lockdown and according to the province of residence. This suggests a pattern of socioeconomic inequalities in the outbreak, which should be taken into account in the



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eventuality of future epidemics to contain their spread and its related disparities.

In Africa, Kansime et al. (2021) assessed implications of COVID-19 pandemic on household income and food security in two East African countries (Kenya and Uganda). Using the Food Insecurity Experience Scale (FIES) to measure food security, the study has fitted probit model to estimate the factors determining whether a respondent's source of income has been affected by the COVID-19 crisis and whether food and nutrition outcomes have worsened during the pandemic. The results show that more than 66% of the respondents experienced income shocks. Food security and dietary quality worsened. Income-poor households and those dependent on labour income were more vulnerable to income shock, and had poorer food consumption during the COVID-19 pandemic compared to others. Farmers were less likely to experience worsened food security. Membership in savings and loan group reduces the likelihood of suffering income shocks and reduction in food consumption (Kansime et al., 2021).

Additionally, Josephson et al. (2020) has applied reduced-form econometric methods to longitudinal household survey data from Ethiopia, Malawi, Nigeria, and Uganda, organized from the pre- COVID-19 face-to-face household surveys and from the novel phone surveys conducted during the pandemic. It has indicated that around 256 million individuals, about 77% of the population in the four countries, were estimated to live in households that have lost income due to the pandemic. Secondly, attempts to cope with this loss were exacerbated by the inability to access medicine and staple foods among 20 to 25 % of the households in each country. Finally, it has mentioned that food insecurity is disproportionately borne by households that were already impoverished prior to the pandemic.

Furthermore, Bukari et al. (2021) examined the effect of COVID-19 on poverty and living standards of households in Ghana. Using data on 3,905 households that were obtained via concurrent online survey and telephone interviews, it has run ordinary least squares, probit model and simultaneous quantile regressions. Results showed that COVID-19 had significantly increased the poverty levels of households while deteriorating living standards. It has also discovered that gender and locational heterogeneities exist regarding the impact of COVID-19 with females and rural dwellers mostly disadvantaged. However, in terms of overall household consumption, those in the middle and upper classes are profoundly affected compared to those in the lowest quintile.

Likewise, a study by Amare et al. (2020) combines pre-pandemic face-to-face survey data with follow up phone surveys collected in April-May 2020 to quantify the overall and differential impacts of COVID-19 on household food security, labor market participation and local food prices in Nigeria. The study exploited spatial variation in

exposure to COVID-19 related infections and lockdown measures along with temporal differences using a difference-in-difference approach. It found that households exposed to higher COVID-19 cases or mobility lockdowns experience a significant increase in measures of food insecurity. Also, it indicated that COVID-19 significantly reduces labor market participation and increases food prices, and the impacts differ by economic activities and households, while the lockdown measures have smaller impacts on wage-related activities and farming activities. In terms of food security, households relying on non-farm businesses, poorer households, those with school-aged children, and those living in remote and conflicted-affected zones have experienced relatively larger deteriorations in food security.

In Ethiopia, Beyene et al. (2020) examined the potential economy-wide impacts of the COVID-19. The study has used a dynamic computable general equilibrium model calibrated to a social accounting matrix for 2010/11 and covered the period from 2010/11 to 2029/30. The analysis accounts for the main channels through which the COVID-19 affects the economy. The domestic transmission channels include reduced labor market participation, lower productivity, and rising domestic trade costs. External channels include higher international trade costs, a drop in export demand, lower import supply, a reduction in foreign direct investment (FDI), reduction in remittances, and lower import price of oil. It has analyzed the impact of the COVID-19 crisis using three scenarios, namely business as usual, and the COVID-19 scenario considered under mild and severe assumptions. Economic impacts are expected to have differentiated impacts on a wide range of economic and social indicators. The pandemic is likely to have significant growth and welfare effects even under an optimistic scenario of mild shock and quick recovery. Employment is likely to be hardly hit. Although there is much uncertainty in the future, the COVID-19 crisis is likely to have medium-to-long-term negative effects. GDP growth rate is expected to converge to the no-COVID-19 baseline relatively swiftly if the scope of the shock is mild. However, the GDP and welfare losses are not likely to be fully recovered. In an amplified scenario, the economic and welfare losses would be higher and the gap with the no COVID-19 baseline would be much greater (Beyene et al., 2020).

