REPUBLIC OF TURKEY
SAKARYA UNIVERSITY
INSTITUTE OF SOCIAL SCIENCES

THE MACROECONOMIC DETERMINANTS OF PERSONAL REMITTANCES IN SIERRA LEONE

MASTER'S THESIS

Kabineh KPUKUMU

Department: Econometrics
Sub-field: Financial Economics

Supervisor: Assoc. Prof. Veli Yılancı

August – 2021

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"The examination was held online on 10/08 /2021 and approved unanimously by the following committee members."

COMMITTEE MEMBERS	ASSESSMENT
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KABINEH KPUKUMU

10/08/2021

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10/08/2021

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ABBREVIATIONS

ADF : Augmented Dickey-Fuller

AGE : Age Dependency Ratio

AIC : Akaike Information Criterion

ARDL : Autoregressive Distributed Lag

BM : Broad Money

CIA : Central Intelligence Agency

CUSUM : Cumulative Sum of Residual Squares

DFGLS : Dickey-Fuller Generalized Least Squares

ECM : Error Correction Model

FDI : Foreign Direct Investment

FE : Fixed Effects

FE 2SLS : Fixed Effects Two Stage Least Squares

FEVD : Forecast Error Variance Decomposition

FMOLS : Fully Modified Ordinary Least Squares

FPE : Final Prediction Error

GDP : Gross Domestic Product

GMM : Generalized Method of Moments

GNI : Gross National Income

HQ : Hanann-Quinn Information criterion

INF : Inflation

IRF : Impulse Response Function

LM : Lagrange Multiplier

LR : Likelihood Ratio

MENA : Middle East and North Africa

MWTS : Modified Wald Test Statistic

NARDL : Non-linear Autoregressive Distributed Lag model

NODADAR : Net Official Development Assistance and Aid Received

OLS : Ordinary Least Squares

PROLS : Panel Robust Ordinary Least Squares

RE : Random Effects

REM : Personal Remittances

SBC : Schwarz Bayesian Criterion

SC : Schwarz Criterion

SLREM : Personal Remittances in Sierra Leone

SSA : Sub-Saharan Africa

SSAREM : Personal Remittances in Sub-Saharan Africa

TY : Toda-Yamamoto

UNDESA : United Nations Department on Economic and Social Affairs

UK : United Kingdom

USA : United States of America

VAR : Vector Autoregressive

WAMZ : West African Monetary Zone

WDI : World Development Indicators

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ABSTRACT

Title of Thesis: The Macroeconomic Determinants of Personal Remittances in Sierra Leone

Author of Thesis: Kabineh Kpukumu

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The topic of migration has sparked an intense debate in the field of academia and policy discourses. Many have argued that it leads to a brain drain syndrome, while others have strongly supported its relevance for economic growth through inward personal remittances worldwide. The substantial flow of remittances and its less volatile nature compared to the other forms of international capital inflows to many countries has made remittances a dependable engine for economic growth.

Sierra Leone still hugely depends on international capital inflows to achieve its development goals. Despite this reality, there is no study to the author's knowledge on this important topic in the country. Thus, this study uses a combination of econometric estimation techniques to ascertain the macroeconomic variables determining personal remittances in Sierra Leone and the causality among the variables in the period 1980 – 2018. The study found out that economic growth, broad money, age dependency ratio, war, and Ebola negatively influence personal remittances in the country, whereas inflation exerts no significant influence on it within the study period. Also, Granger causality running from economic growth to remittances was confirmed, whereas no causality between the other variables and remittances was found. The study, therefore, suggests that the government should implement pro-growth macroeconomic policies and keep inflation within reasonable limits. This stable macroeconomic environment would attract more remittances for investment purposes and reduce the negative impacts that could result from a pure altruism motive of remittance thereby resulting in sustainable remittance inflows and economic development in the country.

Keywords: Remittances, Econometrics, Sierra Leone, Determinants, Causality

ÖZET

Başlık: Sierra Leone'de Kişisel Havalelerin Makroekonomik Belirleyicileri.

Yazar: Kabineh Kpukumu

Danışman: Doç. Dr. Veli Yılancı

Kabul Tarihi: 10/08/2021 **Sayfa Sayısı:** x (önkısım) + 91 (tez)

Göç konusu, akademi ve politika söylemleri alanında yoğun bir tartışmayı ateşledi; birçoğu bunun bir beyin göçü sendromuna yol açtığını iddia ederken, diğerleri, yeterince kullanıldığı takdirde dünyanın birçok ülkesinde kişisel havale yoluyla ekonomik büyüme ve kalkınmayla olan ilişkisini güçlü bir şekilde desteklemektedir.

Sierra Leone, zengin doğal ve mineral kaynaklarına rağmen, kalkınma hedeflerine ulaşmak için hala büyük ölçüde uluslararası sermaye girişlerine -biri kişisel havaleler de dahil olmak üzere- bağımlıdır. Bu gerçeğe rağmen, yazarın bu çok önemli konuda bilgisine dair güvenilir bir çalışma yoktur. Bu nedenle, bu çalışma, ülkedeki kişisel havalelerin makroekonomik belirleyicilerini ve 1980 – 2018 döneminde belirleyiciler ile havaleler arasındaki nedenselliği tespit etmek için ekonometrik tahmin tekniklerinin bir kombinasyonunu kullanmaktadır. Çalışma, ekonomik büyüme, geniş para, yaş bağımlılık oranı, savaş ve Ebola, ülkedeki kişisel havaleleri olumsuz etkilerken, enflasyonun çalışma süresi içinde üzerinde önemli bir etkisi yoktur. Ayrıca, ekonomik büyümeden kişisel havalelere doğru uzanan Granger nedenselliği doğrulanırken, diğer değişkenler ile kişisel havaleler arasında herhangi bir nedensellik bulunamamıştır. Bu nedenle çalışma, hükümetin büyüme yanlısı makroekonomik politikalar uygulaması ve enflasyonu makul sınırlar içinde tutması gerektiğini öne sürmektedir. Bu istikrarlı makro ekonomik ortam, yatırım amaçlı daha fazla kişisel havaleler çekecek ve tamamen özgecilik havale güdüsünden kaynaklanabilecek olumsuz etkileri azaltacak ve böylece sürdürülebilir havale girişleri ve ülkede ekonomik kalkınma ile sonuçlanacaktır.

Anahtar Kelimeler: Kişisel Havaleler, Ekonometri, Sierra Leone, Belirleyiciler, Nedensenlik

INTRODUCTION

From the beginning of human civilization to date, migration has always been a persistent phenomenon. However, in the age of globalization coupled with scientific advancements, international migration has become a dominant topic in academic and policy discourses around the globe. The UNDESA (2017) reported there were 258 million international migrants in 2017 and 150 million migrant workers in 2015. Many academic think-tanks and studies have put forward diverse reasons why people migrate in this modern era, prominent of these are those highlighted by the International Office of Migration (2013). They state that people migrate for four major reasons, namely: firstly, economic factors (pull factors), i.e. the growing wage differentials between the host and home countries; secondly, inefficient public services delivery and corruption (push factors); thirdly, demographic differences between the countries like variations in life expectancy, labor market forces, unemployment rate, which often results in the destination country attracting people from nations where these conditions are appalling; finally, political conflicts which force people out of their countries to another nation with the safer and better socioeconomic environment.

Furthermore, the high spate of international migration undoubtedly has major positive and negative consequences on the global economy, particularly on the sending and receiving countries. Benhabib and Jovanovic (2012) argue that international migration involving skilled migrants can harm the home country's economic development. In contrast to them, many studies have argued that international migration can lead to economic progress in both the host and home countries via personal remittances and transfer of knowledge (Orozco, 2007; Plaza and Ratha, 2011). One among the major benefits of external migration, personal remittances, has become a topical issue in many public discourses by international organizations, think tanks, and governments across the world today. Personal remittances in simple terms are the sum of money transfers from residents abroad to their countries of origin. The connection between remittances and international migration has become so important that it was included as an item on the G8 meeting agenda in 2004 and in the World Bank's May 2005 spring meeting Adenuga (2009).

The World Bank announced that remittances received were approximately US$ 594 billion (current US$) in 2017 and US$ 639 billion in 2018 (current US$) in the world. In the same period, remittances received (% of GDP) were 0.75 and 0.76 in 2017 and 2018 respectively. It is based on the substantial size that international organizations have believed that remittances can serve as an impetus for economic growth and development. Also, World Bank (2016) reported that remittances surpassed Official Development Aid. In line with this also, Tabit and Moussir (2016) remarked that in contrast to the other international capital flow (foreign direct investments and overseas development aid), remittances flow from the migrants to their home countries with no strict conditions attached, and tend to be more stable in the time of crises (Le Goff and Salomone, 2016; Rahman and Wadud, 2014). In Sub-Saharan Africa, remittances received were estimated by the World Bank at US$ 33 billion in 2016. In this region, remittances have been empirically proven to be less volatile compared to debt flows, portfolio equity, and FDI (Plaza and Ratha, 2011). It must however be noted that the figures of remittances are generally underestimated as some proportions of them flow via informal means which are difficult to be captured (Mohapatra and Ratha, 2011).

Sierra Leone, despite the bountiful natural and mineral resources, relies hugely on international capital inflows - one of which is personal remittances - to achieve her development aspirations. With a growing population amidst challenging socioeconomic conditions, people usually emigrate overseas in search of greener pastures and human capital development. Personal remittances received (in terms of physical cash and knowledge transfer) from these migrants would help to sort of reduce the effects of brain drain in the country. In fact, based on the less diversified economic structure of the country coupled with the usual high unemployment rate, the unemployed working-age migrant traveling abroad and remitting cash to the country would be a plus to the country's development than staying unemployed in the country for many years.

Based on the World Bank Development indicators (2017 and 2018), unemployment rates in the country were 4.5 and 4.42%, inflation rates (consumer price index) were 18.22 and 16.03%, total population figures were 7.49 million and 7.65 million, and emigrant stock in 2017 was 159,017. Also, in these turbulent times, personal remittances received (% of GDP) were 1.3% and 1.5% in 2017 and 2018 respectively; FDI received (% of GDP)

were 5.30% and 5.33% in 2017 and 2018 respectively, and net official development assistance and official aid received (current US$) were US$541 million and US$ 505 million in 2017 and 2018 respectively (WDI 2018).

Migrants usually remit monies back home for various micro and macro reasons. It may be for economic, family welfare, health, and socio-political reasons.

Finally, despite the highlighted substantial flow of and relevance of remittances in Sierra Leone and the globally documented results of the considerable influence of personal remittances on economic growth, no authoritative study on the factors influencing their flow and causality between it and those factors in Sierra Leone is yet to be conducted. Thus, this study sheds light on the macroeconomic variables determining personal remittances, causality and its direction among the selected variables in Sierra Leone between the periods 1980 to 2018 using statistical and econometric techniques.

Aim of the Research:

This research mainly aims at employing advanced econometric techniques using time series data to identify the macroeconomic variables determining personal remittances and the causality among the variables in Sierra Leone in 1980-2018 in Sierra Leone.

Objectives:

- To obtain the macroeconomic determinants of personal remittances in Sierra Leone.
- To determine the trend of personal remittance inflows in Sierra Leone.
- To ascertain the (non)existence of causality and its direction among the factors.
- To proffer appropriate policy recommendations for personal remittance inflows in Sierra Leone.

Research Questions:

The purpose of this study necessitates the following research questions:

- Do macroeconomic factors determine personal remittance inflows in Sierra Leone?
- Is there Granger causality between personal remittances and the selected variables?

Hypotheses:

Hypothesis 1:

- H_0: Macroeconomic factors do not influence personal remittances inflows in Sierra Leone.
- H_1: Macroeconomic factors do influence personal remittances inflows in Sierra Leone.

Hypothesis 2:

- H_0: Granger-causality does not exist between economic growth and personal remittances in Sierra Leone.
- H_1: Granger-causality does exist between economic growth and personal remittances in Sierra Leone.

Hypothesis 3:

- H_0: Granger-causality does not exist between personal remittances and broad money in Sierra Leone.
- H_1: Granger-causality does exist between personal remittances and broad money in Sierra Leone.

Hypothesis 4:

- H_0: Granger-causality does not exist between personal remittances and inflation in Sierra Leone.
- H_1: Granger-causality does exist between personal remittances and inflation in Sierra Leone.

Hypothesis 5:

- H_0: Granger-causality does not exist between age dependency ratio and personal remittances in Sierra Leone.

- H_1: Granger-causality does between age dependency ratio and personal remittances in Sierra Leone.

Research Subject

Based on the magnitude of their flow and less volatile nature, personal remittances are gradually becoming a great alternative to external funding for household and business activities around the world. As Sierra Leone hugely depends on international capital flow for achieving development aspirations, if the remittances received are effectively and efficiently utilized, they could be used to help reduce extreme household poverty, spur private investments, boost develop human capital via expenditures on education and health and serve as household savings in times of crises. Thus, the subject of this study is to ascertain the macroeconomic variables determining personal remittances, causality and its direction between the variables in Sierra Leone in the period 1980-2018.

Research Significance

Sierra Leone, despite being blessed with bountiful natural, human, and mineral resources, is still battling development challenges. As a source of hope, the country constantly looks forward to external funding to be able to achieve daunting macroeconomic activities. Personal remittances, as a source of international capital flow, come in handy for many economic agents in the country including households, business entities, and even the government. According to some empirical studies, personal remittances contribute to household poverty alleviation, human capital development via educational and health expenditures at household levels, and private savings (Amuedo-Dorantes and Pozo, 2014; Orozco, 2007; Tabit and Moussir, 2016).

Furthermore, with the growing relevance of personal remittances as an engine for economic growth and development in many countries as evident in many empirical studies so far, accurate knowledge of the factors determining personal remittances inflow is crucial for policy-makers. However, despite their substantial flow for the past few decades now in Sierra Leone, there is no existing study on the macroeconomic factors influencing personal remittances in the country. The results of this study would therefore inform policymakers to appropriately address the macroeconomic determinants of personal remittances in ways consistent with positive and sustainable flows in the

country. Additionally, this study would not only serve as a great addition to the body of extant academic literature on the factors determining personal remittances worldwide, but it also clearly documents the case of a unique country that receives considerable personal remittances yet still suffers from under-development. As a result, the study does not suffer from one of the major problems of cross-country regressions – heterogeneity. Also, the study is the first-ever conducted in the country, it would serve as a great foundation for future studies in the field. The issue of the Granger causality test contained in this study will further enrich its findings which would provide solid information for policy interventions.

Research Methodology

The main research aim was achieved by utilizing annual data on personal remittances received (% of GDP), broad money, GDP, and inflation variables retrieved from the WDI database for Sierra Leone between 1980 and 2018. After collecting the data, ADF and ADFGLS unit root tests were performed to determine stationarity of the variables and the type of co-integration test to be used. Consequent upon the outcomes of the stationarity tests, the ARDL and ECM were employed to obtain the short-run dynamic and long-run estimates respectively. Furthermore, to prove causality and its flow among the selected factors, the Toda Yamamoto Causality technique was applied. Next, the Variance Decomposition and Impulse Response Function approaches were applied to test the factors' variability with respect to innovations in system and the percentage of such variation caused by the innovations in the system. Finally, stability and diagnostic tests were performed to prove if the model suffers or not from abnormal error terms distribution, heteroscedasticity, serial correlation, functional form misspecification, and instability problems.

Research Outline:

In the first chapter, the overview of Sierra Leone including macroeconomic environment, personal remittances trends, and comparison between the other forms of foreign capital flows and personal remittances are discussed.

The second chapter documents the theoretical and empirical literature studies on personal remittances globally and in Sierra Leone context plus the gaps in the existing literature body.

In the third chapter, the sources of data, descriptions of data, and methodological framework of the research are given detailed treatment.

In the fourth chapter, the results from the econometric estimations are fully discussed based on their a priori expectations.

In the last chapter, a comprehensive conclusion in relation to the purpose of the research is made. The findings are juxtaposed with the previous studies on the same subject. Policy recommendations are proffered. And the limitations of the research are explained and the possible areas of future studies on the topic are suggested. Thereafter, the references and appendices follow.

CHAPTER 1: PERSONAL REMITTANCES AND MACROECONOMIC OVERVIEW IN SIERRA LEONE

1.1 Introduction

The overview of the Sierra Leonean macroeconomic environment overview including statistics on key macroeconomic variables like real economic growth rates, inflation, personal remittances (% of GDP), nominal exchange rate, international debt stock (% of gross national income), balance of trade, money supply (% of GDP), fiscal balance, external exchange reserves, private sector credit (% of GDP), total government spending, real interest rates, and capital formation in the period under study are presented. Additionally, personal remittance trends in the country and comparison of the different types of international capital flow into the country, particularly, FDI inflows, net official international assistance and aid received, and personal remittances, in the study period are discussed.

1.2 Macroeconomic Overview of Sierra Leone

Sierra Leone is a small Anglophone West African nation that shares borders with Liberia in the Southeast, Guinea in the North and Northeast, and the Atlantic Ocean in the Southwest. It is endowed with bountiful natural and mineral resources, namely, iron ore, platinum, chromite, diamond, gold, bauxite, coltan, rutile, limonite, zircon, vast and fertile agricultural lands, heavy rainfalls, columbite, tantalite, and with some recent petroleum discoveries in some parts of the country [1]. Like other developing countries, Sierra Leone has had her great share of socioeconomic, political, health, and other challenges the combination of which has undermined her economic development strides to date. Prominent among some of the aforementioned challenges within the study period are: eleven (11) years of bloody civil war in 1991-2002, poor governance practices, and Ebola virus disease outbreak in 2014-2015 which led to massive loss of lives and properties and by extension under-development. In 2018, the country's total population was 7.6 million (World Development Indicators, 2019).

[1] International Trade Administration, U.S Department of Commerce, 2020

After the civil war, the country recorded varying moderate economic growth rates at certain periods and one of the world's highest growth rates in 2013 at 20.7%. Such an unprecedented growth was largely triggered by the booming mines and the mining sector in the country. However, with the exogenous twin shocks of plummeting global ore prices in 2013 and the devastating Ebola Virus disease in 2014, the country recorded one of the worst growth rates in her history at -21.7% in 2015. This was mainly due to the fact that the country greatly depended on the mineral sector for its export earnings and the economic structure was less diversified. After these horrific economic moments in the country, the government has been implementing a couple of economic recovery programs which are gradually leading the country back to moderate growth rates[2].

The country's economy hugely depends on three (3) main sectors: agriculture, industry, and services. The agricultural sector contributes 60.7% to the country's economy and employs over half of the labour force in country; followed by the services sector which contributes 32.9% to the economy; and the industrial sector which accounts for 6.5% of the economy Forestry, farming, and fishing make up the agricultural sector; energy production, mining, construction, and manufacturing constitute the industrial sector; and transportation, non-material goods private economic activities, finance, government activities, and transportation form the services sector (The CIA World Factbook, 2017).

Furthermore, based on the available data, other major macroeconomic indicators within the study period can be summarized by decades as follows:

[2] African Economic Outlook 2017: Entrepreneurship and Industrialization

Table 1 : Some Macroeconomic Indicators 1980-2018

Macroeconomic Indicators	Decades			
	1980-89	**1990-99**	**2000-2009**	**2010-2018**
Real GDP	1.13029	-2.62011	6.800915	5.025541
Inflation	51.92471	43.95754	15.26921	11.5582
Broad money (% of GDP)	23.37495	13.0796	15.49548	21.99588
Personal Remittances (% of GDP)	0.007584	1.251605	1.229183	1.477829
Net Off. Development Asst. and Off. Aid Received	162470998	192263000	409115999	561133335
Real Interest Rate	-15.4954	-0.45055	9.593267	7.478438
Gross Fixed Capital Formation (% of GDP)	12.16327	6.84873	9.542398	21.7503
General government final consumption spending (constant 2010 US$)	194572227	114015928	213293516	313108098
External Debt Stock (% of GDP)	93.91299	186.6607	94.53603	37.99938
Current account (% of GDP)	-2.57571	-8.25838	-8.64297	-22.4516
Trade (% of GDP)	41.98765	49.34321	43.25653	74.76744
Credit received by the private sector (% of GDP)	5.334577	2.960835	3.690475	5.932304

Source: Calculated by the author from the data obtained from the WDI (1980-2018).

Based on the four decades' averages in the table above, comments on few macroeconomic indicators can be summarised as follows: it can be observed that the country experienced a low economic growth in the first decade of the study period, negative growth in the second decade, highest growth in the third decade, and impressive growth in the last decade. The low growth in the first decade could have been due to the fact that the

country's economy was greatly undiversified with underdeveloped sectors and bad governance by a one party system; the negative average growth could be attributed to the decade long of civil war where economic activities were greatly disrupted; the highest average growth rate in the third decade could be attributed to the relative stability and international cooperation efforts in the various sectors in the country during the post-war periods; and the high average growth in the last decade may be due to great improvements in the agricultural and booming mineral sectors.

Additionally, the trade (% of GDP) figure was low in the first decade and highest in the last decade. The highest trade record may be due to increased globalization, increase in multilateral trade agreements between Sierra Leone and her trade partners plus scientific advancements all of which have made international trade easier than before, and the lowest record could be due to lesser developments in the aforementioned areas. Furthermore, the country recorded the lowest general government final consumption expenditure in the first decade and highest in the last decade. The highest case could be attributed to the rising political and economic activities in the country, and the lowest due to a smaller scale of economic and political activities in the first decade.

Finally, current account balance was negative right through the four decades with its lowest in the first and highest in the last decades respectively. This may be so because that the country still greatly depends on imported goods and services and yet to fully exploit her export potentials. The fiscal balance was negative throughout 2000-2018, except 2007 which was at 20.1% of GDP. The foreign exchange reserve reached its maximum at US$ 0.6 billion in 2014 (the Global Economy, 2020).