Additionally, Batana et al. (2021) studied the existence of spatial heterogeneity in the impacts of the early days of the COVID-19 pandemic on urban household incomes in Ethiopia and Kinshasa, Democratic Republic of Congo. Combining new panel household surveys with spatial data, the fixed-effects regression analysis for Ethiopia finds that households in large and densely populated towns were more likely to lose their labor incomes in the early phase of the pandemic, and their recovery was slower than other households. Disadvantaged groups, such as female, low-skilled, self-employed, and poor, particularly suffered in those towns. In Kinshasa, labor income-mobility elasticities are higher among workers—particularly female and/or low-skilled workers—who live in areas that are located farther from the city core area or highly dense and precarious neighborhoods. The between- and within-city evidence



from two Sub-Saharan African countries points to the spatial heterogeneity of COVID-19 impacts, implying the critical role of mobility and accessibility in urban agglomerations.

On the other hand, a research report by Hirvonen (2020) at IFPRI suggests that the pandemic has not led to unusually large increases in food prices. However, a case study in the vegetable sector suggests that price dynamics are highly context and crop specific, calling for more comprehensive price monitoring to identify food value chains and areas where food price increases may have been unusually rapid. Second, employment losses have concentrated on informal sector workers while redundancies in the formal sector have been less significant. Third, there is considerable uncertainty about the income, poverty, and food security implications of this crisis. While most households report income losses, the qualitative and subjective nature of these questions mean that the magnitudes of these losses are unknown. In Addis Ababa, less subjective food security measures indicate only small negative changes in household food and nutrition security. Finally, the report mentioned that limited access to mobile phones in rural areas results in imperfect and incomplete information on how this crisis has been affecting rural households in Ethiopia.

At zonal level in Ethiopia, Asegie et al. (2021) has investigated the effect of COVID-19 on the livelihood activities of smallholder farm households located in South Wollo and Oromia Administrative Zones in Ethiopia. Primary data from 275 respondents were collected and binary logistic regression model run. The dependent variable is the household's livelihood status as a result of the COVID-19 pandemic, takes 1 if at least one livelihood activity was affected and 0, otherwise. The results showed that the lives and livelihoods impacts varied depending on geo-local settings and pre-pandemic livelihood activities of the target districts. It concluded that the pandemic significantly affected all dimensions of livelihood diversification strategies. Particularly non-farm and off-farm livelihood activities of smallholder farmers are significantly affected.

## **MATERIAL AND METHODS**

### *Data Type, Source and Variables*

The empirical analysis relies on a harmonized household phone surveys that have been collected since the outbreak of the COVID-19 pandemic in Ethiopia. The World Bank conducted a high frequency phone survey (HFPS) of households to monitor the economic and social impacts of and responses to the COVID-19 pandemic on households, and thus inform interventions and policy responses (Wieser et al., 2020). The HFPS builds on the national longitudinal Ethiopia Socioeconomic Survey (ESS) that the Central Statistical Agency (CSA) carried out in 2019 in collaboration with the World Bank. The HFPS drew a subsample of the ESS sample that was representative of households with access to a working phone. It is conducted by calling a sample of

households every three to four weeks for a total of 12 survey rounds, starting in April 2020.

Finally, from the HFPS of households, the World Bank has prepared a harmonized dataset in order to create a comparable picture of how the pandemic affects the live of the poor. Harmonized indicators help to track the impact of the pandemic and mitigating policies over time in a comparable manner. Since the outcome variable of this study, which is probability of being food insecure, is available only for five rounds (round 2 – 6) in the harmonized dataset for households in Ethiopia, the study uses a panel data organized from these five rounds only. The main advantage of using panel data is that it deals with time-invariant unobserved heterogeneity that causes bias in estimation if it is not accounted for.

Besides, the study exclusively focuses on household level characteristics as predictor and independent variables. Using the households' id and survey rounds as the main identifiers and following the required data management processes, a panel data of 14,506 observations have been employed. The analysis includes data on total household food insecurity situation, and various households' socioeconomic characteristics and location variables.

Outcome variables: (food insecurity indicators): Food security is measured using two separate, but not exclusive, variables on probability of food insecurity. They are the "probability of being moderately/severely food insecure  $\geq 50\%$ " and the "probability of being severely food insecure  $\geq 50\%$ ". Each takes binary values, "1" if "yes" and "0" if "no". That means, if the probability of being food insecure is greater than or equal to 0.50 ( $\geq 50\%$ ), it takes 1 and 0 otherwise.

Explanatory variables and predictors: The independent variables for the study comprised household level characteristics only. The key indicator variables are sector or location of the the household, ownership of land, livestock, and non-farm family business enterprises, sources of livelihoods such as working in agriculture, wage employment, and income sources such as rent, remittance and assistance. Since they have time trend across the 5 rounds, as seen in the harmonized data by the world Bank, variables such as household size, change in household head, adult equivalence are included in the estimation as time-variant household characteristics in order to control their effects, if any.

TABLE 1. DESCRIPTIVE RESULTS OF KEY EXPLANATORY VARIABLES

No.	Variable	Obs.	Mean	Std. Dev.	Min	Max
1	Rural/Urban	14,506	1.70764	0.45486	1	2
2	Land Ownership	14,506	0.24025	0.42725	0	1
3	Rental income	14,506	0.09176	0.28869	0	1
4	Received remittance	14,506	0.17234	0.37769	0	1
5	Received assistance	14,506	0.05756	0.23292	0	1





6	Percentage of working adults working in agriculture	14,506	18.5313	33.6682	0	100
7	Percentage of working adults working in wage work	14,506	22.4807	34.0672	0	100
8	Ownership of livestock	14,506	0.35999	0.48001	0	1
9	Household head changed	14,506	0.00255	0.05044	0	1
10	Household size	14,506	4.37081	2.20392	1	14
11	Adult equivalence in the household	14,506	3.43859	1.75645	0.73	11.98
12	Household members above 65 & below 15 ages	14,506	1.70081	1.55624	0	9
13	Probability of being moderately / severely food insecure $\geq$ 50%	14,506	0.30360	0.45983	0	1
14	Probability of being severely food insecure $\geq$ 50%	14,506	0.04440	0.20598	0	1

Moreover, to better understand the differential impacts of the pandemic on households' food security, the study used baseline characteristics of households to differentiate those vulnerable households and livelihood activities. As the impacts of the pandemic are likely to vary across households, it aims to uncover heterogeneous impacts across various groups of households based on different dimensions. The variables for identifying the differential impacts are location (rural/urban), ownership of assets (land, and livestock), livelihood activities (agriculture, and wage employment); and income sources (rental income, remittance, and assistance).

The harmonized HFPS on households produced by the World Bank includes household characteristics of the baseline information from the national longitudinal Ethiopia Socioeconomic Survey (ESS) that the Central Statistical Agency (CSA) carried out in 2019 across the country. These data on household characteristics remain the same across all survey rounds. Only household size, adult equivalence and change in the household head vary across the rounds in the dataset. This makes the dataset more convenient and appropriate for analyzing the heterogeneous or differential impacts of COVID-19 across the different groups of households.

Table 2 below presents a simple descriptive indicator (percentage) of the probability of food insecurity of households in all rounds in different groups of households. From the total, 30.36% of the households asked in all rounds (column 1) have reported that they have faced a moderately/severely food insecurity during the pandemic, while the remaining 69.64% (column 2) didn't face such food insecurity problem. Only 4.44% of

the total households have faced severe food insecurity in the five rounds of the study period (column 3).