1.3 Personal Remittances Trends in Sub-Saharan Africa

Huge imbalances among countries induce migration across the world which often lead to positive consequences e.g., workers' remittances, etc. on the one hand, and negative consequences, e.g., brain drain, etc. on the other hand. The UNDESA reported that in 2017, two-thirds of the migrant population in the Sub-Saharan region were from within the continent. Remittances received in Sub-Saharan Africa have been increasing in the last decade of the study period 2010-2018 with recent figures of US$ 42 billion and 47 billion in 2017 and 2018 respectively. The minimum value recorded was US$ 1.3 billion in 1980, maximum was US$ 48 billion in 2018, and average value was US$ 14.3billion. Additionally, with respect to the remittances received (% of GDP), the region recorded 2.6% and 2.8% in 2017 and 2018 respectively. The highest recorded amount was 2.8% in 2018, minimum was 0.4% in 1981, and average was1.5% (World Bank, 2017). These fluctuations and improvements could be attributed to the respective countries' economic growth, increased migrants within the continent, global financial integration, and improved financial systems with the continent.

In Sierra Leone specifically, personal remittances received (current US$) have been fluctuating from the beginning to the end of the study period. The country recorded a minimum remittances inflow of US$ 27,072 in 1990, maximum of US$ 69 million in 2013, and an overall average of US$ 20 million. In 2017, it was recorded as US$48 million (World Development Indicators, 2019). The marked increase in personal remittances flow into the country in recent years could be attributed to considerable global financial integration, relatively improved internal financial practices and transfer channels aided by technology, and high level of migration all of which have made international money transfer easier than before. Additionally, personal remittances received (% of GDP) shows moderate increase albeit some fluctuations with the study period. The minimum recorded value was 0.003% in 1991, maximum was 3.35% in 1999, and average was 0.98%.

Furthermore, the trends in personal remittances in the Sub-Saharan region and Sierra Leone specifically can be diagrammatically illustrated on the following page. The terms in the figures SLREM%, SSAREMGDP, SSAREM, and SLREMCurrent refer to personal remittances received (% of GDP) in Sierra Leone, personal remittances received

(% of GDP) in Sub-Saharan Africa, personal remittances received in Sub-Saharan Africa in current US dollars, and personal remittances received in Sierra Leone in current US dollars respectively within the study period 1980-2018.

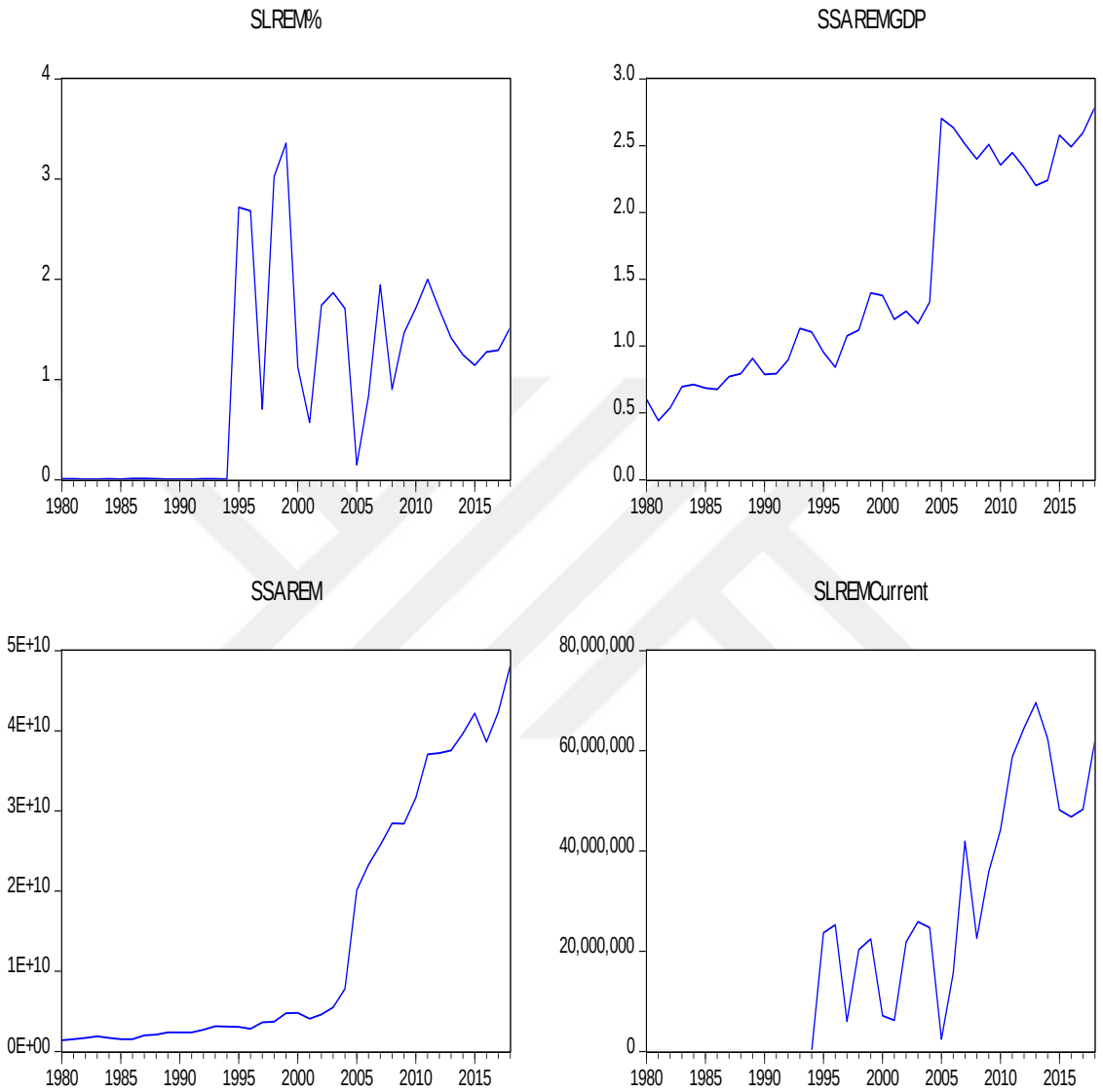

Figure 1 : Personal Remittances Trends in Sub-Saharan Africa 1980-2018

Source: Author's computations using EVIEWS10 based on the data obtained from the World Development Indicators, World Bank 1980-2018.

From the first diagram (SLREM%) above, personal remittances received (% of GDP) in Sierra Leone from 1990-94 were insignificant. However, from 1995-2018, there was a considerable flow of remittances (% of GDP) with its highest peak in 1999. In the second diagram (SSAREMGDP), Sub-Saharan Africa recorded an overall rise in personal remittances received (% of GDP) within the study period with its highest peak in 2018.

In the third diagram (SSAREM), Sub-Saharan Africa experienced fluctuating personal remittances inflows with high levels of inflows from 2000 to 2018. The highest peak was recorded in 2018. In the final diagram (SLREMCurrent), personal remittances received (current US$) in Sierra Leone were insignificant in the period 1990-94, started increasing in 1995 with fluctuations until 2018, and highest in 2013.

1.4 Personal Remittances and Other Capital Inflows in Sierra Leone

International capital inflows represent a great income source for developing nations including Sierra Leone. They are generally in the form of FDI, personal remittances, overseas development assistance/aid/loan, portfolio equity, and other forms of bank loans and grants. If these capital inflows are effectively managed, they could serve as a great impetus for the nation's economic progress. In the last couple of decades, Sierra Leone has received huge amounts of foreign direct investments mainly due to the country's mineral endowments; considerable official development assistance owing to multilateral agreements, and other loans and grants to support the country's development programs. The table below shows a brief comparison among three main forms of foreign capital flows in the country obtained from WDI (2019). The values are averaged by decades within the study period.

Table 2 : Personal Remittances and Other Capital Inflows in Sierra Leone 1980-2018

International Capital Inflows	**Decades**			
	1980-89	**1990-99**	**2000-2009**	**2010-2018**
Personal remittances (Current US$)	70195.55	9794660	20427573	56119673
Net Official Development Assistance and Official Aid Received (current US$)	77509999.85	146891001.9	370936006.2	596910003.7
FDI received, net inflows (current US$)	13151819.54	3439210.513	53761460.15	391385837.8

Source: Calculated by the author based on data from WDI (2019).

Based on the calculated decade averages in the table above, all personal remittances received, FDI net inflows, and net official development assistance and official aid received, steadily increased throughout the four decades under study. To make a clear

comparison between personal remittances and the other capital flows in Sierra Leone in the study period, a diagrammatic illustration is presented on the next page.

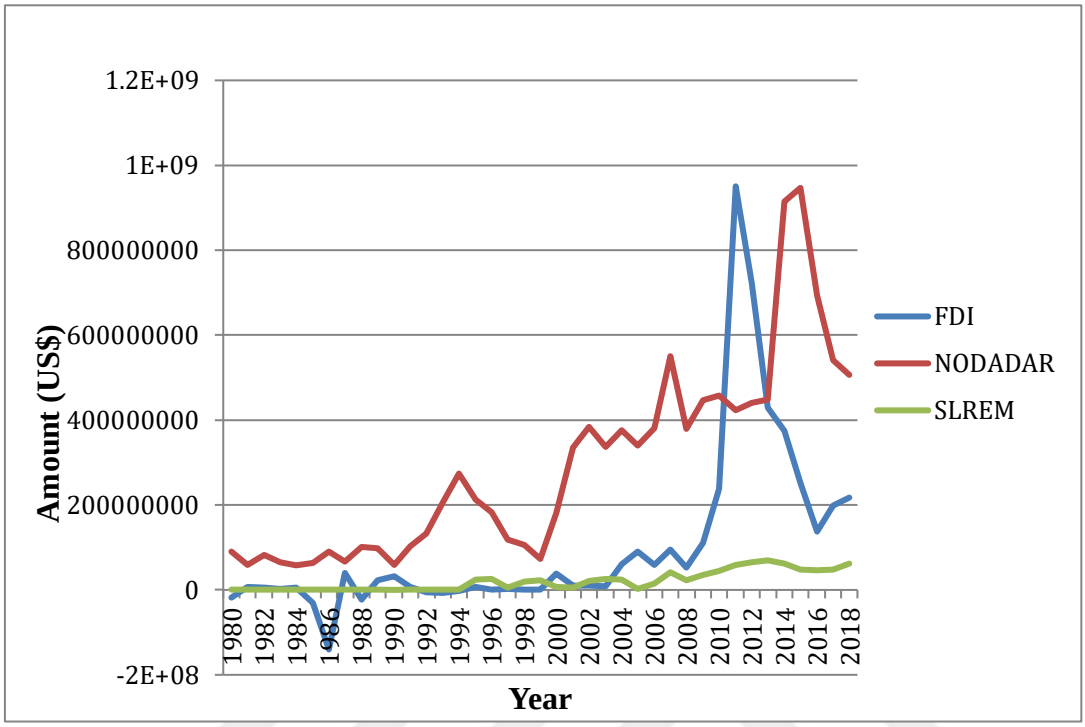

Figure 2 : International Capital Inflows in Sierra Leone

Source: Calculated by the author based on WDI (2019) data. FDI= foreign direct investment received net inflows, NODADAR = net official development assistance and official aid received, and SLREM = personal remittances net inflows in Sierra Leone. Note: the values are in current US dollars.

From the figure above, personal remittances received (current US$) was consistently lower than the other two international capital inflows within the study period. It however, shows a steady increase from 2007 unto 2018. This increase may be attributed to increased migration in the world, improved financial systems, global financial integration, and advancements in technology. Additionally, it can be observed that the net official development assistance and official aid received was on average the highest form of international capital flows received in the country in the period under consideration. This may be due to increased multilateral development agreements between Sierra Leone and other countries in the world in an effort to help the country achieve sustainable economic growth and development.

1.5 Top Countries Remitting to Sierra Leone

As stated previously, many migrants prefer sending remittances via informal channels due to the high costs usually associated with the formal channels. Thus, remittances statistics are always under-reported. Based on the available data, the top three (3) countries sending remittances to Sierra Leone are USA, UK, and Guinea (World Bank Migration and Remittances database, 2017). 77% of the total remittances received in Sierra Leone is accounted for by these countries. It could be because the majority of the Sierra Leoneans abroad reside in these countries. Other major countries sending remittances to the country are Germany, Netherlands, and Senegal. The figure below illustrates the various percentages of total remittances received in Sierra Leone from different countries in 2017 based on the database.

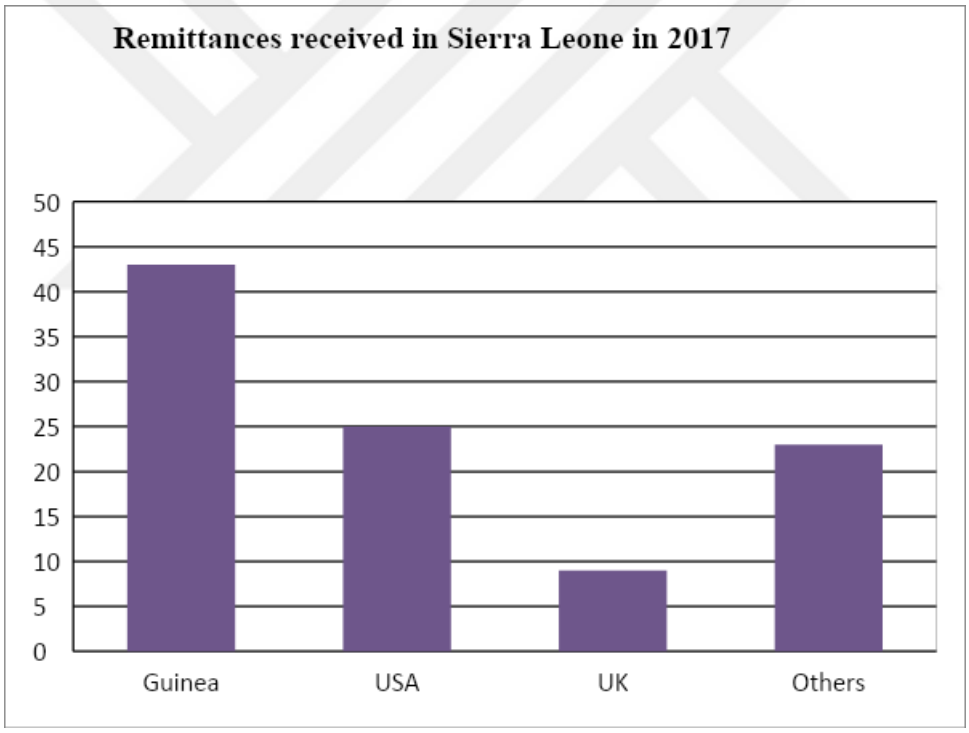

Figure 3 : Remittances Received in Sierra Leone from Other Countries (% of total amount received)

Source: Calculated by the author based on data from the World Bank Migration and Remittances Database 2017.

From the figure above, the bar charts represent the percentage share of every country's remittance to Sierra Leone in 2017. It can be observed that at a country level, Guinea

sends the highest remittances to the country, followed by the USA and UK. The rest of the other countries make up the remaining share.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The underlying empirical and theoretical studies conducted in the recent decades on the macroeconomic factors determining personal remittances worldwide are presented in this section.

2.2 Theoretical Literature

Many factors have been included from time to time in the theoretical framework of the influencers of personal remittances in the world. One of the major early studies which set the theoretical framework of the factors determining personal remittances in the world is Lucas & Stark (1985). They noted that the three major motives people remit are based on tempered altruism or enlightened self-interest, pure altruism, and pure self-interest. Apart from these motives, other scholars have added more motives to the theoretical framework including but not limited to household consumption smoothing, portfolio management/investment, exchange theory, precautionary savings and insurance, loan repayment, and strategic theory. The various motives can be explained as follows:

(a) **Pure Altruism Motive:** this concept basically refers to the act of caring for the household members at home by the migrants through remittances. It constitutes one of the three major motives postulated by Lucas and Stark (1985). Based on the socio-economic challenges in the migrants' home countries, often one of the major reasons for migration, migrants remit home to help lessen the burden on their families and improve their living conditions. McCracken et al. (2017) studied the factors influencing remittances in the source and host countries and they concluded that with a higher income level in the migrant-receiving country, the level of remittance flows to the source country will be higher too, and vice versa; when the income level in the source country is lower, the migrant's family will need remittances thereby necessitating an increase in the remittance flows, and vice versa. Other studies like Hagen-Zanker and Siegel (2011), Borja (2012), and Adams (2009) note that pure altruism hinges on an increase or decrease in the income levels of the migrants abroad. Furthermore, at a macro level, Vargas-Silva and Huang (2006) remark that a higher real GDP growth rate, low inflation rate,

private sector credit constraints, and volatility in the exchange rate in source nations adversely affect remittance inflows. Also, Adams (2008) states that when the financial sector is greatly liberalized, it will experience huge remittance inflows.

(b) **Pure Self-interest Motive:** The second point advanced by Lucas and Stark (1985) as the motive for remittance is pure self-interest. It refers to a situation where migrants send remittances home in hope of inheriting some family properties, chieftaincy as well as buying in assets e.g land, real estate, and livestock Englama (2009). They may also do so to be considered among the influential people in society or to achieve political ambitions (Adenutsi & Ahortor, 2021). McCracken et al. (2017) argued that when the income level in the source country is lower, migrants would send fewer remittances home due to self-interest motive.

(c) **Enlightened Self-interest:** The final point elucidated by Lucas and Stark (1985) which combines components of both pure altruism and pure self-interest is tempered altruism or enlightened self-interest. It essentially denotes implicit contractual agreement made among family members to stay at home or migrate. It is simply done by informal agreements among families to fully sponsor some members to study and/or work abroad, and after settling down abroad, the sponsored members, in turn, will repay the costs incurred by the family on their behalves. After the complete repayment of the costs incurred, the members abroad will also sponsor other family members at home to school and/or work abroad, who will, in turn, repay the full costs after settling down abroad. And the circle goes on and on in the family. Such contractual agreements can generally not be enforced by law, but through family cultural values, solidarity, and sometimes threats of cutting ties with the defaulters Ojapinwa (2012). These forms of contracts include co-insurance, i.e., remittances sent to take care of the older members and during economic crises; loan repayment, i.e., to send remittances to help pay outstanding loan obtained by the family; and strategic behaviour, i.e., to send remittances to acquire joint business or ventures that would make savings for the family for the shared prosperity (Adenutsi & Ahortor, 2021).

(d) **Smoothing Housing Consumption:** this is a bit similar to pure altruism motive. However, it specifically refers to a case where migrants send remittances home to

fund household consumption expenditures. Rosenzweig and Stark (1989) maintain that when the economy weakens or worsens, migrants will remit more to their families back home to reduce the adverse effects on the families. Mandelman and Zlate (2012) remark that the flow of remittances is sensitive to business cycles in both the domestic and migrant-receiving countries. Additionally, other studies found out that remittances are used as a tool to deal with negative economic situations across nations (Amuedo-dorantes and Pozo, 2011; Calero et al., 2009).

(e) **Portfolio Management/Investment Motive:** this denotes the form of remittances sent home purely for business or investment reasons, not personal or family consumption. It was postulated by Cox (1987) and further improved upon by Rapoport and Docquier (2005). The macroeconomic situations in the migrant-sending and receiving countries greatly influence this motive; more remittances will flow if the expected returns on investment are higher in the source country, otherwise, it will flow less. A booming economy will attract more investments and remittances and vice versa. However, there is a negative link between remittances and political and macroeconomic instabilities. This is so because uncertainty in the economy discourages investment (Adenutsi and Ahortor, 2021).

(f) **Loan Repayment Motive:** Many migrants do send remittances home to offset their outstanding loans incurred for their migration expenses, educational, wedding, housing, business, and other personal projects back home.

(g) **Exchange Motive:** This occurs when migrants send remittances back home to their households in exchange for activities executed on their behalf while away from the country. These activities can be the supervision of migrants' construction projects, business deals, physical security of their properties, and maintenance of their properties. Rapoport and Docquier (2005) also supported this motive.

(h) **Strategic Reason:** this motive was put forward by Stark (1991). It refers to a situation where there is insufficient information on the different skillsets of the migrants, thus, the employers do calculate the average product of the entire migrant workers in the company and pay their wage accordingly. This average calculation disadvantages the high-skill workers. As a result, the high-skilled workers send

home remittances to convince the low-skilled workers to stay home and not pose economic challenges for them abroad.

(i) **Precautionary Savings and Insurance Motive:** This was put forward by Amuedo-dorantes et al. (2005) and Amuedo-Dorantes & Pozo (2006). They note that migrants facing huge uncertainty and risk of deportation in destination countries will send home more remittances. On the other hand, those who have settled in the destination countries pretty well with little or no setbacks will not be attracted much to remit money home in the name of savings.

From the reasons above, it can be noted that migrants send remittances back home for one or a combination of reasons based on his or her cultural, demographic, socioeconomic, and individual features in both the source and host countries.

2.3 Empirical Literature

The formalized theoretical framework of the determinants of remittance flow postulated by Lucas and Stark (1985) has ever since sparked a great interest in the subject matter with many researchers advancing multiple determinants of remittance flows in consonance or contrast or even mixed results to one another. Amidst the foregoing studies around the world, none has been specifically conducted on Sierra Leone. There are a few studies on Sub-Saharan Africa, Southern African countries, etc. Thus, this study covers the gaps in the existing literature and serves as a foundation for future studies on the subject matter in the country.

The empirical studies so far which look at the macroeconomic determinants of personal remittances worldwide have mostly advanced income levels in the host and source countries, inflation, financial markets, age dependency, and real interest rate differential, among others. In investigating the economic, financial, and demographic determinants of international remittances covering 76 middle and low-income countries using the Instrumental Variable approach, Adams (2009) concludes that nations sending low-skilled laborers receive more remittances than those send high-skilled laborers. The author justifies that high-skilled laborers tend to be more comfortable working abroad and subsequently inviting their families to join them, hence, have little incentive to be remitting more home that much compared to low-skilled workers who mostly intend to

settle abroad for a shorter period due to the challenging circumstances they do face abroad, hence, they tend to remit more with the intentions of making themselves comfortable upon their return. The study further advanced that the poverty level in the home countries affects the high-skilled and low-skilled workers differently – the poverty level would insignificantly affect the low-skilled workers, while the high-skilled workers would tend to remit less money back home when the poverty level increases in the home country because they mainly remit money for investment purposes; home countries with high per capita GDP receive remittances more than those with low per capita GDP, and source countries with competitive real interest rates have the potential to receive higher remittances than those with low-interest rates.