TABLE 2. PERCENTAGE OF FOOD INSECURITY PROBABILITIES BY GROUPS OF HOUSEHOLDS

		Probability of being moderately/ severely food insecure (P >= 50%)		Probability of being severely food insecure (P >= 50%)	
		Yes % (1)	No % (2)	Yes % (3)	No % (4)
Rural/Urban	Rural	11.43	17.81	1.72	27.51
	Urban	18.93	51.83	2.72	68.05
	Total	30.36	69.64	4.44	95.56
Ownership of land	Yes	21.76	54.21	2.96	73.01
	No	8.60	15.43	1.48	22.55
	Total	30.36	69.64	4.44	95.56
Ownership of livestock	Yes	16.19	47.81	2.23	61.77
	No	14.17	21.83	2.21	33.79
	Total	30.36	69.64	4.44	95.56
Rental income	Yes	28.60	62.23	4.23	86.59
	No	1.76	7.41	0.21	8.97
	Total	30.36	69.64	4.44	95.56
Received remittance	Yes	5.83	58.24	3.47	79.30
	No	24.53	11.40	0.97	16.26
	Total	30.36	69.64	4.44	95.56
Received assistance	Yes	27.55	66.70	4.09	90.16
	No	2.81	2.94	0.35	5.40
	Total	30.36	69.64	4.44	95.56

Source: Author's calculation from the harmonized HFPS data for Ethiopia.

Also, 11.43% and 18.93% of the total households surveyed in all rounds who have faced moderate or severe food insecurity are located in rural and urban areas respectively (column 1). From the total number of households surveyed in all rounds (14,506), different proportions who faced moderately/severely food insecurity (column 1) and those who have been exposed to severe food insecurity in different groups are given in column 3 of Table 2.

### *Analytical Method*

The study aims to examine how the trajectory of COVID-19 food security shock varied by sector of households, ownership of assets, livelihood options and income sources in Ethiopia. Panel regression models are used to determine the dimensions/variables along which food security situations of households have differentially or heterogeneously been affected by the COVID-19 pandemic.

For such situations, the standard econometric methodology suggests the use of efficient panel data estimators, such as fixed effect and random effect estimators (Wooldridge, 2002). Fixed effect estimators control for unobserved time-invariant characteristics of households and account for within-household variations across time. Random effects model takes care of both within- and between-household variations. The Hausman test is applied to identify whether the fixed or random effect estimators



is better for the estimation. The regression equation is given by

$$y_{it} = \alpha + \beta_1 r_t + \beta_2 (r_t h_i) + \beta_3 x_{it} + \delta_i + \varepsilon_{it}$$

where,  $y_{it}$  is a dummy variable for household  $i$  indicating the change in the probability of being moderately and/or severely food insecure (greater than or equal to 0.5) at round  $t$  since the previous survey round  $t-1$ ;  $r_t$  is a dummy indicator for the survey round;  $h_i$  indicates a characteristic of household  $i$ ;  $\delta_i$  is a household fixed effect. Since  $h_i$  is a time-invariant variable (household characteristics), it is interacted with the round dummies.  $\beta_2$  is the parameter of interest, indicating how the probability of households' food insecurity varies by the time-invariant characteristics (heterogeneity parameter). In addition, those time-variant household characteristics are controlled in  $x_{it}$ .

## RESULTS AND DISCUSSIONS

The nature of the data and main objective of the research imply that the fixed effect (FE) is the appropriate method. The Hausman specification test also confirms that in all estimations the fixed effect model is better than the random effect model. So, the estimation results (coefficients and p-values) of the fixed effect model are used in the analysis and discussions below.

In this section, results on the impact of the pandemic on food security and associated heterogeneity factors are presented, corresponding to the model equation above. Estimation is made by interacting the round dummies with the time-invariant variables such as location of the households, ownership of land and livestock, sources of income (rent, remittance or assistance), and livelihood activities (agriculture and wage employment). The parameter associated with the round dummy captures aggregate trends in food security. It also captures aggregate potential differences in food security situations across the six survey rounds.

Both Table 3 and 4 present estimates of the parameter of the round dummy in each case. In almost all estimations, the coefficients of all round dummies are negative and statistically different from zero, except in round 4 of the probability of being moderately/severely food insecure. That means households' overall likelihood of becoming moderately/severely food insecure increases between round 3 and round 4 in Ethiopia, while it decreases in the other survey rounds. Thus, we can safely argue that households in Ethiopia have experienced a declining trend in food insecurity between round 2 (June 2020) and round 6 (late September 2020).