Adenutsi (2014) studied the macroeconomic factors determining workers' remittances and compensation in 36 Sub-Saharan countries by employing the Generalized Method of Moments (GMM) approach and concludes that macroeconomic situations in both the migrants' source and destination nations are overly critical for the flow of workers' remittances and compensation. The author, however, stated that the impacts contrast in both countries, for example, a rising income level in the receiving country will enable the workers to earn and send more money to their domestic home, while a rising income level in the home country depicts better economic conditions and hence demotivate the workers from remitting more money home as their households' welfare would be assumed to be relatively better off than in a period of economic crisis. This is related to the altruistic motive of remittances. Also, when the bilateral exchange rate appreciates in the host country, the workers would be better off as the same amount of money they used to send previously will now gain a higher value thereby encouraging them to remit more money home, but an appreciation in the bilateral exchange rate in the domestic country will make remitting money more expensive for the workers thereby resulting in fewer remittances back home. The study further states that improvements in the international money transfer will lead to more remittances to the home countries as workers find it easier to transfer money.

Adenutsi and Ahortor (2021) conducted a study on the flow of remittances to 38 SSA nations using the GMM dynamic panel data approach for the period 2000-2009 and conclude that real income growth in migrants' destination nations exerts positive

significant effects on remittances flows in the home countries, whereas real income growth in the migrants' source countries adversely affect the flow of remittances. The authors remark that this situation may be related to the pure altruistic motive of remittances. They further note that differences in business cycle between the migrants' source and receiving nations significantly and positively influence the remittances inflows to SSA countries. When the real income level in the destination country increases above that in the source country, the migrants would be incentivized to remit more money home to take care of their families, a case for pure altruism theory. The study also noted that remittance flow in SSA is negatively affected by credit received by the private sector from the bank. They justified that it could be as a result that migrants consider their families back home to be better off if they could easily access bank credit to embark on economic activities, as such, they would be motivated to remit less money home.

Barua et al. (2007) employed a triangulation of various regression methods to study the factors determining workers' remittances in Bangladesh in the period 1993 to 2005 and concluded that remittances flow in the country is positively influenced by the income differential between the migrants' source and destination countries. When the income level is higher in the destination nation relative to the home nation, the migrant may tend to remit more based on pure altruistic motives and vice versa. The study further noted that the differences in inflation between the domestic and destination countries significantly and negatively affect remittances flow to Bangladesh, i.e., if the inflation level in the migrant-receiving country is less comparatively to the home country, the migrant may remit less owing to the fact that higher inflation presents investment uncertainty, a case of self-interest motive; migrants stock exerts a positive influence on remittance inflows; increasing exchange rate in the domestic nation significantly and positively determines remittances flows in the country, i.e., as the home country's currency depreciates, it becomes more profitable and easier for migrants to remit more money home; and real interest rate differential has mixed effects depending on the number of countries chosen, i.e., when the data for 10 host countries was chosen, real interest rate differential has insignificant impact on remittance flows in the country, but when 6 out of 10 countries were chosen, it positively and significantly affect remittance flow in the country.

Buch and Kuckulenz (2010) conducted a study to determine the factors responsible for workers' remittances and capital flows to 87 developing countries in the period 1970 to 2000 using the fixed effects regressions and instrumental variable approach. They conclude that GDP growth, domestic inflation, domestic lending rate, and illiteracy all have negative insignificant impacts on remittances flow and mixed impacts on the other capital inflows in the countries under study. They further noted that GDP per capita and age dependency have significant negative impacts on remittance inflows. They argued that higher age dependency in a country would lead to a lesser number of people in the working-age bracket which will further lower the number of workers who can migrate and hence negatively affect remittance flows, and a higher GDP per capita in a country signifies economic advancement and thus, workers might not be motivated to travel abroad to seek for employment, hence there will be a fall in remittance flow.

Elkhider et al. (2008) investigated the factors determining remittance flows to Morocco by Moroccan residents abroad with the period 1970 to 2006 using a triangulation of econometric techniques. They argue that remittance flows are negatively and positively influenced by the exchange rate and agricultural GDP respectively in the country. They further note that Moroccans abroad do mainly remit money back home for a purely altruistic motive; they remit more money home to support the families in the agricultural projects and less when the exchange rate is increasing.

Hassan (2008) studied the macroeconomic factors determining workers' remittances in Bangladesh in 2004 using the Engle-Granger cointegration approach and concludes the flow of remittances is positively influenced by the interest rate and exchange rate in the home nation and host countries' economic growth. The author argues that a higher interest rate, increasing exchange rate (depreciation), and higher income level in the host countries will motivate the workers to remit more money home. He further argues that the domestic inflation rate has significant negative impacts on remittance flow in the country, i.e., he justifies that higher inflation may present investment uncertainty which in turn will discourage the workers from remitting money home for reasons related to investments.

Hor and Pheang (2017) conducted a study on the macroeconomic and non-economic factors influencing remittance inflows in four (4) developing nations (Laos, Vietnam,

Myanmar, and Cambodia) using the Fixed Estimation Effects and Random Estimation Effects Models in the period 2000-2015. They conclude that domestic GDP per capita, index of political stability, and nominal exchange rate all have significant adverse effects on remittance flows in the country which may be mainly related to pure altruistic motives; while migrant stock to population ratio has significant positive effects on remittances inflows. and GDP per capita in most the host nations present mixed effects on remittance inflows: in 3 countries, it has significant positive effects on remittance inflow; in Thailand, it has significant negative effects on remittances; and in Malaysia, it has insignificant positive effects on remittances. Domestic inflation has insignificant effects on remittance inflows. Furthermore, the study used other non-economic variables as dummies to account for health, political, and financial crises during the study period which presents mixed effects on the remittance inflows in the country.

Lin (2011) investigated the macroeconomic variables determining Tonga's remittance inflows from three (3) developed nations (USA, Australia, and New Zealand) in 1994-2009 using the Generalized Method of Moments (GMM) dynamic panel approach and concludes that the bilateral exchange rate and unemployment rate have significant negative effects on remittance inflows, while, real GDP growth and interest rate differentials between Tonga and the migrant host countries have significant positive impacts on the flow of remittances in Tonga. These may be related to both pure altruism and self-interest motives.

Mallick (2017) investigated the factors affecting workers' remittance flows in eleven (11) major remittance recipient and developing nations in Asia within 1990 to 2014 using the fixed panel regression, and notes that higher domestic real economic growth over the rich migrants' destination nations positively influence remittance inflows, while higher domestic real economic growth above the Asian and middle-income destination nations has insignificant impacts on remittance inflows; when the real interest rate and rate of return on stocks in source country are higher than the rich destination countries, workers tend to remit more, while the same situations between the domestic and middle-income destination nations have insignificant effects on remittance inflows; and when domestic per capita income is higher, remittances fall, but when per capita income in the host nations is higher, remittances rise.

Mcgowan and Mahon (2010) employed the fixed effects estimation approach and seemingly unrelated regression method to study the macroeconomic factors causing remittance flows in The Caribbean and Latin America (The Dominican Republic, El Salvador, Mexico, and Guatemala) in the period 1998 to 2008. The results of the fixed effects estimation suggest that migrants' farm employment abroad and personal income have significant positive effects on remittances inflows; domestic exchange rate has positive impacts, and interest rate and inflation rate differentials have significant adverse impacts on remittance inflows in the aforementioned countries.

Nabi (2011) investigated macroeconomic factors influencing remittances in Bangladesh using the Ordinary Least Squares approach in the period 1981 – 2007 and concludes that remittances are positively influenced by the destination country's GDP, home country's exchange rate, and financial sector development, whereas domestic GDP exerts significant adverse effects on remittances and inflation has no significant effect on it.

Naeem et al. (2019) studied the correlation between macroeconomic factors and personal remittances and the impacts of the former on the latter in Pakistan in the period 2005 using correlation and regression methods. They conclude that exchange rate and current account both have strong and moderate positive correlations with personal remittances respectively, whereas inflation and unemployment have negative correlations with personal remittances. They further note that the exchange rate exerts positive impacts on personal remittances, whereas inflation, current account, and unemployment all have insignificant impacts on personal remittances in the country.

Ncube and Brixiova (2013) investigated the macroeconomic factors determining remittances and its impacts in Africa using the OLS regression method for the period 1990-2011. They conclude that GDP, used as a proxy for domestic income level, positively and significantly affects remittance inflows, nominal exchange rate, and inflation rate both adversely impact remittance inflows in Africa. They further conclude that remittance inflows in Africa are largely based on investment purposes. Also, they state that remittance inflows can lessen the pressures on external balance funding on the government, especially in the case of Egypt.

Ojapinwa (2012) conducted a study on the factors that determine the inflow of migrants' remittances in Nigeria within the period 1977 to 2009 using the OLS approach. The author

concludes that real GDP and nominal exchange rate both have positive significant impacts on migrants' remittance flow; debt-income ratio and inflation rate both have significant adverse effects on migrants' remittances; and population growth, domestic credit to the private sector utilized as a proxy for financial deepening, and trade openness all have insignificant effects on migrants' remittances in Nigeria within the study period.

Omon (2021) studied the factors influencing migrants' remittances in five (5) states in the West Africa Monetary Zones (WAMZ) for the year 1990-2016 employing the Panel Robust Ordinary Least Squares (PROLS) technique and concludes that the income level of the host country (USA), credit to the private sector used as a proxy for financial development in the home country, and unemployment rate in the home country all have positive significant impacts on remittances flow in WAMZ; whereas, domestic per capita and depreciating nominal exchange rate exert negative significant effects on migrants' remittances in WAMZ, and domestic inflation rate exerts a positive insignificant effect on remittance flows in WAMZ.

Panda and Trivedi (2015) employed three-panel data estimation techniques – Pooled OLS, Fixed Effects, and Random Effects Models – to study the macroeconomic factors accounting for remittance flows in 24 emerging and developing countries for the period 1991 to 2012. They selected the Fixed Effects models as the most suitable and conclude that world GDP and consumer price index (utilized as a proxy for inflation) have positive significant effects on remittance flows and depreciating bilateral nominal exchange rate exerts negative significant effects on remittance inflows in the countries under study.

Rana and Hashmi (2015) in studying the determinants of workers' remittances in Bangladesh between the period 2000-2014 did use the panel data estimation techniques – pooled OLS, fixed effects, and random-effects models. Based on the chosen model (random-effects model), they conclude that labor force in the destination countries, consumption expenditure, and exchange rate adversely affect remittances inflow in Bangladesh. They explain that an increase in the labour force in the migrant-receiving countries intensifies competition in the labour market hence reducing the chances of securing jobs for Bangladeshi workers and a further reduction in the number of remittances sent home. The same negative effect is experienced for appreciating the exchange rate and rising consumption expenditures. On the other hand, imports, exports,

consumer price index, and government expenditure exert significant positive impacts on remittance inflow in the country. Furthermore, it was noted that foreign direct investment inflow has no significant impact on remittance inflow in Bangladesh.

Shah and Majid (2020) researched the socioeconomic determinants of foreign remittances in Banu District in Bangladesh in 2015 using the Ordinary Least squares technique and remark that annual earnings abroad, number of dependents at home, experience abroad, and migrants' level of education positively and significantly affect foreign remittance inflow in Banu District, whereas, properties owned by the migrants at home have adverse negative effects on foreign remittances in the District.

Singh et al. (2011) conducted an investigation on the factors determining remittances and the macroeconomic function remittance plays in 36 Sub-Saharan countries between 1990 and 2008 by employing the fixed effects model and two-stage fixed effects OLS (FE 2SLS). They conclude that financial deepening, expatriate stock, destination country' income, and institutional quality all have significant positive significant effects on remittances in the region; whereas, domestic real per capita GDP and interest rate differentials exert negative significant impacts on remittances. However, the real exchange rate and dual exchange rate have no significant effects on remittances in the country.

Singogo (2020) analyzed macroeconomic factors determining remittances in seven (7) Southern African nations using multiple panel co-integration tests, random effects, and fixed effects models in the period 2003 – 2016 and concludes that economic growth (GDP) and nominal exchange rate both exert significant positive impacts on remittance inflows in the countries under study, whereas inflation, age dependency ratio, and broad money have no significant effects on remittances.

Tabit and Moussir (2016) researched the major macroeconomic variables influencing migrants' remittances in twenty-two (22) developing nations applying the fixed and random effects models in the time frame 1990 – 2014 and remark that the source country's per capita GDP and financial development have negative significant influences on migrants' remittances, whereas, inflation, institutional quality, and destination nation's per capita GDP all have positive significant influences on migrants' remittances in the countries under study. Furthermore, nominal exchange rate, domestic real interest rate,

and migrant stocks exert no significant impact on migrants' remittances in the period under study.

Tsaurai and Maseko (2020) applying panel date estimation methods – pooled OLS, Fixed Effects, and random effects models – investigated the factors determining remittances in twenty (20) transitional economies in the world within the period 1997 – 2014 and conclude that savings, financial development, and inflation positively and significantly affect remittances in the countries under consideration, whereas, per capita GDP and foreign direct investment inflows negatively and positively influence remittances. They further note that trade openness and human capital development do not significantly affect remittances.

Vargas-Silva and Huang (2006) investigated some major domestic and foreign economic factors influencing remittances in the USA, Mexico, El Salvador, Colombia, and the Dominican Republic in the period 1981 to 2003 by employing multiple econometric techniques (VECM, Granger Causality, Impulse Response Function, and Variance Decomposition). They conclude that remittances are affected by only the destination country's economic situations, i.e. remittance in Mexico is granger caused by inflation, monetary policy, and unemployment rate in the US, whereas, economic factors in Mexico including GDP, inflation, and exchange rate do not granger cause remittances in the country.

Yoshino et al. (2020) conducted a study on the factors responsible for the inflow of international remittances in twenty-two (22) Asian Pacific countries applying the Generalized Method of Moments (GMM) in the period 2002 – 2015 and they conclude that trade openness, income level differentials, and gross enrolment ratio in secondary education positively and significantly influence international remittance inflows, whereas, net foreign direct investment inflows have significant adverse effects on international remittance inflows. They further note that political stability and exchange rate do not affect international remittance inflows in the countries under study.

Yuni et al. (2013) applied the Generalized Method of Moments to study the factors influencing remittances in twenty-one (21) African nations between the periods 1980 and 2011 and conclude that tax revenue and growth in broad money exert significant adverse effects on remittances, whereas age dependency ratio, lending rate, and inflation

significantly and positively affect remittances in the countries. Additionally, they remark that per capita GDP and real effective exchange rate exert no significant effects on remittances in the period under consideration.

Zakari and Nasiru (2016) employed the Pedroni Panel Cointegration Test and Fully Modified OLS (FMOLS) to model the macroeconomic factors responsible for remittance inflow in sixteen (16) West African nations in the period 1990 – 2014 and they noted that remittance inflows in source countries are positively affected by income level and exchange rate, whereas the domestic unemployment rate has significant adverse effects on remittances.

Kock and Sun (2011) carried out a study on the macroeconomic factors determining the rising workers' remittance inflow in Pakistan using panel data estimation techniques (pooled OLS, Fixed Effects, and Random Effects models) and Bayesian estimation for the years 1997- 2008 and conclude that factors such migrant stock growth, favourable nominal exchange rate and real effective exchange rate, increased skill sets of migrants, agricultural output, and relatively favourable investment return in both Pakistan and the destination country are responsible for increasing inflow in remittances in the country.

Arvin and Lew (2012) conducted a study to understand how remittances could be impacted by happiness and foreign aid using bilateral data set of 102 source countries and 56 receiving countries for the year 2005 by employing OLS and Instrumental Variable method. They conclude that bilateral aid, the marginal effect of source or host country's happiness for the majority of the countries under study, life expectancy, border sharing, the colonial connection among the countries, shared language, bigger economies, weak political stability in sending countries, government debt burden, and student enrolment ratio all have significant positive impacts on migrants' remittances. On the other hand, distance between countries, inflation in migrants sending countries, and government share of GDP in migrants receiving countries exert significant adverse effects on migrants' remittances. Furthermore, aid dependency ratio, inflation in migrants receiving countries, the extent of globalization of both the migrants sending and receiving nations, dependency ratios in both the domestic and destination countries, and political stability in migrants receiving countries have no significant impacts on migrants' remittances.

Mustafa and Ali (2018) investigated the link between remittances inflow in Pakistan and macroeconomic conditions in both Pakistan and 23 main migrants' destination countries in the period 2002 – 2013 using gravity and augmented gravity models. They conclude that destination countries' GDP, stock of migrants, common language links, and colonial relationships exert significant positive impacts on remittance, whereas the geographical distance between countries has significant adverse effects on remittances. Additionally, GDP in migrants' sending country, inflation in both the source and destination nations, unemployment in both the source and destination nations, disaster in the destination countries, and political instability in the home country exert no significant effects on remittances in Pakistan for the period under consideration.

Al-Assaf and Al-Malki (2014) studied the nexus between remittance inflow in Jordan and domestic and foreign macroeconomic factors in the period 1972-2009 applying the ARDL and VECM estimation techniques. They remark that the Jordanian income level, income level in Saudi Arabia, and bilateral exchange rate have significant adverse effects on remittance inflows in Jordan, whereas income level in the United Arab Emirates exerts significant positive impacts on remittances in the period under study.

Lartey and Mengova (2016) researched the connection between institutional quality and remittances in ninety (90) developing countries using the fixed effects Estimator and GMM estimator in the period 1970 – 2012. They note that improvements in monetary policy institutions, effectiveness in government institutions' operations, effective legal system, and guaranteed property rights exert significant positive impacts on remittances, whereas financial development has significant adverse effects on remittances. They further comment that credit market regulation in the countries has no significant on remittances.

Niimi et al (2010) investigated the nexus between remittances and brain for eighty-two (82) countries by applying the OLS and Instrumental Variable estimation technique using data for some variables in 2000 and others in 2006. They conclude that the migrants' educational level, home countries' financial sector development, rate and level of migration, and population have significant positive effects on remittances, whereas domestic per capita income and anticipated growth rate exert significant adverse effects on remittances.

Abbas et al. (2017) studied the major financial, political, and macroeconomic factors influencing remittance inflow in Pakistan within the period 1972 – 2012 by employing the Generalized Method of Moments. They conclude that external conflicts (terrorist attacks), financial liberalization, good democratic governance, differences in interest rate between home and recipient countries, domestic real GDP (income level), level of education, migrant stock, effective law and order, real effective exchange rate, and the existence of corruption have significant positive influences on remittances, whereas, foreign debts, domestic inflation, and internal conflicts exert significant adverse effects on remittance inflows in the country.

In studying the economic factors influencing remittance inflows in Pakistan with the period 1990 – 2014 using multiple regression techniques, Kamran et al. (2014) conclude that domestic inflation rate, interest rate, and exchange rate have significant adverse impacts on remittance inflows in the country, whereas, GDP used as a proxy for economic growth and foreign direct investment (FDI) exert significant positive impacts on remittance inflows in the country.

Singh (2019) employed the GMM technique using a panel data of 114 countries within the period 1984 – 2016 to revisit the evidence of the effects of institution quality on remittances as widely quoted in literature studies and concludes that progress in government stability index, investment environment, accountable democratic governance, and high cases of internal conflicts positive influence remittances in the countries under study. It was further noted that corrupt governance climate and deteriorating socioeconomic situations in the country also affect remittance inflows positively and statistically.

Fayissa and Nsiah (2012) applied the Panel Fully Modified OLS technique to investigate the impacts of financial services development on remittances using panel data of forty-four (44) countries in the Americas and Africa in the period 1985 – 2007. They conclude that stability of exchange rate, migrant stock size, and financial services development positively and significantly affect remittance inflows for all the different categorizations of their sample data. They further note that Africa benefits more in terms of higher remittance inflows from financial services development than the Americas.

Fonchamnyo (2012) conducted a study to identify the factors responsible for remittance inflow in thirty-six (36) Sub-Saharan countries using the Random Effects Model and Generalized Methods of Moment in the period 1980 – 2009 and concludes that age dependency ratio, religion (Catholics), financial sector development, and differences in per capita income between the migrants' receiving and sending countries positively and significantly affect remittances in the economies, whereas, per capita income in the home country has significant adverse effects and inflation mixed-effects (in both models) on remittances in the countries under study.

Guetat and Sridi (2017) investigated the nexus between the effects of institutional quality and remittances in fifteen (15) MENA nations by applying the Generalized Methods of Moment in the period 1984 – 2011 and remarked that remittance inflows in the MENA region are adversely affected by the composite risk index, exchange rate, human capital development (educational level), and inflation, whereas, the home country's economic growth, lagged remittances, financial openness, trade openness, and investment level have significant negative impacts on remittances inflows in the region.

Khodeir (2015) employed the VECM approach to ascertain the factors causing remittances and shocks in the Egyptian economy within the period 1980 - 2012 and concludes that broad money and domestic real GDP per capita statistically and positively influence remittances inflow in the country, whereas, nominal exchange rate and oil price have significant adverse effects, and domestic total reserves have no significant effects on remittance inflows in the country.

Nnyanzi (2016) used the OLS, RE, and FE estimation techniques to research the major determinants of remittance inflows in Africa within the period 1990 – 2011 and concludes that destination country's per capita income, differences in interest rate, institutional quality, money supply, financial development, migrant stock, age dependency ratio, real exchange rate, financial openness, global financial crisis, border sharing, and the colonial relationship between countries positively affect the inflow of remittance in Africa. On the other hand, geographical distance between countries, domestic per capita income, corruption index, and informal activities exert significant adverse effects on remittance inflows in Africa. Also, the author further noted that the unemployment rate in the source country has no significant impact on remittances.

Akçay (2018) applied the Bounds test cointegration technique to test the nexus among remittances, economic growth, and misery index in Turkey in the period 1975 – 2011 and concludes that misery index has significant positive impacts on remittance inflows in the country, whereas GDP per capita used as a proxy for economic growth does not significant impacts on remittance inflow in the country in the given study period.

Akçay and Karasoy (2019) investigated the impacts of oil price and macroeconomic stability on remittance inflow in Egypt using the Autoregressive Distributed Lag cointegration technique for the period 1980 – 2015. They conclude that oil price, macroeconomic instability, depreciating home currency, and destination countries' economic (GDP) growth have significant positive impacts on remittance inflows, whereas financial development significantly and adversely affects remittance inflows in the country. They further note that domestic economic growth and external conflicts (the Gulf and Iran-Iraq wars) have insignificant impacts on remittance inflow in the country.