The impact of COVID-19 is likely to vary across households due to differences in underlying conditions of the households. Table 3 reports the results for the probability of households being moderately/severely food insecure (column 1-4) and the probability of households being severely food insecure (column 5-8) across various

heterogeneity variables. The interaction terms between dummy rounds and the heterogeneity variables capture the temporal variation in the evolution of food insecurity associated with households' location, sectors, ownership of land and livestock, and various income and livelihood sources.

The interaction terms between the survey rounds and rural (column 5) is statistically different from zero in the fifth round (i.e. 0.762 at 5%), indicating that households in urban areas faced a higher chance of being severely food insecure than those in rural households between round 4 and round 5 (July-August 2020). As the spread of the pandemic was initiated and spread in urban areas, government responses, including mobility restrictions and lockdowns, were mostly intensified in urban areas and are expected to affect urban residents more directly than rural households at least in the short term.

Again, the interaction terms between rounds and percentage of working adults working in the agricultural sector are negative and significant in round 3 and 4, (column 3) and round 5 (column 6), each at 10% level of significance. This implies that households with greater percentage of adult household members working in the agricultural sector have a lower probability of being food insecure (June/July/August 2020). This is expected since farming activities require relatively less human-to-human interaction and transportation technologies, they are supposed to be affected relatively less than the other livelihood activities.

Ownership of land has positive and significant coefficients in round 5 and 6 (column 2, Table 3) on the probability of being moderately/severely food insecure. Even though the coefficients are not statistically significant in most cases, ownership of land, in column 2 and column 6 of Table 3, present unexpected and mixed results on the differential impact of the pandemic on food insecurity. In fact, it is whether the land is cultivated or not, or being used for the intended purpose, that should determine the variation in food security, not just a simple ownership of the land. Whatsoever the case is, the implication of ownership of land by Ethiopian households could be a subject for discussion and further researches.

Moreover, livestock ownership is also a source of heterogeneity in the impacts of the COVID-19 pandemic in households' food security situation in Ethiopia. Column 4 and column 8 present results on the impact of COVID-19 on food insecurity by livestock ownership. The interaction terms in round 5 and 6 (column 8) are negative and statistically different from zero, which implies that households who own livestock have a decreased probability of being severely food insecure between the 4th and 5th round (July/August 2020) and between the between the 5th and 6th (August/September 2020).



TABLE 3. ESTIMATION RESULTS OF FE MODELS IN ETHIOPIA FOR LOCATION AND SECTORAL HETEROGENEITY

	Probability of being moderately/severely food insecure (P >= 50%)				Probability of being severely food insecure (P >= 50%)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Round 3	-0.1959 (0.159)	-0.1125 (0.251)	-0.0276 (0.777)	-0.1031 (0.340)	-1.496* (0.000)	-1.121* (0.000)	-1.0810* (0.000)	-1.107* (0.000)
Round 4	0.307** (0.032)	0.3659* (0.000)	0.5022* (0.000)	0.409* (0.000)	-1.328* (0.000)	-1.563* (0.000)	-1.4806* (0.000)	-1.420* (0.000)
Round 5	-0.606* (0.000)	-0.664* (0.000)	-0.5178* (0.000)	-0.518* (0.000)	-1.432* (0.000)	-0.763* (0.000)	-0.7381* (0.001)	-0.462** (0.032)
Round 6	-0.8244 (0.000)	-0.840* (0.000)	-0.7091* (0.000)	-0.650* (0.000)	-1.220* (0.000)	-1.203* (0.000)	-1.1912* (0.000)	-0.806* (0.000)
Round 3*rural	0.1292 (0.451)				0.4293 (0.185)			
Round 4*rural	0.1624 (0.353)				-0.2371 (0.482)			
Round 5*rural	0.1075 (0.556)				0.762** (0.027)			
Round 6*rural	0.1171 (0.532)				0.074 (0.827)			
Round 3*land		0.0122 (0.947)				-0.3364 (0.318)		
Round 4*land		0.1795 (0.334)				0.2868 (0.407)		
Round 5*land		0.469** (0.015)				-0.5553 (0.115)		
Round 6*land		0.339*** (0.088)				0.0940 (0.785)		
Round 3*agri.			-0.004*** (0.091)				-0.005 (0.207)	
Round 4*agri.			-0.004*** (0.076)				0.0003 (0.938)	
Round 5*agri.			-0.0007 (0.749)				-0.007*** (0.096)	
Round 6*agri.			-0.0018 (0.470)				0.0007 (0.860)	
Round 3*livestock				-0.0220 (0.895)				-0.2604 (0.403)
Round 4*livestock				0.0144 (0.932)				-0.1250 (0.708)
Round 5*livestock				-0.0379 (0.829)				-1.015** (0.002)
Round 6*livestock				-0.2367 (0.192)				-0.780** (0.019)
Household FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	5,658	5,658	5,658	5,658	1,649	1,649	1,649	1,649