Akçay and Karasoy (2019b) used the Non-linear ARDL (NARDL) to ascertain the asymmetric effects of oil prices on remittances in India within the period 1975 – 2017 and note that adverse changes in oil prices exert greater effects on remittance than positive changes in them. The further remark that depreciating exchange rate has significant positive effects and financial development has significant adverse effects on remittances, whereas, GDP per capita has negative impacts on remittances in the short run but none in the long run.

Bettin et al. (2017) conducted a study to determine the nexus between remittances and shocks in developing countries by applying the fixed effects estimation technique on bilateral data on remittances from over a hundred provinces in Italy to eighty-seven (87) countries in the developing world within the period 2005 – 2011. They conclude that financial development and per capita GDP in remittance-receiving nations have significant adverse impacts on remittances, whereas, natural disasters in remittance-receiving countries, deterioration in the terms-of-trade, trend per capita economic growth (GDP) in receiving countries, host country's per capita GDP, simultaneous shocks to both the remittances sending and receiving nations, domestic and receiving countries' population, host nation's financial development, and stock of migrants lead to significant

positive impacts on remittance inflows. They further note that armed conflicts have no significant effects on remittances within the study period.

Aydas et al. (2005) investigated the factors determining remittances inflow in Turkey using the Ordinary Least Squares technique within the period 1965-1993. They comment that migrant stock, differences in interest rates, destination countries' per capita income, and real overvaluation have significant positive effects on remittances, whereas, source country's (Turkey) per capita income, black market premium, and military regimes in Turkey exert significant adverse effects on remittances in the country.

From the above explanations, it can be noted that multiple macroeconomic factors are determining personal remittances across the world. The above factors are by no means exhaustive, rather a collection of some of the recent studies in the field.

CHAPTER 3: DATA AND METHODOLOGY

3.1 Introduction

In this section, the sources of the dataset and description of the variables under study and the methodology used to obtain the results and by extension, the objectives of the study are discussed.

3.2 Data Description

The study employs an econometrics approach, particularly the Autoregressive Distributed Lagged model coupled with other subsidiary tests, on secondary data to ascertain the macroeconomic factors determining personal remittances in Sierra Leone. The variables used in the study are personal remittances (% of GDP), age dependency ratio (% of working-age population), broad money (% of GDP), inflation rate GDP deflator (annual %), and real GDP growth rates. The data for the variables were obtained from the WDI database for the time 1980 to 2018. Additionally, in order to capture the effects of socio-political, economic, and health crises within the study period, two dummy variables were created for the eleven (11) years (1991-2002) of civil war and two (2) years (2014-15) of Ebola virus disease outbreak in the country both of which led to the loss of thousands of lives and properties and disruption of economic activities.

Furthermore, ***Real GDP growth rate,*** used as a proxy for economic growth, represents the annual percentage growth rate of GDP based on constant (2010 as the base year) local currency. ***Personal remittances*** as defined by the World Bank consist of personal transfers and compensation of employees, particularly including all current transfers in cash or in-kind made or received by resident households to or from non-resident households and the income of border, seasonal, and other short-term workers who are employed in an economy where they are not resident and of residents employed by non-resident entities. ***The age dependency ratio*** refers to the ratio of dependents (people younger than 15 or older than 64) to the working-age population (ages 15 to 64). In this study, data for this ratio is shown as the proportion of dependents per 100 working-age population. ***Broad money*** is the sum of currency outside banks; demand deposits other than those of the central government; the time, savings, and foreign currency deposits of resident sectors other than the central government; bank and travellers' checks; and other

securities such as certificates of deposit and commercial paper. ***Inflation*, as measured by the annual growth rate of the GDP implicit deflator,** signifies the rate of price change in the economy as a whole and the GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency.

3.3 Unit Root Tests

To ascertain the stationarity and order of integration of series, a couple of unit root tests are generally performed with the most common ones being Augmented Dickey-Fuller (Dickey & Fuller, 1979; 1981) and Phillips-Perron unit root test (Phillips and Perron, 1988) However, when the sample is small, the aforementioned tests have been noted by many researchers not to be reliable due to poor sample size and power properties which means it is possible for the ADF test to over reject and under reject when the null hypothesis is true and false respectively (DeJong et al., 1992; Harris and Sollis, 2003). To overcome this challenge, therefore, the Dickey-Fuller Generalized Least Squares (DFGLS) test (Elliot et al., 1996) and NG and Perron (Ng and Perron, 2001) unit root tests are recommended as they can perform better in small samples. Full details on these two tests can be found at Pradhan (2010b). For this study, the Dickey-Fuller Generalised Least Squares unit root test is used in comparison with the Augmented Dickey-Fuller test. If the series is stationary at level then it can be concluded that it is integrated of order zero and if it is stationary at the first difference, then it is integrated of order one (1).

Furthermore, cointegration tests such as Johansen and Granger tests require that all the variables be integrated of order 1, whereas the Autoregressive Distributed Lag Model is a bit flexible and can still be used even if the series are integrated of the same or different orders. As such, the ARDL method does not necessarily require a pre-testing for stationarity before estimation, rather, a stationarity test is just performed to make sure that the orders of integration of the variables do not exceed one as it would lead to the approach would collapse (Ouattara, 2004). Also, Afzal et al. (2010) recommended that the dependent variable be integrated of order one while the independent variables can be a mixture of orders one and zero, as a regression with a dependent variable of I(0) would produce coefficients of the error correction term beyond the standard bounds of 0 and -1.

3.3.1 Augmented Dickey-Fuller Test

Dickey & Fuller (1979, 1981) developed the Augmented Dickey-Fuller test to ascertain stationarity and order of integration of series. The ADF unit root test equations are given as follows:

$$\Delta Y_t = \alpha + \boldsymbol{\rho} Y_{t-1} + \sum_{s=1}^{m} \boldsymbol{\lambda}_t \Delta Y_{t-s} + \varepsilon_t \quad \text{----------} \quad (1)$$

$$\Delta Y_t = \alpha + \beta t + \boldsymbol{\rho} Y_{t-1} + \sum_{s=1}^{m} \boldsymbol{\lambda}_t \Delta Y_{t-s} + \varepsilon_t \quad \text{----------} \quad (2)$$

In equation (1) above, it is assumed that there is a constant but no trend, whereas, it is assumed that there are both intercept and trend in equation (2). $\boldsymbol{\alpha}$ denotes an intercept, $\boldsymbol{\beta}$ is a coefficient of a deterministic trend, **t** is a deterministic trend, $\boldsymbol{\rho}$ represents a coefficient of autoregressive process, $\boldsymbol{\Delta}$ denotes change or difference operator, $\boldsymbol{\Delta Y_t = Y_t - Y_{t-1}}$, **m** represents the lag order of the autoregressive process, $\mathbf{Y_{t-1}}$ and $\boldsymbol{\Delta Y_{t-1}}$ represent lagged values and changes in the lagged values of I(1) of Y_t, $\boldsymbol{\lambda}$ is a coefficient of the changes in the lagged values of Y_t, and $\boldsymbol{\varepsilon_t}$ is the error term (white noise). The negative or positive sign of the intercept (α) leads to the upward or downward movement of the series, whereas its absolute values determine the steepness of the series (Afzal et al., 2010). The deterministic trend and intercept are maintained in the equation only if they are significant. In order to correct autocorrelation in the error term, the lagged differences are added to the equations above. Also, in order to determine the optimal lag length **m** in the equations above, the Schwartz Information Criterion is used.

Furthermore, it is worth noting that the main coefficient of interest in the ADF equations above is $\boldsymbol{\rho}$. If $\boldsymbol{\rho} = 0$, then the Y_t series contains unit root problem, thus it can be concluded that the series is integrated of order one. The null hypothesis of the ADF test is the series has a unit root (non-stationarity) and the alternative hypothesis states that the series is stationary (does not have a unit root). To decide on the test results, if the critical values are less than the absolute values of the ADF test statistics, then the null hypothesis can be rejected thereby confirming that the series is stationary. However, if the critical values are greater than the absolute values of the ADF test statistics,

3.3.2 Dickey-Fuller Generalized Least Squares Test (DFGLS)

DFGLS proposed by Elliot et al. (1996) is an extended version of the ADF unit root test which is done by de-trending and demeaning processes of the ADF test. The authors of this test and later studies, for instance, Schwert (2002), have proven that it has better statistical properties, like power, when dealing with small sample sizes compared to the Augmented Dickey-Fuller test. Particularly put, Elliot et al. (1996) found out that their proposed test has considerably improved power when dealing with an unknown mean and/or trend (1996, p813).

Furthermore, as in the case of the Dickey-Fuller test where unit root may be carried out in the presence or absence of a trend term, the DFGLS test also has two forms: GLS de-trending case (with a trend and constant) and GLS demeaning case (only the constant but no trend). In the GLS detrending case, the series under consideration is tested on a linear trend and constant and the residual series is employed in the Standard Dickey-Fuller equation. On the other hand, in the case of the GLS demeaning, the series under consideration is regressed only on the constant and the resulting residual series is used as the dependent variable in the Dickey-Fuller equation.

Suppose that the order of integration of the series Y_t is to be tested, the GLS de-trending test is performed with the H_0: $\alpha = 0$ in the equation.

$$\Delta Y_t^d = \alpha_0 + \alpha_1 \Delta Y_{t-1}^d + \alpha_2 \Delta Y_{t-2}^d + \text{----------} + \alpha_{p-1} \Delta Y_{t-p+1}^d + \varepsilon_{i,t} \quad \text{----------} \ (3)$$

From the above equation, Y_t^d represents the detrended series and the null hypothesis of the test supposes that Y_t contains a random walk trend with the possibility of a constant as can be seen below:

$$Y_t^d = Y_t - \alpha - \beta t \quad \text{----------} \ (4)$$

For the case of GLS detrended, the test is performed by employing the following variables:

$$\bar{Y} = [Y_1 \ (1 - \bar{\alpha}L)Y_2, \text{----------}, (1 - \bar{\alpha}L)Y_T)] \quad \text{----------} \ (5)$$

$$\bar{E} = [E_1 \ (1 - \bar{\alpha}L)E_2, \text{----------}, (1 - \bar{\alpha}L)E_T)] \quad \text{----------} \ (6)$$

$E_t = (1,T)'\bar{\alpha} = 1 + \frac{\bar{a}}{T}$ ---------- (7)

T in the above equation symbolises the number of observations for Y_t and $\bar{a}$ is fixed (Elliot et al.,1996). Applying the OLS methodology on the following equation:

$\bar{Y} = \delta_0\bar{E} + \delta_1\bar{E}_t + \varepsilon_t$ ---------- (8)

Furthermore, the trend is removed from Y_t with the utilization of the OLS estimators (δ_0 and δ_1). Now using the ADF test, the OLS regression can be fitted on the transformed variable.

$\Delta Y_t^d = \alpha + \boldsymbol{\rho} Y_{t-1}^d + \sum_{s=1}^{m} \boldsymbol{\lambda}_t \Delta Y_{t-s}^d + \varepsilon_t$ ---------- (9)

Here, the task is to ascertain under the null hypothesis if $\boldsymbol{\rho}$=0 or not. For the alternative hypothesis, we assume that $\bar{a}$ = -7 in the previous equation of $\bar{a}$ and then calculate

$\Delta Y_t^d = Y_t - \delta_0$. In both cases above, Elliot et al. provide the tabulated values.

3.4 Model Specification

To determine the macroeconomic determinants of personal remittances, the study employed the model adopted from Singogo (2020) who investigated the determinants of remittances in Southern African countries. Their original model is as follows:

$REM_t = f(REM_{t-1}\ GDP_t,\ BM_t, INF_t, AGE)$ ---------- (10)

Where REM refers to remittances as a percentage of GDP, REM_{t-1} is the lagged remittances, GDP is real GDP growth rates, BM is broad money as a percentage of GDP, INF is inflation rate GDP deflator annual percentage, and AGE is age dependency ratio (% of working-age population), and 't' is period from 1,....n. The model uses lagged remittances as it is assumed that the previous remittances have impacts on the current one (Coulibaly, 2009; Singogo, 2020; Yuni et al., 2013).

Moreover, due to the occurrence of eleven (11) years of civil war between in the period 1991-2002 and a deadly Ebola virus disease outbreak in 2014-15 in the country both of which resulted in the loss of thousands of lives and properties and disruption in economic activities in the country, two dummy variables WAR and EBOLA are created to capture

the impacts of war and Ebola respectively on personal remittances in the country. Thus, the above equation can be functionally rewritten as:

$REM_t = f(REM_{t-1}\ GDP_t,\ BM_t, INF_t, AGE_t, WAR, EBOLA)$ ----------(11)

Writing it as a stochastic specification becomes:

$REM_t = \beta_0 + REM_{t-1} + GDP_t + BM_t + INF_t + AGE_t + WAR_t + EBOLA_t + \varepsilon_t$ ---------- (12)

ε_t represents the error term which is independently and identically distributed with a zero and constant variance. The descriptions of the other variables in the equation remain the same as in equation (10).

Furthermore, personal remittances serve as the dependent variable. GDP deflator (annual %), which is used as a proxy for Inflation, is used to take account for changes in the environmental conditions of the receiving (home) nation as was done by Singogo (2020). Some studies like Coulibaly (2009) used GDP per capita to account for the same. Also, to capture fluctuations in the home country's economic conditions, the GDP annual growth was used. To avoid the problem of omitted variable bias, the study added two (2) control variables that are assumed to be of significance, namely: broad money (as a % of GDP) and age dependency ratio measured as a percentage of the working population. Like Yuni et al. (2013), broad money was utilized to take into account the impacts of sophistication of the market in the country. Finally, the age dependency ratio was utilized to ascertain the effects of dependency on remittances in the country. From some of the selected literature studies for this research, Castillo-Ponce et al. (2011) used employment rate, broad money, interest rate differentials; Ojapinwa (2012) used inflation, unemployment rate, population growth, trade openness, debt-income ratio, and nominal exchange rate; Buch and Kuckulenz (2010) used inflation rate, lending rate, GDP per capita, GDP growth, age dependency ratio, and illiteracy; and Yuni et al. (2013) used tax revenue, GDP per capita, broad money growth, age dependency ratio, inflation, real effective exchange rate, lending rate, and lagged remittances; and Singogo (2020) used nominal exchange rate, GDP growth, age dependency ratio, broad money, and inflation.

The a priori conditions are GDP negatively impacts personal remittance in the country, i.e. GDP<0. This is expected as many migrants leave the country in search of better

economic conditions abroad and when they settle down there, they may tend to remit money home to take care of the families back home. They will send more money back home in order to take care of their families when the economic situations are worsening and vice versa. This result was found in studies like Castillo-Ponce et al. (2011), Niimi et al. (2010), Adenutsi (2011), Singh et al. (2011). Broad money is expected to exert negative impacts on remittances, i.e. BM<0. This is so because broad money is used to signify market sophistication Yuni et al. (2013) and the market is still underdeveloped in Sierra Leone. This would lead to higher costs of remittance transactions, thus, reducing the flow of remittances in the country. Yuni et al. (2013) and Castillo-Ponce et al. (2011) confirmed this in their studies. Inflation is expected to be negative, i.e. INF<0. This is so because inflation in the country denotes investment uncertainty which would discourage migrants from remitting more money home for investment purposes. This expectation aligns with studies such as Ojapinwa (2012). The age dependency ratio is expected to be negative, that is, AGE<0. This is so because, as the dependant population grows more than the working population (high age dependency ratio), the number of labourers who could migrate abroad reduces and hence a decline in the remittance inflow in the country (Buch and Kuckulenz, 2010). Also, based on the fact that war and Ebola are both crises that disrupted normal economic crises in the country, the dummy variables WAR and EBOLA are expected to be negative, i.e. WAR=EBOLA= <0.

3.5 Co-integration Test

To assess the impacts of the macroeconomic variables on remittances and the long-run relationship among them, the Autoregressive Distributed Lag (ARDL) co-integration approach or bounds test postulated by Pesaran et al. (1999) was used. The reasons for choosing the ARDL method are many. According to Pesaran et al. (1999) when dealing with a small sample data, ARDL estimates have been proven to be more efficient and reliable even in the case of an over-specified dynamic structure (Inder, 1993; Narayan, 2005; Narayan and Smyth, 2005; Pesaran and Smith, 1998; Banerjee et al.,1993). Also, unlike Engle and Granger (1987) cointegration and Johansen and Juselius (1990) Maximum Likelihood cointegration tests which demand that the series be integrated of the same order (order one specifically), the ARDL approach is indifferent to the order of integration of the variables, i.e, ARDL can be used even when the variables are integrated

of the same or mixed orders Pesaran et al. (2001). Bahmani-oskooee and NG (2002) confirmed this feature of ARDL too in their study. It is as a result of this that it is not a compulsory requirement for pretesting for stationarity before using the ARDL cointegration approach. Nkoro and Uko (2016) noted that the ARDL cointegration approach may crash in a case where the series is integrated with a stochastic trend of order two, i.e., I(2). To avoid such, therefore, it is advisable to perform a pre-test for stationarity in order to ensure that the orders of integration of the series do not exceed one. ARDL expresses relationship/equilibrium between/among variables in the long and short-run without compromising information about the long run. Moreover, Duasa (2007) posited that the ARDL approach does not fall into the problem of a greater number of specifications which usually occurs in a standard cointegration test like the decision on the number of variables to be included, handling of deterministic factors, the decision of lag lengths, and so on. Finally, when the orders in the ARDL model are correctly modified, the dual problems of serial correlation and endogeneity can be overcome (Pesaran et al., 1999).

For the purpose of this research, the ARDL model can be specified as follows (Pesaran et al., 2001):

$$\Delta REM_t = \alpha_0 + \alpha_1 REM_{t-1} + \alpha_2 GDP_{t-1} + \alpha_3 BM_{t-1} + \alpha_4 INF_{t-1} + \alpha_5 AGE_{t-1} + \alpha_6 WAR_{t-1} + \alpha_7 EBOLA_{t-1} + \sum_{s=1}^{m} \beta_1 \Delta REM_{t-s} + \sum_{s=1}^{m} \beta_2 \Delta GDP_{t-s} + \sum_{s=1}^{m} \beta_3 \Delta BM_{t-s} + \sum_{s=1}^{m} \beta_4 \Delta INF_{t-s} + \sum_{s=1}^{m} \beta_5 \Delta AGE_{t-s} + \beta_6 \Delta WAR_{t-s} + \beta_7 \Delta EBOLA_{t-s} + \varepsilon_t \quad \text{---------- (13),}$$

Where α_0 represents a constant, α_{1-7} are long run coefficients, β_{1-7} are short run coefficients, Δ and ε_t have been defined in equation (2). If there exists a cointegration or long run relationship, the long run model can be specified as follows:

$$REM_t = \alpha_0 + \sum_{s=1}^{m} \beta_1 REM_{t-s} + \sum_{s=1}^{m} \beta_2 GDP_{t-s} + \sum_{s=1}^{m} \beta_3 BM_{t-s} + \sum_{s=1}^{m} \beta_4 INF_{t-s} + \sum_{s=1}^{m} \beta_5 AGE_{t-s} + \beta_6 WAR_{t-s} + \beta_7 EBOLA_{t-s} + \varepsilon_t \quad \text{---------- (14)}$$

With the existence of a cointegration or long relationship among the variables, the Error Correction Model which captures the speed at which the model adjusts back to a long equilibrium after a short run distortion can be specified as:

$$\Delta REM_t = \alpha_0 + \sum_{s=1}^{m} \beta_1 \Delta REM_{t-s} + \sum_{s=1}^{m} \beta_2 \Delta GDP_{t-s} + \sum_{s=1}^{m} \beta_3 \Delta BM_{t-s} + \sum_{s=1}^{m} \beta_4 \Delta INF_{t-s} + \sum_{s=1}^{m} \beta_5 \Delta AGE_{t-s} + \beta_6 \Delta WAR_{t-s} + \beta_7 \Delta EBOLA_{t-s} + \boldsymbol{\lambda} ECT_{t-1} + \varepsilon_t \text{ ---------- } (15)$$

Where ECT_{t-1} is the error correction term which measures the speed of adjustment and $\boldsymbol{\lambda}$ is its coefficient which should be negative and < -1 plus statistical significance in order to confirm the long run relationship.

The error correction term can be expressed as:

$$ECT_{t-1} = REM_t - \alpha_0 - \sum_{s=1}^{m} \beta_1 REM_{t-s} - \sum_{s=1}^{m} \beta_2 GDP_{t-s} - \sum_{s=1}^{m} \beta_3 BM_{t-s} - \sum_{s=1}^{m} \beta_4 INF_{t-s} - \sum_{s=1}^{m} \beta_5 AGE_{t-s} - \beta_6 WAR_{t-s} - \beta_7 EBOLA_{t-s} \text{ ---------- } (16)$$

3.6 Toda-Yamamoto Causality Test

The use of the ARDL technique mentioned above can provide information on both the short and long runs relationships among the variables and effects of the independent variables on the dependent variable. However, it cannot determine the causality direction among the variables. Thus, to clearly understand which variable causes the other and in which direction, there is a need to conduct a causality test. There a couple of causality tests so far available in econometric literature, for example, Granger causality (Granger, 1969), Sims causality (Sims, 1972), Toda-Yamamoto causality (Toda and Yamamoto, 1995), and Toda-Yamamoto Dolado-Lütkepohl causality (Dolado and Lütkepohl, 1996) test. They have their advantages and limitations.

The Granger causality (Granger, 1969) which enjoyed a great dominance in econometrics some decades ago and from which many other causality tests have emerged, estimates two equations Y and X as follows:

$$Y_t = \sum_{i=1}^{n} \beta_i Y_{t-i} + \sum_{j=1}^{n} \alpha_j X_{t-j} + v_{1t} \text{ ---------- } (17)$$

$$X_t = \sum_{i=1}^{n} \lambda_i X_{t-i} + \sum_{j=1}^{n} \delta_j Y_{t-j} + v_{2t} \text{ ---------- } (18)$$

From equations (17) and (18) on the previous page, v_{2t} and v_{1t} are assumed to be uncorrelated. Granger (1969) states that X Granger-causes Y if α_j is significantly different from zero, and Y Granger-causes X if δ_j is significantly different from zero. These two

situations are referred to as unidirectional causality. If both X and Y Granger-cause each other, then there exists a bi-directional (feedback) causality between them. Additionally, if there exists no causality (be it unidirectional or bi-directional) between the variables, then they are independence of each other. The test also assumes that the series is stationary at levels. The null hypothesis for Granger causality between two variables X and Y is that H_0: X does not granger-cause Y, and Y does not granger-cause X. The alternative hypothesis states that X does granger-cause Y and vice versa. The final decision lies on the value of F-statistics value, reject the null hypothesis if the F-statistic is greater than the F critical value.

However, a number of researchers have noted a couple of inherent limitations of the Granger causality test. Maddala (1992) commented that time series are not always stationary (at levels). This phenomenon could lead to nonsense regression. Gujarati and Porter (2010) remarked that t-statistics lack a normal distribution when the variables are integrated, thus leading to an invalid F-test procedure in the Granger causality test. Enders (1995) noted that it is permissible to test jointly test first differential VAR by utilizing F-statistic for a two-variable VAR with two lagged period but only when one of the variables is not stationary.

The aforementioned shortcomings of Granger causality lead to bias estimates. To solve these challenges, Toda and Yamamoto (1995) developed an augmented version of the Granger causality test. This study uses the Toda-Yamamoto causality which recommends an augmentation of the VAR system by the maximal integration order to ensure asymptotic Wald statistic distribution, i.e. asymptotic χ^2 distribution Wolde-Rufael (2006). According to Toda-Yamamoto, it has the following advantages: it can be carried out irrespective of whether or not the series are integrated of the same order, different orders, or even of order two (2); performs better than the Granger causality test in the case of smaller sample sizes; does not require pretesting to be done to determine whether the variables are co-integrated, so long the order of integration does not surpass the lag length of the system; and it utilizes a modified Wald test for coefficient restrictions of a VAR (k), with k as the model's optimal lag length. Also, it minimizes the risks of incorrectly identifying the integration order of the series by fitting the VAR model to the series' levels Mavrotas and Kelly (2001). The Toda-Yamamoto causality test can also

include dummy variables. The standard Toda-Yamamoto representations for two variables are as follows:

$$Y_t = \phi + \sum_{i=1}^{p} \beta_i Y_{t-i} + \sum_{i=p+1}^{p+dmax} \rho_i Y_{t-i} + \sum_{j=1}^{p} \alpha_j X_{t-j} + \sum_{j=p+1}^{p+dmax} \psi_j X_{t-j} + v_{1t} \text{ ---------- (19)}$$

$$X_t = \gamma + \sum_{i=1}^{p} \pi_i X_{t-i} + \sum_{i=p+1}^{p+dmax} \sigma_i X_{t-i} + \sum_{j=1}^{p} \delta_j Y_{t-j} + \sum_{j=p+1}^{p+dmax} \varphi_j Y_{t-j} + v_{2t} \text{ ---------- (20)}$$

Where Y and X are the main variables; γ, φ, δ, σ, $\boldsymbol{\psi}$, $\boldsymbol{\rho}$, ϕ, α, β, and π are the coefficients of the model; dmax is the assumed maximum integration order in the system; v_{1t} and v_{2t} which are identically and independently distributed of $(0, \Sigma v_1)$ and $(0, \Sigma v_2)$ respectively, are the error terms in the model; Σv_2 and Σv_1 are covariance matrices of V_2 and V_1 respectively.

Furthermore, for this research Toda-Yamamoto causality test can be represented as follows:

$$REM_t = \phi + \sum_{i=1}^{p} \beta_i REM_{t-i} + \sum_{i=p+1}^{p+dmax} \beta_i REM_{t-i} + \sum_{i=1}^{p} \alpha_j GDP_{t-i} + \sum_{i=p+1}^{p+dmax} \alpha_j GDP_{t-i} + \sum_{i=1}^{p} \pi_i BM_{t-i} + \sum_{i=p+1}^{p+dmax} \pi_i BM_{t-i} + + \sum_{i=1}^{p} \lambda_j INF_{t-i} + \sum_{i=p+1}^{p+dmax} \lambda_i INF_{t-i} + \sum_{i=1}^{p} \rho_i AGE_{t-i} + \sum_{i=p+1}^{p+dmax} \rho_i AGE_{t-i} + \varepsilon_t \text{ ---------- (21)}$$

The variables and their coefficients are the same as defined in the preceding equations.

The Toda-Yamamoto causality representation in equation (21) above can also be similarly expressed in a matrix form as was done by Okafor et al. (2016):

$$\begin{bmatrix} REMt \\ GDPt \\ BMt \\ INFt \\ AGEt \end{bmatrix} = \begin{bmatrix} \alpha 10 \\ \alpha 20 \\ \alpha 30 \\ \alpha 40 \\ \alpha 50 \end{bmatrix} + \sum_{i=1}^{k} \begin{bmatrix} \alpha 11,i & \alpha 12,i & \alpha 13,i & \alpha 14,i & \alpha 15,i \\ \alpha 21,i & \alpha 22,i & \alpha 23,i & \alpha 24,i & \alpha 25,i \\ \alpha 31,i & \alpha 32,i & \alpha 33,i & \alpha 34,i & \alpha 35,i \\ \alpha 41,i & \alpha 42,i & \alpha 43,i & \alpha 44,i & \alpha 45,i \\ \alpha 51,i & \alpha 52,i & \alpha 53,i & \alpha 54,i & \alpha 55,i \end{bmatrix} \begin{bmatrix} REMt-1 \\ GDPt-1 \\ BMt-1 \\ INFt-1 \\ AGEt-1 \end{bmatrix} +$$

$$\sum_{j=1}^{dmax} \begin{bmatrix} \alpha 11,k+j & \alpha 12,k+j & \alpha 13,k+j & \alpha 14,k+j & \alpha 15,k+j \\ \alpha 21,k+j & \alpha 22,k+j & \alpha 23,k+j & \alpha 24,k+j & \alpha 25,k+j \\ \alpha 31,k+j & \alpha 32,k+j & \alpha 33,k+j & \alpha 34,k+j & \alpha 35,k+j \\ \alpha 41,k+j & \alpha 42,k+j & \alpha 43,k+j & \alpha 44,k+j & \alpha 45,k+j \\ \alpha 51,k+j & \alpha 52,k+j & \alpha 53,k+j & \alpha 54,k+j & \alpha 55,k+j \end{bmatrix} \begin{bmatrix} REMt-k-j \\ GDPt-k-j \\ BMt-k-j \\ INFt-k-j \\ AGEt-k-j \end{bmatrix}$$

$$+ \begin{bmatrix} \varepsilon 1 \\ \varepsilon 2 \\ \varepsilon 3 \\ \varepsilon 4 \\ \varepsilon 5 \end{bmatrix}$$

Where:

REM_t = personal remittances (as a % of GDP) at period t

GDP_t = real GDP growth rates at period t

BM_t = broad money at period t

INF_t = inflation at period t

AGE_t = age dependency ratio at period t

K= the model's optimal lag length, it ranges from i= 1,2,3..

α_{10}, α_{20}, α_{30}, α_{40}, and α_{50} are the constant terms. $\alpha_{11,t}$ $\alpha_{12,t}$ $\alpha_{13,t}$ α_{14},t …… $\alpha_{55,t}$ are the parameters of the variables with their respective lag lengths.

REM_{t-1} = personal remittances (as a % of GDP) at period t-1

GDP_{t-1} = real GDP growth rates at period t-1

BM_{t-1} = broad money at period t-1

INF_{t-1} = inflation at period t-1

AGE_{t-1} = age dependency ratio at period t-1

d_{max} = the maximum integration order, j = 1, 2

$\alpha_{11,k+j}$ $\alpha_{12,k+j}$ $\alpha_{13,k+j}$ $\alpha_{14,k+j}$ ……$\alpha_{55,k+j}$ are the parameters of the variables with their respective lag length and the overall maximum integration order.

REM_{t-k-j} = personal remittances (as a % of GDP) at period t-k-j

GDP_{t-k-j} = real GDP growth rates at period t-k-j

BM_{t-k-j} = broad money at period t-k-j

INF_{t-k-j} = inflation at period t-k-j

AGE_{t-k-j} = age dependency ratio at period t-k-j

ε_1, ε_2, ε_3, ε_4, and ε_5 are the residuals of the model, they are independently identical with an unchanging variance, a fixed mean, and suffer not from autocorrelation.

Furthermore, to capture the effects of war and Ebola in the system, the modified Toda-Yamamoto equation can be written as follows:

$$REM_t = \phi + \sum_{i=1}^{p} \beta_i REM_{t-i} + \sum_{i=p+1}^{p+dmax} \beta_i REM_{t-i} + \sum_{i=1}^{p} \alpha_j GDP_{t-i} + \sum_{i=p+1}^{p+dmax} \alpha_j GDP_{t-i} + \sum_{i=1}^{p} \pi_i BM_{t-i} + \sum_{i=p+1}^{p+dmax} \pi_i BM_{t-i} + + \sum_{i=1}^{p} \lambda_j INF_{t-i} + \sum_{i=p+1}^{p+dmax} \lambda_i INF_{t-i} + \sum_{i=1}^{p} \rho_i AGE_{t-i} + \sum_{i=p+1}^{p+dmax} \rho_i AGE_{t-i} + \sigma WAR_t + \varphi EBOLA_t + \varepsilon_t \quad (22)$$

3.6.1 Employing Modified Wald Test Statistic (MWTS) to Test for Causality.

The MWTS of the Toda-Yamamoto approach seeks to prove whether the right-hand side coefficients of every equation are, separately and/or collectively, equal to zero. But in conducting this modified version, the existing d^{th} lag in the equation under consideration should be excluded and treated as an exogenous series. Failure to do will result in Wald test statistic producing unusual asymptotic Chi-square distribution (Giles, 2011).

(a) Causality resulting from REM to GDP

H_0 $REM_t \Rightarrow GDP_t$: $\alpha_{21,1} = \alpha_{21,2} = \ldots\ldots\ldots = \alpha_{21,k} = 0$

Result: REM is said to Granger-cause GDP if the estimated coefficients of REM are significantly different from zero (treating *REM* lag *d* as an exogenous variable), that is, H_0 which states that there is no Granger causality from REM to GDP is rejected. However,

if the estimated coefficients of GDP are not statistically significant, then it can be concluded that there is a unidirectional causality between the two variables which runs from REM to GDP.

(b) Causality resulting from REM to BM

H_0 $REM_t \Rightarrow BM_t$: $\alpha_{31,1} = \alpha_{31,2} = \ldots\ldots\ldots = \alpha_{31,k} = 0$

Result: REM is said to Granger-cause BM if the estimated coefficients of REM are significantly different from zero (treating *REM* lag *d* as an exogenous variable), that is, H_0 which states that there is no Granger causality from REM to BM is rejected. However, if the estimated coefficients of BM are not statistically significant, then it can be concluded that there is a unidirectional causality between the two variables which runs from REM to BM.

(c) Causality resulting from REM to INF

H_0 $REM_t \Rightarrow INF_t$: $\alpha_{41,1} = \alpha_{41,2} = \ldots\ldots\ldots = \alpha_{41,k} = 0$

Result: REM is said to Granger-cause INF if the estimated coefficients of REM are significantly different from zero (treating *REM* lag *d* as an exogenous variable), that is, H_0 which states that there is no Granger causality from REM to INF is rejected. However, if the estimated coefficients of INF are not statistically significant, then it can be concluded that there is a unidirectional causality between the two variables which runs from REM to INF.

(d) Causality resulting from REM to AGE

H_0 $REM_t \Rightarrow AGE_t$: $\alpha_{51,1} = \alpha_{51,2} = \ldots\ldots\ldots = \alpha_{51,k} = 0$

Result: REM is said to Granger-cause AGE if the estimated coefficients of REM are significantly different from zero (treating *REM* lag *d* as an exogenous variable), that is, H_0 which states that there is no Granger causality from REM to AGE is rejected. However, if the estimated coefficients of GDP are not statistically significant, then it can be concluded that there is a unidirectional causality between the two variables which runs from REM to AGE.

(e) Causality Resulting from GDP to REM

H_0 $GDP_t \Rightarrow REM_t$: $\alpha_{12,1} = \alpha_{12,2} = \ldots\ldots\ldots = \alpha_{12,k} = 0$

Result: GDP is said to Granger-cause REM if the estimated coefficients of GDP are significantly different from zero (treating *GDP* lag *d* as an exogenous variable), that is, H_0 which states that Granger causality does not run from GDP to REM is rejected. However, if the estimated coefficients of REM are not statistically significant, then a unidirectional causality is said to exist between the two variables which runs from GDP to REM.

(f) Causality Resulting from BM to REM

H_0 $BM_t \Rightarrow REM_t$: $\alpha_{13,1} = \alpha_{13,2} = \ldots\ldots\ldots = \alpha_{13,k} = 0$

Result: BM is said to Granger-cause REM if the estimated coefficients of BM are significantly different from zero (treating *BM* lag *d* as an exogenous variable), that is, H_0 which states that there is no Granger causality from BM to REM is rejected. However, if the estimated coefficients of REM are not statistically significant, then a unidirectional causality is said to exist between the two variables which runs from BM to REM.

(g) Causality Resulting from INF to REM

H_0 $INF_t \Rightarrow REM_t$: $\alpha_{14,1} = \alpha_{14,2} = \ldots\ldots\ldots = \alpha_{14,k} = 0$

Result: INF is said to Granger-cause REM if the estimated coefficients of INF are significantly different from zero (treating *INF* lag *d* as an exogenous variable), that is, H_0 which states that there is no Granger causality from INF to REM is rejected. However, if the estimated coefficients of REM are not statistically significant, then a unidirectional causality is said to exist between the two variables which runs from INF to REM.

(h) Causality Resulting from AGE to REM

H_0 $AGE_t \Rightarrow REM_t$: $\alpha_{15,1} = \alpha_{15,2} = \ldots\ldots\ldots = \alpha_{15,k} = 0$

Result: AGE is said to Granger-cause REM if the estimated coefficients of AGE are significantly different from zero (treating *AGE* lag *d* as an exogenous variable), that is, H_0 which states that there is no Granger causality from AGE to REM is rejected. However,

if the estimated coefficients of REM are not statistically significant, then a unidirectional causality is said to exist between the two variables which runs from AGE to REM.

(i) Causality resulting from GDP, BM, INF, and AGE to REM

H_0 GDP_t, BMt, INF_t, & $AGE_t \Rightarrow REM_t$: $\alpha_{12,1} = \alpha_{12,2} = \ldots \alpha_{12,k} = \alpha_{13,1} = \alpha_{13,2} = \ldots \alpha_{13,k} = \alpha_{14,1} = \alpha_{14,2} = \ldots\ldots \alpha_{14,k} = \alpha_{15,1} = \alpha_{15,2} = \ldots\ldots = \alpha_{15,k} = 0$.

Result: GDP, BM, INF, and AGE are said to Granger-cause REM if their estimated coefficients are significantly different from zero (treating GDP, BM, INF, and AGE lags *d* as exogenous variables), that is, H_0 which states that there is no Granger causality from GDP, BM, INF, and AGE to REM is rejected. However, if the estimated coefficients of REM are not statistically significant, then it can be concluded that there is a unidirectional causality among the variables which runs from GDP, BM, INF, and AGE to GDP.

Finally, in cases (a) and (e), if REM Granger causes GDP and GDP Granger-causes REM, it can be confirmed that there is bi-directional/feedback causality between the variables; in cases (b) and (f), if REM Granger-causes BM and BM Granger-causes REM, then there exists bi-directional causality between them; in cases (c) and (g), if REM Granger-causes INF and INF Granger-causes REM, then a bi-directional causality can be concluded to exist between them; in cases (d) and (h), if REM Granger-causes AGE and AGE Granger-causes REM, then can be safely concluded that there is bi-directional causality between the variables. However, in all of the aforementioned cases above, if both of the variables do not Granger-cause each other, then it can be concluded that they are independent of each other.

3.6.2 Toda-Yamamoto (TY) Causality Estimation Procedure

TY Causality is applied through the following stages:

Stage 1: Determine the order of integration.

Unit root tests are performed to determine the order of integration of the series. When series are integrated of different orders, we take the maximum order (d_{max}). In this study, we use the Augmented Dickey-Fuller and Dicked Fuller-Generalized Least Squares unit root tests and the maximum order found from both tests is I(1).

Stag 2: Optimum lag length (k) determination.

To determine the optimal lag length, the VAR model needs to be created and estimated at levels irrespective of the integration order obtained in stage 1 above. Thereafter, the popular conventional information criteria such as Hannan-Quinn, LR, Akaike Information Criterion (AIC), and Schwarz Information Criterion (SIC), etc. are utilized to determine the optimal lag length. Researchers have different opinions and preferences on the choice of information criterion. However, there is no consensus to confirm that one information criterion is the best; rather, they all have their advantages. This study selects the optimum lag length using the Akaike Information Criterion. After determining the optimum lag length, stability and diagnostic tests such as heteroscedasticity, serial correlation, normality test, etc. should be performed to test the suitability and stability of the model.

Stage 3: Test for Granger causality using the modified Wald test on VAR (k)

If results from stage 1 above proved that the series are integrated of the same order, the Johansen methodology will be used to ascertain co-integration between/among the variables; otherwise, the ARDL Bounds Test will be employed to determine the existence of cointegration among the variables. It is worthy to note that the outcome of the cointegration test does not affect or stops the Toda-Yamamoto steps, however, when there is cointegration, the Toda-Yamamoto causality test is expected to prove causality between/among the variables. Next, we add the maximum integration order (d_{max}) obtained in step 1 and optimum lag length (k) in step 2 to get a VAR model with $k+d_{max}$ lag length. Then, the MWTS, which possesses an asymptotic Chi-square distribution and k degrees of freedom, is employed to test the significance of the parameters with k^{th} optimal lag in an equation under consideration in the VAR model.

To employ the Toda-Yamamoto approach based on the Granger causality test, the following equations will be derived:

- $REM_t = \phi + \sum_{i=1}^{p} \beta_i REM_{t-i} + \sum_{i=p+1}^{p+dmax} \beta_i REM_{t-i} + \sum_{i=1}^{p} \alpha_j GDP_{t-i} + \sum_{i=p+1}^{p+dmax} \alpha_j GDP_{t-i} + \sum_{i=1}^{p} \pi_i BM_{t-i} + \sum_{i=p+1}^{p+dmax} \pi_i BM_{t-i} + + \sum_{i=1}^{p} \lambda_j INF_{t-i} + \sum_{i=p+1}^{p+dmax} \lambda_i INF_{t-i} +$

$\sum_{i=1}^{p} \rho_i AGE_{t-i} + \sum_{i=p+1}^{p+dmax} \rho_i AGE_{t-i} + \sigma WAR_t + \varphi EBOLA_t + \varepsilon_t$ ---------- (21)

- $GDP_t = \phi + \sum_{i=1}^{p} \beta_i GDP_{t-i} + \sum_{i=p+1}^{p+dmax} \beta_i GDP_{t-i} + \sum_{i=1}^{p} \alpha_j REM_{t-i} + \sum_{i=p+1}^{p+dmax} \alpha_j REM_{t-i} + \sum_{i=1}^{p} \pi_i BM_{t-i} + \sum_{i=p+1}^{p+dmax} \pi_i BM_{t-i} + + \sum_{i=1}^{p} \lambda_j INF_{t-i} + \sum_{i=p+1}^{p+dmax} \lambda_i INF_{t-i} + \sum_{i=1}^{p} \rho_i AGE_{t-i} + \sum_{i=p+1}^{p+dmax} \rho_i AGE_{t-i} + \sigma WAR_t + \varphi EBOLA_t + \varepsilon_t$ ---------- (23)

- $BM_t = \phi + \sum_{i=1}^{p} \beta_i BM_{t-i} + \sum_{i=p+1}^{p+dmax} \beta_i BM_{t-i} + \sum_{i=1}^{p} \alpha_j GDP_{t-i} + \sum_{i=p+1}^{p+dmax} \alpha_j GDP_{t-i} + \sum_{i=1}^{p} \pi_i REM_{t-i} + \sum_{i=p+1}^{p+dmax} \pi_i REM_{t-i} + + \sum_{i=1}^{p} \lambda_j INF_{t-i} + \sum_{i=p+1}^{p+dmax} \lambda_i INF_{t-i} + \sum_{i=1}^{p} \rho_i AGE_{t-i} + \sum_{i=p+1}^{p+dmax} \rho_i AGE_{t-i} + \sigma WAR_t + \varphi EBOLA_t + \varepsilon_t$ ---------- (24)

- $INF_t = \phi + \sum_{i=1}^{p} \beta_i INF_{t-i} + \sum_{i=p+1}^{p+dmax} \beta_i INF_{t-i} + \sum_{i=1}^{p} \alpha_j GDP_{t-i} + \sum_{i=p+1}^{p+dmax} \alpha_j GDP_{t-i} + \sum_{i=1}^{p} \pi_i BM_{t-i} + \sum_{i=p+1}^{p+dmax} \pi_i BM_{t-i} + + \sum_{i=1}^{p} \lambda_j REM_{t-i} + \sum_{i=p+1}^{p+dmax} \lambda_i REM_{t-i} + \sum_{i=1}^{p} \rho_i AGE_{t-i} + \sum_{i=p+1}^{p+dmax} \rho_i AGE_{t-i} + \sigma WAR_t + \varphi EBOLA_t + \varepsilon_t$ ---------- (25)

- $AGE_t = \phi + \sum_{i=1}^{p} \beta_i AGE_{t-i} + \sum_{i=p+1}^{p+dmax} \beta_i AGE_{t-i} + \sum_{i=1}^{p} \alpha_j GDP_{t-i} + \sum_{i=p+1}^{p+dmax} \alpha_j GDP_{t-i} + \sum_{i=1}^{p} \pi_i BM_{t-i} + \sum_{i=p+1}^{p+dmax} \pi_i BM_{t-i} + + \sum_{i=1}^{p} \lambda_j INF_{t-i} + \sum_{i=p+1}^{p+dmax} \lambda_i INF_{t-i} + \sum_{i=1}^{p} \rho_i REM_{t-i} + \sum_{i=p+1}^{p+dmax} \rho_i REM_{t-i} + \sigma WAR_t + \varphi EBOLA_t + \varepsilon_t$ ---------- (26)

The descriptions of the variables and their coefficients are the same as in equation (21) on the previous page.