Note: \*, \*\* and \*\*\* represent 1%, 5% and 10% levels of significance.

In the next section, the study explores potentially heterogeneous impacts of the pandemic across households with varying livelihoods activities and income sources. Our analysis in this regard is also in line with several studies across the world suggesting that the pandemic has had heterogeneous impacts on different livelihood options and sectors (Amare et al., 2020). The availability of baseline data allows estimating the impact of the pandemic across various socioeconomic groups and regions. In order to better understand the differential impacts, the study utilizes baseline characteristics of households to differentiate vulnerable households and income sources. So, the heterogenous impacts of the pandemic across households' income and livelihood sources such as rental income, remittance, assistance, and wage employment, among others are estimated and the results are presented in Table 4 below. These variables are interacted with round dummies to quantify the differential impact of the pandemic across the groups.

Column 1 and column 5 presents the interaction results between round dummies and rental income of households. Thus, coefficients in round 3 (0.583), round 4 (0.943), round 5 (0.894) and round 6 (1.166) are positive and statistically significant. This means that households whose income source was rental income previous to the onset of the pandemic have increased likelihood of being moderately/severely food insecure between round 2, round 3, round 4 and round 5 (between May and August 2020), and higher chance of being severely food insecure between round 5 and round 6 (August-September 2020). So, the impact of the pandemic is significantly heterogeneous among households with and without rental income. Businesses closure and decrease in economic activity due to the direct impacts of the pandemic and also government's containments measures could be attributed to this differential impact of the pandemic by rent income source.

Then, the interaction term between round and remittance is negative and significant only in round 5 (-0.427 at 10%) which indicates remittance had chance of decreasing probability of becoming food insecure in Ethiopia during the pandemic (column 2). Households who have been receiving assistance from the government before the onset of the pandemic have decreased chance of becoming moderately or severely food insecure in Ethiopia. The interaction between round dummies and assistance are negative and statistically significant different from zero in round 3 (-0.585), round 5 (-1.206) and round 6 (-0.736) at 1%, 5% and 10%, respectively, levels of significance. So, households relying on remittance and assistance income are not significantly harmed by the pandemic.



TABLE 4. ESTIMATION RESULTS OF FE MODELS IN ETHIOPIA FOR HETEROGENEITY BY HOUSEHOLDS' INCOME SOURCES

	Probability of being moderately/severely food insecure (P >= 50%)				Probability of being severely food insecure (P >= 50%)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Round 3	-0.146*** (0.091)	-0.062 (0.505)	-0.070 (0.418)	-0.1126 (0.244)	-1.212* (0.000)	-1.167* (0.000)	-1.231* (0.000)	-1.2295* (0.000)
Round 4	0.359* (0.000)	0.385* (0.000)	0.429* (0.000)	0.3949* (0.000)	-1.467* (0.000)	-1.361* (0.000)	-1.536* (0.000)	-1.607* (0.000)
Round 5	-0.586* (0.000)	-0.454* (0.000)	-0.451* (0.000)	-0.5641* (0.000)	-0.965* (0.000)	-0.880* (0.000)	-0.897* (0.000)	-1.178* (0.000)
Round 6	-0.752* (0.000)	-0.707* (0.000)	-0.696* (0.000)	-0.8352* (0.000)	-1.237* (0.000)	-1.122* (0.000)	-1.203* (0.000)	-1.251* (0.000)
Round 3*rent	0.583*** (0.091)				-0.566 (0.531)			
Round 4*rent	0.943* (0.009)				-0.190 (0.838)			
Round 5*rent	0.894** (0.017)				0.851 (0.256)			
Round 6*rent	0.051 (0.897)				1.166*** (0.092)			
Round 3*remit		-0.253 (0.224)				-0.268 (0.489)		
Round 4*remit		0.171 (0.427)				-0.533 (0.214)		
Round 5*remit		-0.428*** (0.055)				-0.217 (0.578)		
Round 6*remit		-0.215 (0.349)				-0.245 (0.547)		
Round 3*assist			-0.585*** (0.056)				0.1562 (0.794)	
Round 4*assist			-0.253 (0.415)				0.8424 (0.147)	
Round 5*assist			-1.206* (0.001)				-0.486 (0.471)	
Round 6*assist			-0.736** (0.034)				0.4352 (0.482)	
Round 3*wage				0.0001 (0.990)				-0.002 (0.965)
Round 4*wage				0.0010 (0.695)				0.0102*** (0.088)
Round 5*wage				0.0015 (0.566)				0.0172* (0.002)
Round 6*wage				0.005*** (0.094)				0.0062 (0.384)
Household FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	5,658	5,658	5,658	5,658	1,649	1,649	1,649	1,649