3.7 Variance Decomposition

To understand the variations in the dependent variable in this study, a variance decomposition analysis is performed. It is a conventional statistical technique used in multivariate analysis to unearth basic underlying structures of large variable sets Anderson (2003). It aids in interpreting a fitted vector auto regression model. Sims (1980) is one of the earliest advocates of this technique. Sims doubted the exogeneity commonly

assumed in simultaneous equations models, hence, prefers the variance decomposition function for a VAR model. It is also referred to as Forecast Error Variance Decomposition (FEVD). In the field of macroeconomics, variance decomposition is used specifically as a tool to meaningfully describe the proven relationships between/ among variables in a fitted vector autoregressive model (Lütkepohl, 2010). It captures exogenous shocks, the relative significance of such shocks to the variations in the model, and how the significance varies over time.

FEVD essentially signifies the proportion of the changes or shocks in the dependent variable that is accounted for by its own lagged values and individual independent variables. It can be illustrated graphically using bar or area graphs. Sims (1980) remarks that all of the forecast error variance of the variable would be explained by own innovations if the variable truly possesses exogenous characteristics with reference to the other variables in the VAR system (Narayan and Smyth, 2006). The variance decomposition used in this research is Cholesky decomposition.

3.8 Impulse Response Functions (IRFs)

Sims (1980) doubted the underlying exogeneity assumption in simultaneous equation models, hence, he proposed the vector autoregressive models as a better way to capture exogeneity in economic models. However, it is a herculean task to clearly capture the relations among the series in the VAR model, thus, the impulse response function has been put forward to provide simple explanations of the VAR models (Lütkepohl, 2010). IRFs are used to ascertain the dynamic impacts of shocks on a system. They are interpreted as each variable's response to a certain shock in a system over a given period.

3.9 Stability and Diagnostic Tests

In an event where cointegration is proven to exist among the variables, stability and diagnostics would be performed to ascertain whether the model is stable and does not suffer from the troubles of serial correlation, heteroscedasticity, misspecification of function form, abnormal distribution of error terms. The cumulative sum of recursive residuals (CUSUM) is employed to confirm its stability while the Lagrange Multiplier test (LM), Histogram normality test (Jarque and Bera, 1980), and Breusch-Pagan-

Godfrey heteroscedasticity (Breusch and Pagan, 1979) test are used to test for serial correlation, normality, and heteroscedasticity respectively.

Serial correlation in Statistics simply refers to a situation where the residual/error term of one period is correlated with another error term in the following period. It is also referred to as autocorrelation. There are first-order and second-order serial correlations, and they can either be negative or positive. Serial correlation in a model leads to inefficient forecast and estimates, unrealistic regression coefficients and goodness of fit and exaggerated T-statistics. It can be tested using the Lagrange Multiplier (LM) test, Durbin-Watson test, residuals plot, correlogram, Ljung Box test, and Moran's I statistic[3]. For this research, the serial correlation LM test is utilized.

Normality test is simply a way of ascertaining whether the sample data is drawn from a population that is normally distributed. Non-normal distribution can provide inefficient estimates. Normality tests can be performed using both graphical and analytical methods. For this study, the Jacque-Bera normality test is utilized.

The heteroscedasticity test is a test that determines whether the residuals in regression are constant or varying over time. If they are proven to be changing over time, then there is a problem of heteroscedasticity i.e., changing variance. This case will lead to inefficient estimators in the model. There are several heteroscedasticity tests, but this study uses the Breusch Pagan test which assumes that there is no heteroscedasticity in the data, and the alternative hypothesis is that there is heteroscedasticity in the data.

3.10 Procedures of Estimation

Firstly, unit-roots – ADF and DFGLS tests – were performed to ascertain stationarity and the orders of integration of the variables. After the variables have been confirmed to be stationary and integrated of different orders by both unit root tests, the ARDL cointegration or bounds test cointegration approach was chosen above the other cointegration techniques. Additionally, other advantages of the ARDL model such as better performance and power properties in small sample sizes, applicability whether the series are integrated of the same orders, etc over the others made its choice in this study

[3] Stephanie Glen. ''Serial Correlation/ Autocorrelation: Definition, Tests ''From StatisticsHowTo.com: Elementary Statistics for the rest of us! https://www.statisticshowto.com/serial-correlation-autocorrelation/

more realistic. In applying the ARDL cointegration technique, the F-statistic is used to determine whether or not there is a long-run relationship between the variables. The null hypothesis of such test is that, long-run relationship/cointegration does not exist among the variables, i.e., $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = \alpha_7 = 0$; while alternative hypothesis is $\alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq \alpha_6 \neq \alpha_7 \neq 0$ (cointegration exists among the variables). The result of the F-statistics is compared with the two critical values (lower and upper) for a final decision on the (non)existence of cointegration to be made. The upper critical value stipulates that the series are of order one, i.e. I(1) while the lower critical value signifies that the series is of order zero, i.e. I(0). Based on the results, it can be concluded that there exists a long-run relationship/ cointegration among the variables when the calculated F-statistic exceeds the upper critical value. In such a situation, the null hypothesis can be rejected irrespective of the fact that the series are I(0) or I(1). Thus, the long-run equation can be estimated as can be seen in equation (14) above. In a similar vein, if the lower critical value exceeds the F-statistics, then the null hypothesis cannot be rejected which means that cointegration does not exist among the variables. However, in a situation where the F-statistics falls in between the two critical bounds, no definite conclusion can be reached on cointegration among the variables without prior knowledge of their orders of integration (Dausa, 2009). Additionally, Pesaran et al. (2001) noted that when all the series are proven to be I(1), then a cointegration decision is taken in relation to the upper critical value. In the same light, if the series are tested to be I(0), the cointegration decision is taken in relation to the lower critical value.

Furthermore, after having confirmed the existence of a long-run relationship, the suitable lag length for the ARDL can then be chosen in order to ensure Gaussian error terms – error terms free from autocorrelation, abnormal distribution, heteroscedasticity, among others. The choice of appropriate lag length can be done by employing the Hannan-Quinn Criterion (HQC), Akaike Information Criterion (AIC), or Schwarz Bayesian Criterion (SBC). From the estimates of the different criteria above, the lag length with the smallest value is chosen to be the optimal lag length. (see Pesaran et al., 2001). The optimal lag length in this study was chosen based on AIC as it has the least estimates.

Next, to obtain information about the short and long run, the Error Correction Model (ECM) is estimated. This is expressed in equation (15) above. In the ECM, the error

correction term measures the portion of disequilibrium in the short run that can be corrected to attain convergence in the long run. If its value is positive, it denotes a divergence in the model. As stated previously, it should be negative, statistically significant, and less than 1. Upon confirming co-integration among the variables and obtaining information about the short and long run, diagnostic and stability tests are performed to prove that the model does not suffer from serial correlation, abnormal error terms distribution, heteroscedasticity, functional form misspecification, and instability.

Moreover, to determine causality and its direction among the selected variables in this study, the Toda-Yamamoto causality test is applied. To apply this test, the maximum order of integration of the variables first needs to be determined via a stationary test. Next, the optimal lag length from the estimated VAR model at levels needs to be determined and added to the maximum order of integration to obtain the optimum lag length ($k+d_{max}$). Thereafter, some residual tests need to be conducted on the VAR model to prove its appropriateness and stability. Finally, the Toda-Yamamoto causality or Modified Wald Test statistic will be conducted using the modified optimum lag length.

Finally, to determine the pattern and percentage of responses to own innovations and innovations in the other variables, the Impulse Response Function and Variance Decomposition are applied.

CHAPTER 4: RESULT ANALYSES AND DISCUSSIONS

4.1 Introduction:

In this section, the results obtained from the research using econometrics techniques with the help of EVIEWS 10 are presented and analyzed in detail.

4.2 Descriptive Statistics:

Table 4 below presents descriptive statistics of the variables under study. The statistics mainly include the measures of central tendency, dispersion, and shape.

Table 3 : Descriptive Statistics

Indicators	REM	GDP	AGE	INF	BM
Mean	0.979081	2.521560	88.04181	31.16765	18.39649
Maximum	3.357844	26.41732	91.86385	165.6766	29.44246
Minimum	0.003560	-20.59877	78.65501	-6.008735	9.925912
Std. Dev.	0.984672	8.503325	3.623485	36.74226	5.418866
Skewness	0.627035	-0.166145	-1.112566	1.908878	0.390158
Kurtosis	2.438881	5.185495	3.263371	6.641167	2.190127
Observations	39	39	39	39	39

Source: Author's computations

From the table on the previous page, it can be observed that personal remittances as a percentage of GDP recorded an average of 1% with the highest value reaching 3.4%, lowest at 0.004%, and movement away from the mean at 1%. This means that the inflow of personal remittances was substantial for the period under study. Real economic growth grew by 2.5% on average with its highest reaching 26.7% and lowest at -20.6%. This means that the country experienced fair growth within the study period. Its movement away from the average (standard deviation) is a bit high, 8.5. For the age dependency ratio, the average of the dependents on every 100 working-age population was 88 with a maximum of 92, minimum of 79, and standard deviation of 3.6. This means that there was a huge dependence on the working population. There was an average of 31% inflation with a maximum of 166% and a minimum of -6%, and a standard deviation of 37%. This

means that there those economic conditions, especially the cost of living, were pretty high in the country during the period under study. Broad money (% of GDP) had an average of 18% with a maximum of 29%, a minimum of 10%, and a standard deviation of 5%. Finally, it can be concluded from the statistics above that the age dependency ratio has the highest average value, inflation has the highest maximum and standard deviation values, and personal remittances has the lowest average and standard deviation values.

4.3 Stationarity Tests

Based on the small sample size, the study conducted unit root tests using the Augmented Dickey-Fuller (ADF) and Dickey-Fuller Generalized Least Squares (DFGLS) techniques to ascertain stationarity and the orders of integration of the variables. Additionally, these unit root tests were performed to at least make sure that none of the variables is integrated of order two as it may cause the Autoregressive Distributed Lag Model (ARDL) cointegration technique to crash (Nkoro and Uko, 2016). To ascertain the macroeconomic factors determining personal remittances in Sierra Leone, the ARDL cointegration technique was chosen over the other cointegration techniques for its indifference to integration orders of the variables, efficient estimates in small sample data, reliability in an over-specified dynamic data structure, expresses a short-run relationship between/among variables without compromising information about their long-run relationship too, and correction of serial correlation and endogeneity when the orders are correctly specified in the model (Pesaran et al., 1999). The computed results using the unit root tests can be seen on the following page:

Table 4 : ADF and DFGLS Unit Root Tests

Variables	ADF t-stats		DFGLS t-stats		I(d)
	Constant	Constant & Trend	Constant	Constant & Trend	
REM	-1.555335 (2) {0.4946}	-1.673308 (2) {0.7424}	-1.194776 (2)	-1.769968 (2)	I(1)
ΔREM	-9.215201** (1) {0.0000}	-9.116202** (1) {0.0000}	-9.353870** (1)	-9.338493**(1)	
GDP	-5.544335** (0) {0.0000}	-5.832332** (0) {0.0001}	-5.552547** (0)	-5.846641** (0)	I(0)
BM	-1.741481 (0) {0.4029}	-1.648791 (0) {0.7541}	-1.658676 (0)	-1.686651 (0)	I(1)
ΔBM	-6.317260** (0) {0.0000}	-6.312769** (0) {0.0000}	-6.017491** (0)	-6.455194** (0)	
INF	-3.341593** (7) {0.0214}	-2.818628 (7) {0.2016}	-1.257880 (3)	-3.476485** (0)	I(0)
AGE	-0.287482 (5) {0.9164}	-0.955176 (6) {0.9364}	-3.440212** (5)	-1.481072* (6)	I(0)

Source: Author's computations using Eviews10. Note: ***, **, and * means the variables are statistically significant at 1%, 5%, and 10% respectively (it means the null hypothesis of no stationarity was rejected); in the parentheses are the number of lags according to the Akaike Information Criterion and underneath are the p-values.

From the reported results above, GDP, AGE, and INF series are integrated of order zero, i.e. stationary at levels. This means that the null hypothesis, which asserts that there is no stationarity, was rejected at levels. Also, REM and BM series are integrated of order one, i.e. they are stationary at first difference. It also means that H_0, which claims that the series is not stationary, can be rejected at first difference. Thus, consequent upon the fact that the integration orders of the series are mixed, the ARDL co-integration technique can be aptly used to determine the macroeconomic factors determining personal remittances in Sierra Leone.

4.4 Co-integration Test

4.4.1 Bounds Tests

Based on the lag length selection test done using the AIC, SIC, and Hannan-Quinn information criterion, a lag length of three (3) was selected and consequently used in the Bounds Test. The Bounds Test results are presented in Table 3 below. The Bounds Critical values were obtained from the Bounds test computations in Eviews10. The case of unrestricted constant and no trend was chosen.

Table 5 : Bounds Test Results

T statistics	Value	Lag length	Bounds Upper and Lower Critical values	
		Significance level	I(0)	I(1)
F Statistics	5.436280	3	10%	2.45	3.52
			5%	2.86	4.01
			1%	3.74	5.06

Source: Author's computations using Eviews 10.

From the Bounds Test results in the table above, the null hypothesis - which states that there is no relationship between personal remittances and the independent variables – is rejected because the F-statistic (5.436280) is greater than the bounds upper critical value at 5% significant level (4.01). Thus, it can be concluded that there exists a long-run relationship or co-integration among the variables. Consequent to this outcome, therefore, the short-run and long-run estimates are obtained.

4.4.2 Long-Run Estimation Results

The confirmation of a long-run relationship among the variables necessitates the calculation of short-run and long-run estimates. To achieve this, the ARDL model or Bounds Test Co-integration is employed in consonance with the AIC. The case of unrestricted constant and no trend was chosen. The results of the long run estimation are presented in table 4 below:

Table 6 : Long-Run Estimates

DEPENDENT VARIABLE: Personal Remittances (REM)				
Independent Variables	**Coefficient**	**Std. Error**	**T-statistic**	**Prob.**
AGE	-0.540399	0.300621	-1.797613	0.0874
BM	-0.278628	0.156959	-1.775160	0.0911
GDP	-0.216711	0.125051	-1.732978	0.0985
INF	-0.002565	0.012431	-0.206374	0.8386

Source: Author's computations using EVIEWS10. Std. Error = standard error

4.4.3 Short-Run Dynamics Estimates

As the long-run estimates have been obtained above, it is also prudent to obtain the short-run dynamics estimates, ascertain the degree of convergence or divergence of the model, and determine the effectiveness of the error correction mechanism. The case of unrestricted constant and no trend was chosen. The results of the short-run dynamics are presented in Table 5 on the following page:

Table 7 : Short-Run Dynamics Estimates (ECM Regression)

Dependent Variable: Personal Remittances (REM)				
Variable	**Coefficient**	**Std. Error**	**T-statistic**	**Prob.**
C	26.26622	4.590410	5.721976	0.0000
D(REM(-1))	-0.024202	0.103730	-0.233317	0.8179
D(REM(-2))	-0.563441	0.098455	-5.722854	0.0000
D(BM)	-0.038342	0.032300	-1.187065	0.2491
D(BM(-1))	0.122211	0.032197	3.795699	0.0011
D(BM(-2))	0.064848	0.030725	2.110612	0.0476
D(GDP)	-0.015067	0.009796	-1.538131	0.1397
D(GDP(-1))	0.069557	0.014592	4.766880	0.0001
D(GDP(-2))	0.065151	0.010614	6.138212	0.0000
EBOLA	-0.441665	0.102651	-4.302592	0.0003
WAR	-0.694051	0.242084	-2.866980	0.0095
Coint Eq(-1)	-0.469965	0.082289	-5.711189	0.0000

R-squared	0.805213	Mean dependent var.	0.042044
Adjusted R-squared	0.715936	S.D. dependent var	0.916207
S.E. of regression	0.488317	Akaike info criterion	1.665497
Sum squared resid	5.722878	Schwarz criterion	2.193336
Log-likelihood	-17.97894	Hannan-Quinn criteria.	1.849727
F-statistic	9.019244	Durbin-Watson stat	2.138872
Prob (F-statistic)	0.000004		

Source: Author's computations using EVIEWS10. Std. Error = standard error

4.5 Diagnostic and Stability Tests

Diagnostic and stability tests were conducted to prove that the model is suitable and free from serial correlation, heteroscedasticity, abnormal error terms distribution, heteroscedasticity, functional form misspecification, and instability. The results can be seen on the following page:

Table 8 : Diagnostic Tests

Tests	**P-values**
Breusch-Godfrey Serial Correlation LM Test	0.6446
Jarque-Bera Normality Test	0.7164
Breusch-Pagan-Godfrey Heteroscedasticity Test	0.1084
Ramsey RESET Test	0.2122

Source: Author's computations**.**

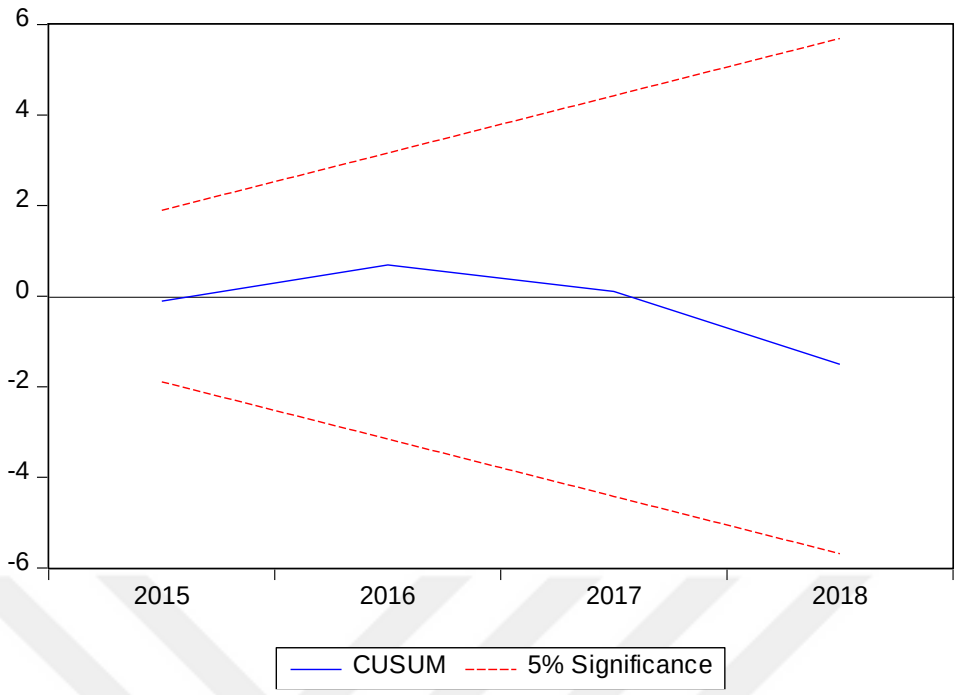

Figure 4 : CUSUM Stability Test

Source: Author's computations.

4.6 Discussions

4.6.1 Long-Run Estimates

The Bounds Test has proven that there is a long-run relationship between personal remittances and the chosen macroeconomics determinants. However, in employing the ARDL co-integration technique, merely proving the existence of a long-run relationship among the variables is a necessary but not a sufficient condition to determine the impacts/effects of the explanatory variables on the dependent variable or the extent of the relationship among the variables. Thus, both the short-run and long-run coefficient estimations were conducted to produce precise results in accordance with the main research question and objectives.

The results from the static long-run estimation can thus be explained accordingly. GDP (real economic growth), which is used to capture fluctuations in the home country's economic conditions, has a statistically significant negative relationship with personal remittances at the 10% significance level in the period under study. This agrees with the

a priori expectation as cited from the previous studies mentioned in the model specification section, especially Castillo-Ponce et al. (2011), Niimi et al. (2010), Adenutsi et al. (2011), Singh et al. (2010). However, this is in contrast with Singogo (2020) and Ojapinwa (2012) who report that GDP is positively and significantly related to personal remittances. Precisely, ceteris paribus, it means that for every 1 unit increase in economic growth, the personal remittances (REM) will fall by 0.22. This is related to the concept called counter-cyclicality. This could be explained by the fact that as the economy grows and flourishes, citizens would tend to depend less on monies sent from abroad and workers abroad would also tend to cut down on what they have been remitting back home as the economic situation tends to get better. Also, it could mean that when the economic situation in the country worsens, families abroad would send more money back home to take care of their families in such crises. This situation relates to both the pure altruistic motive on one hand and pure self-interest motive (for the case of investment).

Inflation (INF), used to take account for fluctuations in the environmental conditions of the receiving (home) nation, has a statistically insignificant negative relationship with personal remittances at the 10% significance level. This result does not conform to the a priori expectation as per the previous studies, for example, Ojapinwa (2012) reports that inflation is negatively and significantly related to personal remittances. However, this result is in line with Singogo (2020), Omon (2021), and Buch and Kuckulenz (2010) who also found out that inflation has an insignificant effect on personal remittances in Southern African countries, 5 countries in West Africa Monetary Zones (WAMZ), and 87 developing countries respectively. Ceteris paribus, this situation could be explained by the fact that most of the families in Sierra Leone do heavily rely on remittances from their family members living abroad. As such, whether the inflation rate is high in the country, the families abroad would remit monies to the families at home to take care of them, either less due to the high transactional cost or more to take care of the increased cost of living. This is a case of pure altruism. Additionally, it could be related to what Buch and Kuckulenz (2010) note as ‘cancel-out effect’, i.e. a high level of inflation in the home country which depicts macroeconomic instability will motivate workers to migrate abroad seeking better economic conditions with the possibility of remitting home more for purely altruistic purposes, however, based on the high level of uncertainty caused by

high inflation level, workers will be discouraged from remitting home for pure self-interest or investment purposes thereby leading to a case where the pure self-interest or investment motive cancelling out the pure altruism motive.

Broad Money (BM), which can also be referred to as money supply in the country, has a statistically significant negative relationship with personal remittances at a 10% level. This resonates with the a priori condition as evidenced in previous studies like Castillo-Ponce et al. (2011) and Yuni et al. (2013). Particularly, it means that for every unit increase in money supply, personal remittances would decline by 0.28, holding all other factors constant. This could be substantiated by the fact that an increase in money supply in the country could lead to increasing price levels (inflation) in the country thereby resulting in high transactional cost and cost of living. This makes it expensive to remit money back home, thus, a fall in personal remittances. It could also mean that with more money in circulation, it would somehow be easier for citizens to access credits which would, in turn, lower their demand for remittances, hence a decline in remittance flow in the country.

Age Dependency ratio (AGE), which is used to ascertain the effects of dependency on remittances in the country, has a statistically significant negative relationship with personal remittances at a 10% level. Precisely, all factors remaining the same, means that an increase in the age dependency ratio leads to a drop in personal remittances by 0.5. This result conforms to the a priori expectation as in the study of Buch and Kuckulenz (2010). It also contradicts the findings of Yuni et al. (2013) who found out there is a positive relationship between the two variables in question. However, since the studies are done in different countries, certain factors might account for the differences in the result. Also, for this study, it could be partly explained by the fact that many people retiring from work do have access to pensions and could easily access credit based on the professional records which they could, in turn, invest it in profitable business ventures, thus reducing their demand for personal remittances. Also, as Buch and Kuckulenz (2010) note, it could be a case that an increase in age dependency ratio means the number of dependents is far more than the workers, hence, the number of people who can migrate to work abroad would reduce thereby inversely affecting the amount of remittances inflows in the country.

4.6.2 Short-Run Results

From the reported results in Table 5, it can be concluded that the lagged error term (-0.47) is statistically significant at all significance levels, though the study bases its decision on the 10% significance level to ensure uniformity in all the statistical decisions made in the different estimations. However, it should be noted that this is by no means a rule. The negative and statistically significant coefficient of the lagged error term obtained is in unison with the usual econometric expectation in terms of confirming a co-integrating relationship among the variables and the extent to which equilibrium can be achieved in the model. Precisely, the absolute value of the lagged error term signifies that 47% of the disequilibrium or shocks in the previous would be corrected in the current year in ensuring convergence to an equilibrium state. Its negative and significant sign also denotes the effectiveness of the error correction mechanism in the model.

War and Ebola, which serve as dummy variables for crises during the period of study, have a statistically significant negative relationship with personal remittances. Particularly, for every year of crises in the country, personal remittances would decline by 0.69 and 0.44 respectively, holding all other factors constant. This could be explained by the reality that in terms of crises, many economic activities (including means of international money transfers) are severely affected. Thus, it becomes quite expensive and difficult to remit money back home. In the civil war in the country, many banks and financial institutions were forced to close due to security issues. Also, in the period of Ebola virus disease, the country was greatly isolated from the rest of the world due to many international travel bans to and from the country. Thus, some forms of remittances which are usually done through people carrying physical cash in their travel luggage or personal items were reduced.

One of the lagged values of personal remittances has a statistically significant negative relationship with the current personal remittances in the country. Holding all other factors constant, this could mean that as overseas people remit more money back home in the previous period, they may tend to send a bit less in the current period hoping their families back home might have some money left to take care of them.

Unlike, in the long-run, the lagged values of GDP and BM have a positive and statistically significant relationship with personal remittances. This could be related to the fact that with a high economic growth coupled with a high quantity of money in circulation, residents abroad may tend to send more money back home to their families to live through the rising prices that may result due to too much money in circulation.

4.6.3 Stability and Diagnostic Tests Results

From the stability and diagnostic tests results conducted and presented in Table 6 and Figure 1 above, it is safe to conclude that the ARDL model is appropriate and accurate for this study as it does not suffer from heteroscedasticity, serial correlation, functional form misspecification, non-normal error terms distribution, and instability.

4.6.4 Toda-Yamamoto Causality Test

4.6.4.1 Results of VAR Lag Order Length

Table 9 : VAR Lag Order Length Results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-548.1423	NA	15261078	30.73013	30.95006	30.80689
1	-398.4472	249.4919	15198.19*	23.80262	25.12222*	24.26320*
2	-384.0742	19.96246	29864.66	24.39301	26.81228	25.23740
3	-343.8330	44.71246*	16155.35	23.54628*	27.06521	24.77448

Source: Author's computations

From the above results, the VAR lag length selected is lag three (3) according to the Akaike Information Criterion. Thus, to employ the Toda-Yamomoto causality or Modified Wald Test Statistic approach, the optimum lag length ($k+d_{max}$) becomes 3+1= 4, where d_{max} is the maximum order of integration which is one (1) in this case, as far as the conducted unit root tests are concerned.

4.6.4.2 Var Residual Serial Correlation LM Test

Table 10 : Var Residual Serial Correlation Lm Test

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	37.96616	25	0.0466	1.869483	(25, 20.1)	0.0782
2	35.13933	25	0.0857	1.640624	(25, 20.1)	0.1305
3	35.30691	25	0.0828	1.653627	(25, 20.1)	0.1268
4	27.11044	25	0.3504	1.091975	(25, 20.1)	0.4249

Null hypothesis: there is no serial correlation at lag h

Source: Author's computation using EVIEWS 10

From the results above, it can be concluded that there is no serial correlation in the estimated VAR model based on a 5% statistical significance level, i.e., the null hypothesis, which states that serial correlation does not exist at lag h, cannot be rejected. Thus, the Toda-Yamamoto causality test can be estimated if the other residual tests provide favourable results too.

4.6.4.3 VAR Residual Jarque-Bera Normality Test

Table 11 : VAR Residual Normal Test

Component	Jarque -Bera	df	Prob.
1	0.362761	2	0.8341
2	9.958172	2	0.0069
3	3.377440	2	0.1848
4	0.056487	2	0.9722
5	1.481921	2	0.4767
Joint	15.23678	10	0.1237

Source: Author's calculation using EVIEWS 10. Null hypothesis: residuals are multivariate normal.

From the above results, it is safe to conclude that the residuals used are jointly normally distributed at a 5% statistical significance level, i.e., the null hypothesis, which states that

residuals are multivariate normal, cannot be rejected at the said statistically significant level.

4.6.4.4 VAR Residual Heteroscedasticity Test (White Heteroscedasticity No Cross-Terms)

Table 12 : Var Residual Heteroscedastic Test

Joint test		
Chi-sq	**df**	**Prob.**
457.2267	450	0.3967

Source: Author's computations using EVIEWS 10.

From the results above, it can be concluded that the residuals are homoscedastic, that is, the null hypothesis, which states that residuals are not heteroscedastic, cannot be rejected at a 5% statistical significance level.

From all the residual tests conducted above, it is safe to conduct the Toda-Yamamoto causality or modified Wald test statistic test.

4.6.4.5 Toda-Yamamoto Causality Test Results

Table 13 : Toda-Yamamoto Causality Test Results

Cause	Effect	χ^2	df	Prob > χ^2	Decision
REM	GDP	2.000782	3	0.5722	No causality i.e., failed to reject H_0
GDP	REM	9.195074	3	0.0268	Unidirectional causality, i.e., H_0 is rejected.
REM	BM	0.898946	3	0.8257	No causality i.e., failed to reject H_0
BM	REM	2.199940	3	0.5320	No causality i.e., failed to reject H_0
REM	INF	3.129565	3	0.3721	No causality i.e., failed to reject H_0
INF	REM	0.382377	3	0.9439	No causality i.e., failed to reject H_0
REM	AGE	7.379920	3	0.0607	No causality i.e., failed to reject H_0
AGE	REM	1.235842	3	0.7444	No causality i.e., failed to reject H_0

Source: Author's computations using Eviews 10. Note: df refers to degrees of freedom, prob means probability, and χ^2 means chi-square. The other variables are as previously defined.

From the results from the Toda-Yamamoto causality test above, it can be concluded that there is a unidirectional causality flowing from GDP to REM at the 5% statistical significance, that is, the null hypothesis which claims that there is no Granger causality running from GDP to REM is rejected and the alternative hypothesis is accepted. Thus, it

means that economic growth Granger causes personal remittances in the country. From the estimated VAR model, there is a significant negative relationship between GDP and REM, which implies that increase in GDP results in a decrease in REM. This could be explained by the fact that as the economy grows more, families back home may depend less on remittances from abroad as living conditions at home would be a bit favourable for the citizens, hence, the migrants who usually remit moeny home to take care of their families in times of economic crises would now remit less money. This result confirms the concepts counter-cyclicality in the economy and pure altruism motive of remitting money. This finding is consistent with that of Hassan (2008) and Mustafa and Ali (2018) who also found that economic growth Granger causes remittance inflow in Pakistan and Haiti respectively. However, the result is contrary to the findings of Ahamada and Coulibaly (2013) who concluded that there is no causality between economic growth and remittance flowing from either direction in the Sub-Saharan Africa. The difference between our study and the latter could be attributed to their scopes, i.e, this substantive study used a time series data on one country and the latter used a panel data of many countries hence the possibility of heterogeneity challenge, diverse economic structures of the two study areas, and time frame differences. The result above also confirms that there is no Granger causality running from remittances to GDP. This aligns with the findings of Hassan (2008) and contradicts that of Siddique et al. (2012). Their differences could be attributed to similar reasons above.

Furthermore, at the 5% statistical significance level, there exists no Granger-causality between REM and INF flowing from either direction. This aligns with Hassan (2008) and Laniran and Adeniyi (2015). This could be explained by the fact that the inflow of remittances in the country does not significant affect the economic conditions, e.g. inflation, in the country. In the same vein, inflation does not significantly influence remittance inflow, i.e., migrants will keep on remitting irrespective of the price levels in the country. However, this contrasts with that of Vargas-Silva and Huang (2006) who found that US inflation rate Granger causes remittance inflow in Mexico. The apparent difference between our study and the latter is that the latter considered both foreign and domestic macroeconomic factors countries with different economic structures while ours only considered domestic factors.

The result also shows that there is no causality between broad money and remittances at 5% statistical significance. This could be attributed to the similar case advanced for the relationship between certain economic conditions and remittances. For the case of Sierra Leone, it could be the case that migrants abroad do not base their decisions to remit money back home solely on the money supply/circulation in the country, rather, on the need to help their families back home. This result contrasts with the findings of Vargas-Silva and Huang (2006) who confirmed that US broad money Granger causes inward remittances in Mexico. As stated above, one of the differences could be attributed to the choice of variables in our study and the study: we only considered domestic variables and they considered both domestic and foreign factors.

Finally, it is observed from the above results that there exists no causality between age dependency ratio and remittances at 5% statistical significance level. This could be attributed to the motive of remittance, for instance, for migrants who are more interested in pure self-motive of remittance rather than pure altruism motive, they would continue remitting whether the age dependency ratio rises or falls. They would be more interested in business or investment purposes more than the welfare of the families back home. On the other hand, remittance inflow has no influence on whether the age dependency ratio rises or falls.

4.6.5 Impulse Response Functions

The study ascertained the impulse response functions based on the Cholesky decomposition. The results can be seen in the graphs on the following page. The horizontal axes of the graphs denote periods (in years) and the vertical axes denote standard deviation innovations in the variables. The degree or magnitude of the shocks is measured in one standard deviation innovation. The selected period is ten (10) years. The red dotted lines in the graphs denote confidence intervals and the blue lines denote the responses of or variations in the variables.

4.6.5.1 Response of Remittances to Remittances

The graph below depicts the responses of personal remittances (REM) to standard deviation innovations in REM.

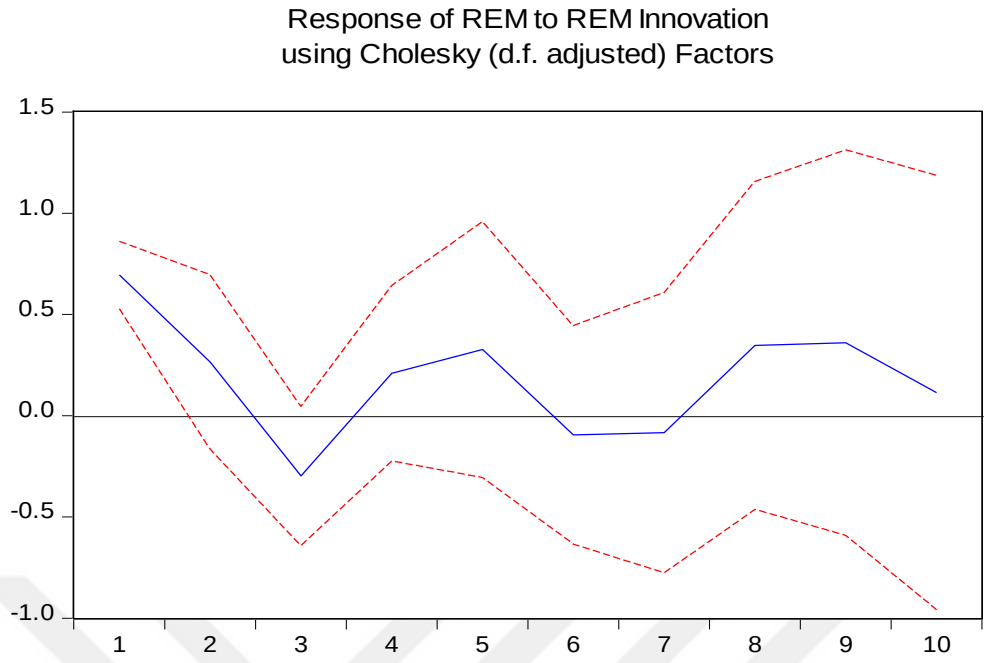

Figure 5 : Responses of REM to S.D Innovations in REM

Source: Author's computations using EVIEWS 10.

4.6.5.2 Response of Remittances to Economic Growth

The graph below depicts the responses of personal remittances (REM) to standard deviation innovations in economic growth (GDP).

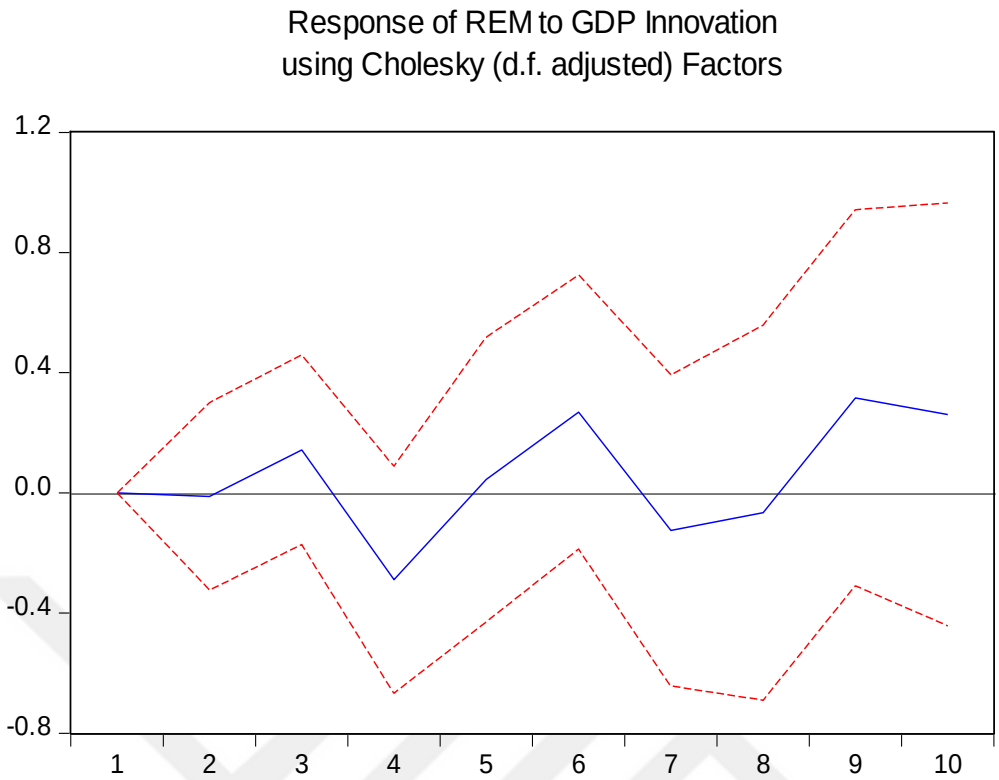

Figure 6 : Responses of REM to S.D Innovations in GDP

Source: Author's computations using EVIEWS 10.

4.6.5.3 Response of Remittances to Broad Money

The graph below depicts the responses of personal remittances (REM) to standard deviation innovations in broad money (BM).

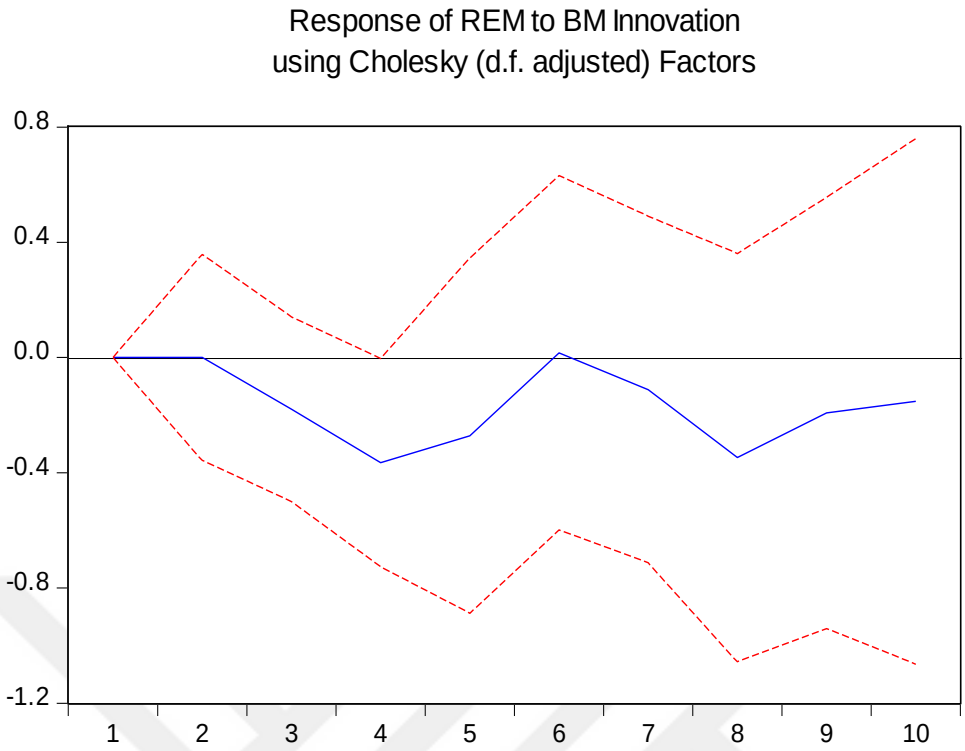

Figure 7 : Responses of REM to S.D Innovations in BM

Source: Author's computations using EVIEWS 10.

4.6.5.4 Response of Remittances to Inflation

The graph below depicts the responses of personal remittances (REM) to standard deviation innovations in inflation (INF).

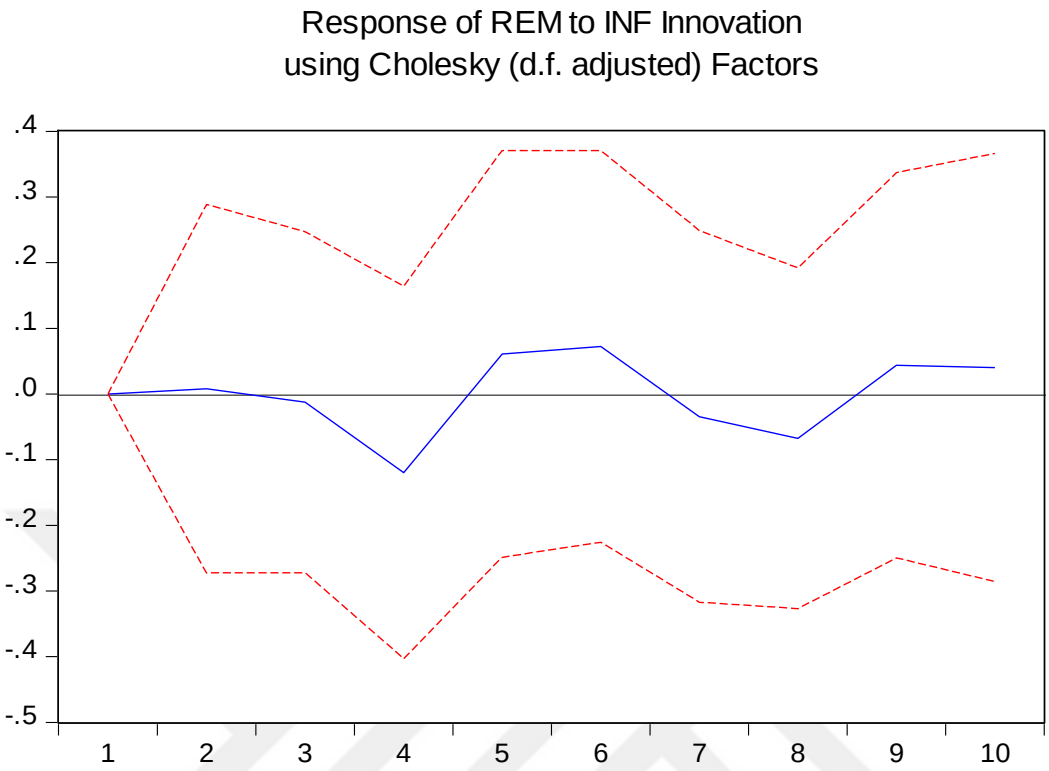

Figure 8 : Responses of REM to S.D Innovations in INF

Source: Author's computations using EVIEWS 10

4.6.5.5 Response of Remittance to Age Dependency Ratio

The graph below depicts the responses of personal remittances (REM) to standard deviation innovations in age dependency ratio (AGE).