Note: \*, \*\* and \*\*\* represent 1%, 5% and 10% levels of significance.

Finally, column 4 and column 8 present the differential impact of the pandemic across wage activity as income source. And, the interaction coefficients are positive and significant in round 4 (0.010 at 10%) and round 5 (0.016 at 1%) which indicates that greater involvement in wage earning activities increases the chance of becoming moderately/severely food insecure between round 5 and 6, and severely food insecure between round 3 and 4 (June-July 2020), and between round 4 and 5 (July-August 2020). This is expected since wage-related activities could be closed or, stooped working or fired their workers due to the government’s containments measures and the pandemic’s direct economic impact.

TABLE 5. TEST OF JOINT SIGNIFICANCE OF INTERACTION TERMS (HETEROGENEITY INDICATOR VARIABLES)

No.	Interactions terms (heterogeneity indicators)	Probability of being moderately/ severely food insecure $\geq$ 50%		Probability of being severely food insecure $\geq$ 50%	
		Chi2(4)	Prob>chi2	Chi2(4)	Prob>chi2
1	Round*rural	1.00	0.9102	8.92	0.0630
2	Round*land	8.72	0.0684	6.13	0.1896
3	Round*agri.	4.87	0.3013	4.98	0.2894
4	Round*livestock	2.36	0.6705	13.19	0.0104
5	Round*rent	10.71	0.0300	5.16	0.2711
6	Round*remit	8.30	0.0811	1.61	0.8078
7	Round*assist	13.47	0.0092	4.14	0.3877
8	Round*wage	3.59	0.4642	11.70	0.0197

Joint significance of the interactions between each heterogeneity indicator variable and the round dummy are tested and presented in Table 5. The impact of COVID-19 on moderate/severe food insecurity is heterogeneous between those households who own land, earn rental income, and receive remittance and assistance and those households who do not.

Besides, there is statistically significant difference in the impacts of the pandemic on severe food insecurity between urban and rural households. It brings also heterogeneous severe food insecurity between those who owns livestock and those who do not. Households who rely on wage employment are exposed to a significant differential impact of the pandemic than those who do not. Overall, rural/urban, ownership of land and livestock, rental income, remittance, assistance and wage employment are statistically significant heterogeneous indicator variables on the impacts of the early days of COVID-19 on households overall food security.

As a robustness check, we estimate the models above using subsamples and different specifications (estimation results are available in the log-file attached as appendix). First, we estimate the fixed effect model specifications using only the subsample of households that do not live in Addis Ababa. This is to test the possibility that our findings are driven by households in Addis Ababa, by far the largest city in Ethiopia and unique in many aspects. Secondly, the fixed effect models are re-estimated by excluding the additional time-variant controls for household characteristics, such as





change in household head, household size, adult equivalence, and number of household members whose is below 15 years and above 65 years. The results confirmed that our findings are robust against the change in the subsample and model specifications used in the estimation. Excluding Addis Ababa from the sample and omitting the time variant household characteristics from the specification and estimation of the fixed effect model does not substantially change the results. In all cases, the findings remain the same. So, the fixed models specified and estimated are appropriate.

## CONCLUSIONS

COVID-19 affects food security of households through different pathways. COVID-19 related lockdowns and social distancing measures can adversely affect incomes by reducing economic and livelihood activities, which directly affects food security of households. Several studies from different developing countries, including Africa, show that the pandemic has had heterogeneous impacts on food security, various livelihood options and sectors in their economy. This study intended to explore the trajectory and heterogeneous impacts of the early days of the COVID-19 pandemic on food insecurity across households with different location or sectors, ownership of assets and varying livelihoods and sources of incomes in Ethiopia. It has used a nationally representative harmonized panel data on households drawn from the high frequency phone survey and national longitudinal Ethiopia Socioeconomic Survey (ESS) that the Central Statistical Agency (CSA) carried out in collaboration with the World Bank.

The fixed-effects regression results show that the COVID-19 pandemic had a statistically significant impact on overall food insecurity in Ethiopia. Households have experienced a declining trend in food insecurity between round 2 (June 2020) and round 6 (late September 2020). The joint significance test shows that rural/urban, ownership of land and livestock, rental income, remittance, assistance and wage employment are statistically significant heterogeneous indicator variables on the impacts of the early days of COVID-19 on households' overall food insecurity.

Specifically, households in urban areas faced a higher chance of being severely food insecure than those in rural households between July-August 2020. It also shows that households that rely more on the agricultural sector have a lower odds of being food insecure (June - August 2020) than those households who do not. Moreover, livestock ownership is also a source of heterogeneity in the impacts of the COVID-19 pandemic in households' food security situation in Ethiopia. Households who own livestock have a decreased probability of being severely food insecure between the 4th and 5th round (July-August 2020) and between the between the 5th and 6th (August-September 2020).

Besides, households whose income source was rental income previous to the onset of the pandemic have increased likelihood of being moderately/severely food insecure between round 2, round 3, round 4 and round 5 (between May and August 2020), and higher chance of being severely food insecure between round 5 and round 6 (August-September 2020). So, the impact of the pandemic is significantly heterogeneous among households with and without rental income.

The interaction term between round dummies and remittance is negative and statistically significant only in round 5, and between round dummies and assistance are negative and statistically significant different from zero in round 3, round 5 and round 6. This suggests the significant role that has been played by remittance and assistance income in protecting households from deteriorating trajectory of food insecurity during the pandemic in the short term.

Finally, the coefficients relating round dummies and wage employment are positive and statistically significant in round 4 and round 5, and this suggest that indicates that greater involvement in wage earning activities increases the chance of becoming moderately/severely food insecure between round 5 and 6, and severely food insecure between round 3 and 4 (June - July 2020), and between round 4 and 5 (July - August 2020). Households that have been relying on wage employment as income source were significantly exposed to food insecurity due to the pandemic.

The findings of the study can be used to informing short term and medium-term policy responses and interventions by the government at different levels and international donor organizations. It could inform safety nets and social protection policy interventions aiming at ameliorating the impacts of the pandemic, as well as pinpoint tailored strategies by identifying the most impacted households or members of the populations. In the short term, it was important to provide direct support to those households in the form of, for example, cash transfers and food rationing. In the medium term, it might have been useful to build disadvantaged groups and households' resilience against shocks by improving their accessibility to jobs, and markets for food and make transactions. This informs that the country should strengthen its programs and works on social protection and rehabilitation through safety net programs so that it could have supported the severely exposed households. This is an important lesson that the same preparation is required for future unforeseen economic shocks.

Finally, the scope of the analysis does not allow distinguishing specific pathways in the COVID-19 impacts on urban households' only or rural households only. For instance, in large and densely populated towns, people are less likely to travel during the pandemic in view of the high contagion risk and relatively strict mobility restrictions and lockdowns. This could be a source of heterogeneity in COVID-19 impacts among urban households only. Also, it does not look at other potential paths of differential impacts of the pandemic. For example, the disadvantaged groups of



workers who live far from their workplace are supposed to be hit hard by mobility restrictions. Those household members with no option to work remotely and need to travel around for their jobs in self-employment may have been particularly vulnerable to mobility shocks and exposed to food insecurity problem.

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