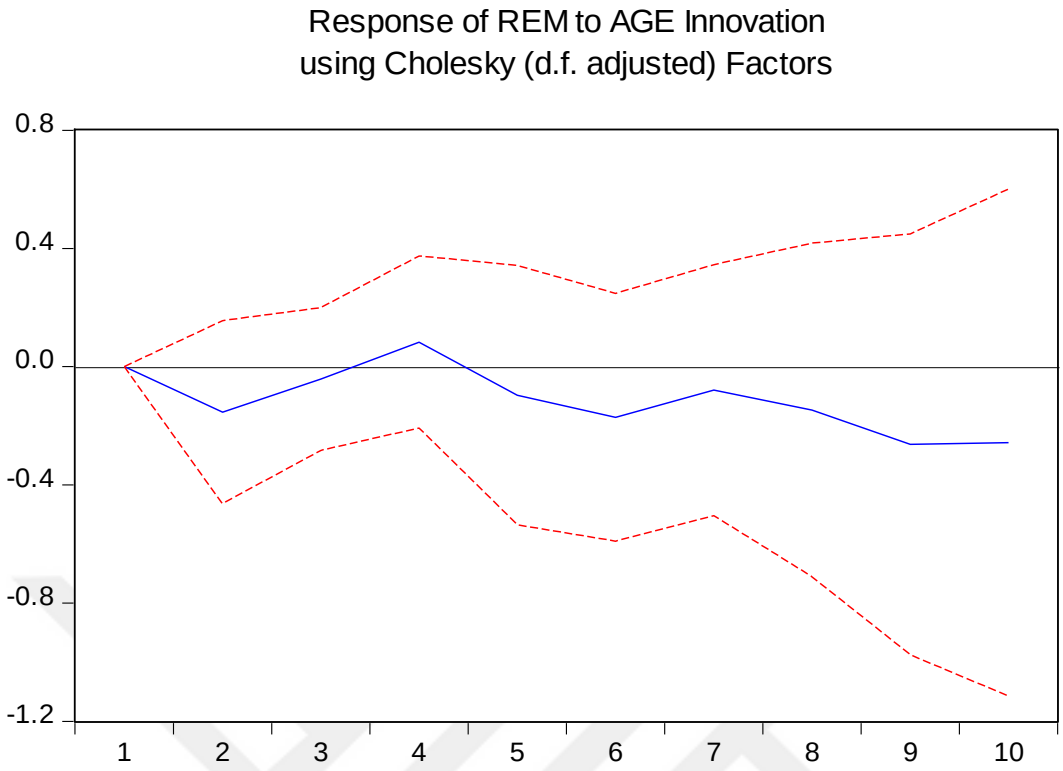

Figure 9 : Responses of REM to S.D Innovations in AGE

Source: Author's computations using EVIEWS 10. S.D means standard deviation

From the results in figure 3, a one standard deviation innovation to REM leads to a sharp decline response of REM from period one (1) until period three (3). From periods 3 to 5, the response increases and hits the steady state in period 4. From period 5 to 6, REM's response falls into the negative region. From periods 6 to 7, there was no noticeable change in the response. It starts rising again from period 7 unto period 8. From period 8 to 9, there was no observable change in the response. From period 9 to 10, the response falls howbeit in the positive region. Thus, it can be concluded that a standard deviation shock to REM will lead to both negative and positive responses of REM in the long and short runs.

In figure 4, a one standard deviation shock to GDP, there is no observable response of REM in periods 1 to 2. From periods 2 to 3, the response starts increasing but falls sharply to the negative zone from periods 3 to 4. From period 4 to 6, it rises again unto the positive region and attains a steady state in period 5. From periods 6 to 7, it declines sharply. From 7 to 9, it continuously rises and reaches a steady state in period 8. From periods 9 to 10, the response falls again albeit in the positive region. It can be concluded that a one

standard deviation innovation to GDP leads to mixed responses of REM. Thus, it would be quite useful for policymakers to be aware of these dynamics to formulate good economic growth-related policies that would boost remittances in the country.

In figure 5, a one standard deviation innovation to BM leads to no noticeable changes in REM's response from periods 1 to 2. From periods 2 to 4, the response continuously declines in the negative region. From period 4 to 6, it gradually increases unto a steady state. From periods 6 to 8, it falls and starts rising from period 8 to 10. Thus, it can be concluded that a one standard deviation shock to broad money leads to a negative response of remittances in both the short and long runs.

In figure 6, one standard deviation to inflation (INF) leads to no noticeable change in REM's response from periods 1 to 3. From periods 3 to 4, the response declines. From periods 4 to 5, REM's response increases and attains a steady-state in period 5. From periods 5 to 6, there was no noticeable positive response. From period 6 to 8 it slowly decreases and falls in the negative region. From periods 8 to 9, it gradually increases and attains a steady state in period 9. From periods 9 to 10, there is no noticeable change in the response. Therefore, it can be concluded that a one standard deviation innovation to inflation on a whole leads to a greater negative than the positive response of personal remittances in the country.

Finally, in figure 7, a one standard deviation innovation to AGE results in a decline in the response of remittances from periods 1 to 2. From periods 2 to 4, remittances continuously rise, attains a steady state in period 3, and have the highest peak in period 4. From periods 4 to 6, the response drastically declines and falls in the negative region. From period 6 to 7, it rises albeit in the negative region. From period 7 to 10, the response continuously declines and remains in the negative region. Therefore, it can be concluded that a one standard deviation innovation to AGE on a whole has a greater negative than the positive response of remittances. This means that an increase in the age dependency ratio will lead to a decline in personal remittances for a greater period.

The graphs of the responses of the other individual variables in the system to one standard deviation innovation to their counterparts can be found in the appendix section.

4.6.7 Variance Decomposition

To determine the proportion of the shocks in the dependent variable that is accounted for by its own lagged values and individual independent variables, this study utilized the variance decomposition function also known as the Forecast Error Variance Decomposition. The results can be seen below:

Table 14 : Variance Decomposition of REM Using Cholesky (d.f adjusted) Factors

Period	S.E.	REM	GDP	BM	INF	AGE
1	0.695365	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.759942	95.87046	0.024543	1.46E-08	0.010588	4.094407
3	0.848977	89.08269	2.870408	4.487865	0.030707	3.528324
4	1.001450	68.39229	10.40202	16.52902	1.450413	3.226256
5	1.094876	66.14893	8.868852	19.98041	1.522466	3.479345
6	1.146801	60.97383	13.59389	18.23235	1.786324	5.413612
7	1.165284	59.57711	14.32511	18.56952	1.817001	5.711261
8	1.276554	57.03070	12.20532	22.88418	1.795839	6.083964
9	1.402763	53.82719	15.19262	20.83687	1.583575	8.559741
10	1.462797	50.10302	17.15519	20.24557	1.531942	10.96427
Cholesky Ordering: REM GDP BM INF AGE						

Source: Author's computation using EVIEWS 10.

From the results above, it can be observed that at the end of the third years, 89% of the forecast variance in remittances (REM) is explained by its own innovations, with BM, GDP, and AGE accounting for 4%, 2%, and 3% respectively. From the fourth to the tenth year, a significant percentage of the forecast error variance in personal remittances is accounted for by shocks in the other variables in the system – BM, GDP, AGE, and INF in descending order of magnitude.

At the end of the tenth year, 50% of the forecast error variance in personal remittances is accounted for by own innovations, with shocks to broad money, economic growth, age dependency ratio, and inflation accounting for 20%, 17%, 10%, and 1% respectively. It can be observed that shocks to broad money contributed the greatest percentage of

variation in personal remittances compared to the other variables in the system; the second, third, and last being economic growth, age dependency ratio, and inflation respectively. It is thus crucial for policymakers to understand these dynamics.

Finally, it can be concluded that economic growth (GDP) is the most exogenous of all the variables as 71% of its forecast error variance is explained by own innovations; second is broad money, as 53% of its forecast error variance is explained by own shocks; and third is personal remittances, as 50% of its forecast error variance is explained by its own shocks. The other two variables account for less than 30% of their forecast error variances (see the variance composition tables of the other variables in the appendix section).

CHAPTER 5: CONCLUSION AND POLICY RECOMMENDATIONS

5.1 Introduction

This chapter draws conclusion of the research and proffers policy recommendations for greater inflows of personal remittances in the country. It furthers suggests rooms for future research on the topic.

5.2 Conclusion

Personal remittance inflows are believed by many scholars to be of great significance for countries' economic development because they serve as additional resources for both government and individual households. This situation can however be only achieved if a favourable economic climate is facilitated by the receiving countries' governments. Against this background, seeks to study the macroeconomic determinants of personal remittances inflow and the causality between the determinants and personal remittance inflow in Sierra Leone in 1980 – 2018, a country blessed with abundant natural and mineral resources yet highly dependent on international capital inflows to achieve her development aspirations. This study is one of its kind in the history of the country and will thus serve as a foundation for future academic research and most importantly to inform macroeconomic policy decisions in the country.

To achieve the goal of this study, a combination of econometric techniques – Autoregressive Distributed Lag Model co-integration technique, unit root tests, Toda-Yamamoto Causality test, Impulse Response Function, Variance Decomposition, stability, and diagnostic tests – were employed using data from World Development Indicators on World Bank's website. The estimation results prove that real economic growth rate (GDP), broad money, and age dependency ratio exert negative significant impacts on personal remittances inflows in the country, whereas inflation does not significantly affect personal remittance inflows. Additionally, war and Ebola both exert negative significant effects on personal remittances inflows in the short-run, but in the long run, they have no effects on it. These results underscore the impacts of macroeconomic conditions on personal remittances in the country.

Furthermore, it can be observed from the coefficients of the independent variables in the long run that the age dependency ratio is the greatest determinant that impacts personal remittance inflows in the country. This means that, when the dependent population is higher than the working population, there will be fewer workers who can travel abroad to work and remit money back home, thus, a decline in remittances. Alternatively, a rising number of retirees as a proportion of the dependent population presents the opportunity for more pensions which could be used to undertake financial ventures and profit-making thus reducing the over-dependence on remittance inflows in the country. Broad money and GDP follow the age dependency ratio respectively in terms of their degrees of impact on personal remittances. Also, in the short run, war has greater negative effects on personal remittance inflows, followed by the Ebola virus disease.

Moreover, the Toda-Yamamoto Causality test proves there is a unidirectional causality running from economic growth (GDP) to personal remittances (REM) at a 5% statistical significance level, which means that an increase in GDP will result in a decrease in personal remittances inflow in the country. The test also proves that there is no causality in whatsoever direction between the other macroeconomic determinants and personal remittances. Additionally, the conducted Impulse Response function reveals that personal remittance response negatively to one standard deviation innovations in the other variables for most of the selected period. The Variance Decomposition reveals that at the end of the selected period, 50% of the variation in personal remittances can be explained by own innovations. It was also confirmed that the most exogenous variables according to their order of magnitude are: economic growth, broad money, and personal remittances.

In conclusion, it can be stated that personal remittances are received in the country based on the dual motives of pure altruism and pure self-interest. On the side of pure altruistic motive, people remit less when the country's GDP is high and more when it is low, hence the negative impacts of GDP on personal remittances in the long results. This is done to help cushion the negative effects of the economic crisis on the households left behind and less is sent when the economy is booming as the family will then have more income to take care of themselves. The same is the case of age dependency ratio whereby with many more dependents (especially more retirees) than the working class, there would be potential access to more pensions in the country, hence, workers abroad tend to remit less

as their household members have greater access to pensions, holding all other factors constant. Also, an increase in money supply in the country could present an opportunity for greater access to capital by household members, hence, based on the pure altruistic motive, workers will remit less as their household members do have access to finance to take care of their consumption or other expenditures and vice versa. On the other hand, workers would remit less money back home based on pure self-interest motive when there is an increase in broad money (increase in the money supply) which could lead to inflation and other investment uncertainties. The pure self-interest motive is also justified in the cases of war and Ebola which lead to investment risks and uncertainties; hence, workers would tend to remit less when there is an increase in these cases. The pure altruistic motive of personal remittance mentioned above is further justified by the Toda-Yamamoto causality test.

5.3 Policy Recommendations

Personal remittance inflow is a source of foreign capital that every country would want to exploit based on the fact it often has little or no conditionality attached as in the case of loans and other forms of international capital, and it is less volatile compared to the other forms of capital. This is so partly because whether there are crises, workers would still have to remit sometimes even more money home to take care of their families, a case of pure altruism. On the other hand, workers tend to remit more when they feel that there is a stable macroeconomic climate in the country for investment purposes. Thus, to ensure an increasing and sustainable inflow of personal remittances in Sierra Leone, the government should pursue macroeconomic policies that can boost economic growth and maintain inflation at a fair level that will ensure investment certainty in the economy. With these stable macroeconomic conditions, workers will remit more money home for investment purposes, and which will cancel out the negative impacts that could be caused by pure altruistic motives thereby ensuring sustainable remittance inflows and economic development.

5.4 Limitations and Further Research

Measuring personal remittance inflows has been a perennial challenge in the academic field. This is because many workers do remit money back home via informal channels, the exact value of which is impossible to be adequately captured. Ratha (2005) commented that about 50% of remittances flow through informal channels around the world. Against this backdrop, only data on officially reported remittances by the World Bank was used in this study which cannot give a complete picture of the inflows. This is the same with all studies around the world on remittances inflows. Thus, the findings of this study should be taken as a representative but not as complete information on personal remittances in the country. Additionally, personal remittance inflow can be affected by both domestic and foreign factors. However, this study only considered the domestic factors due to data inaccessibility for most of the foreign factors.

It is therefore suggested that future studies should focus on both the foreign and domestic factors that determine remittance inflows, consider other major domestic factors not already captured here, volatility in personal remittance inflows, and the impact of personal remittances on economic growth in Sierra Leone.

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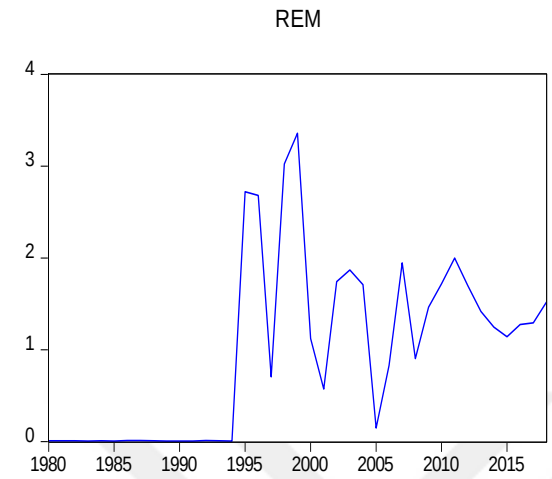
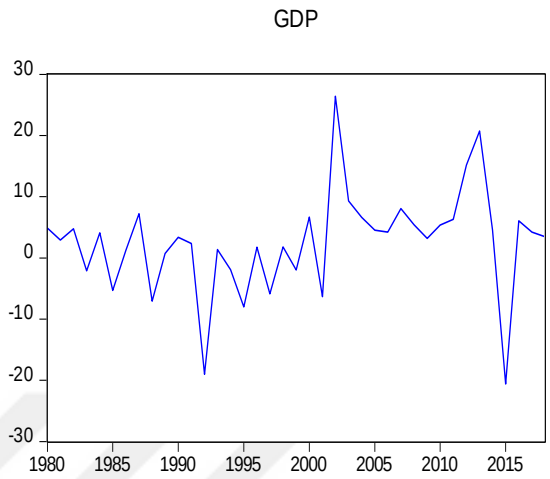
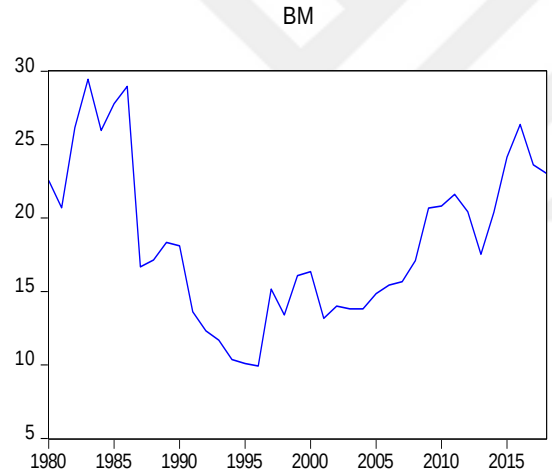
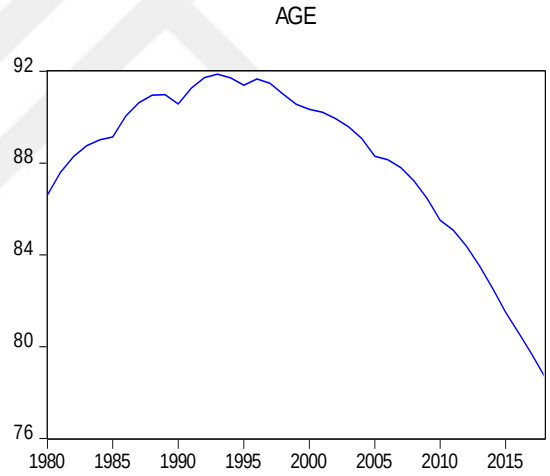
APPENDICES

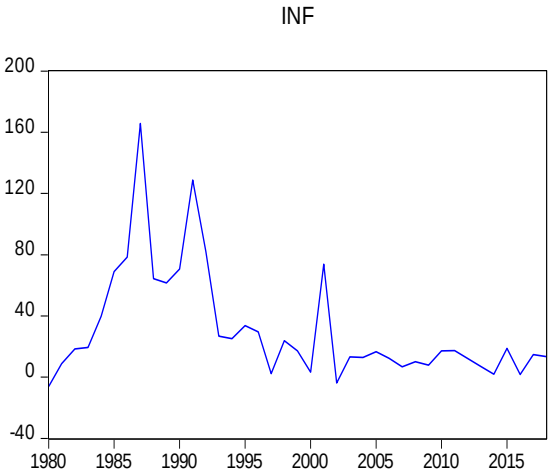
Time Series Graphs Of The Variables Under Study



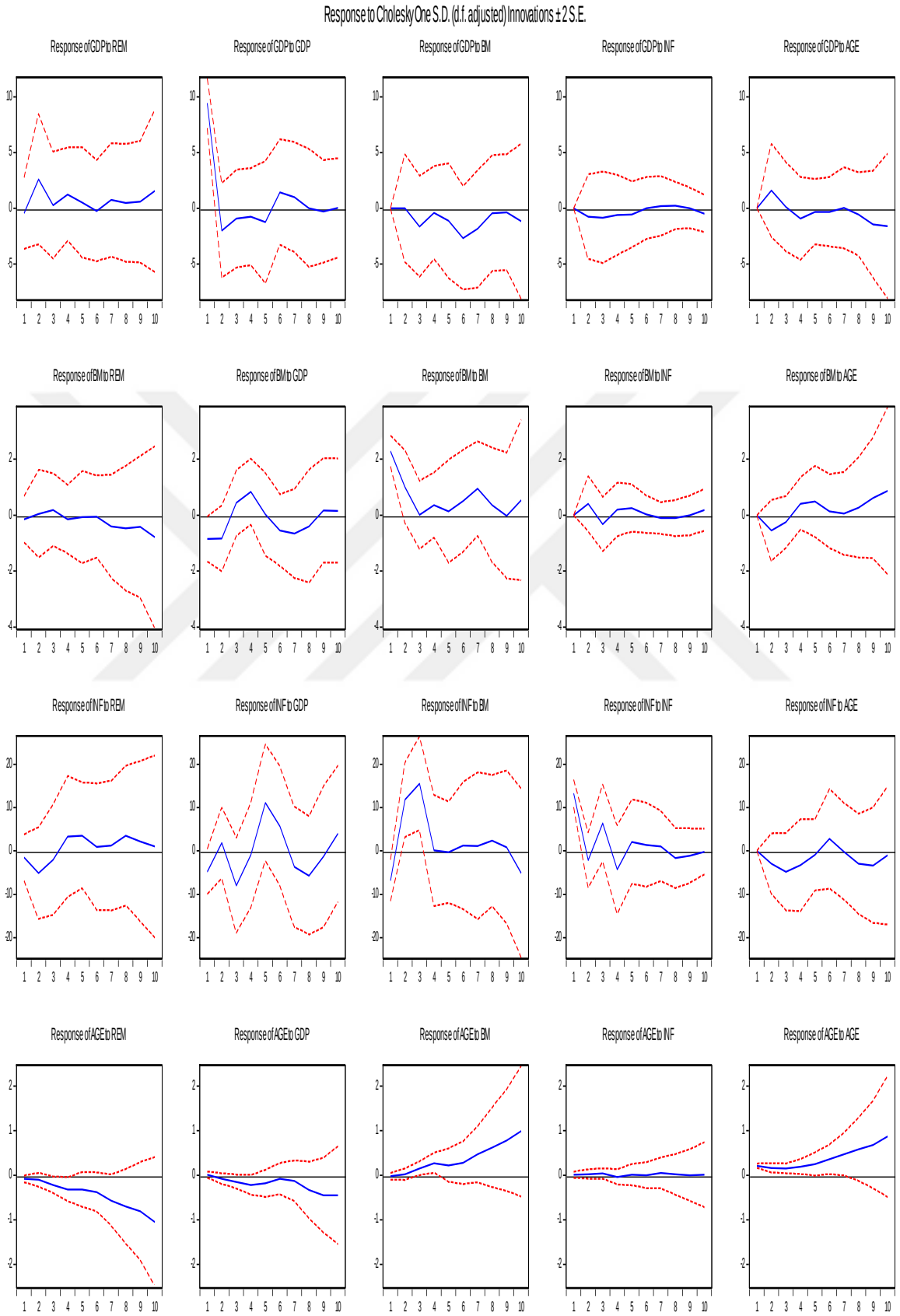








Impulse Response Functions Of The Other Variables



Variance Decomposition Of The Other Variables

Variance Decomposition of GDP: Period	S.E.	REM	GDP	BM	INF	AGE
1	0.695365	0.213184	99.78682	0.000000	0.000000	0.000000
2	0.759942	6.827530	90.12756	4.44E-06	0.539979	2.504923
3	0.848977	6.628645	87.37523	2.438721	1.140354	2.417048
4	1.001450	7.854203	85.11667	2.505191	1.422665	3.101270
5	1.094876	7.855037	83.88238	3.516721	1.651820	3.094046
6	1.146801	7.299390	79.23569	9.005551	1.526398	2.932970
7	1.165284	7.447233	76.91503	11.31507	1.502017	2.820656
8	1.276554	7.574028	76.45553	11.38950	1.543842	3.037096
9	1.402763	7.682743	74.99387	11.26551	1.513506	4.544368
10	1.462797	9.060366	71.48069	11.70211	1.598456	6.158384

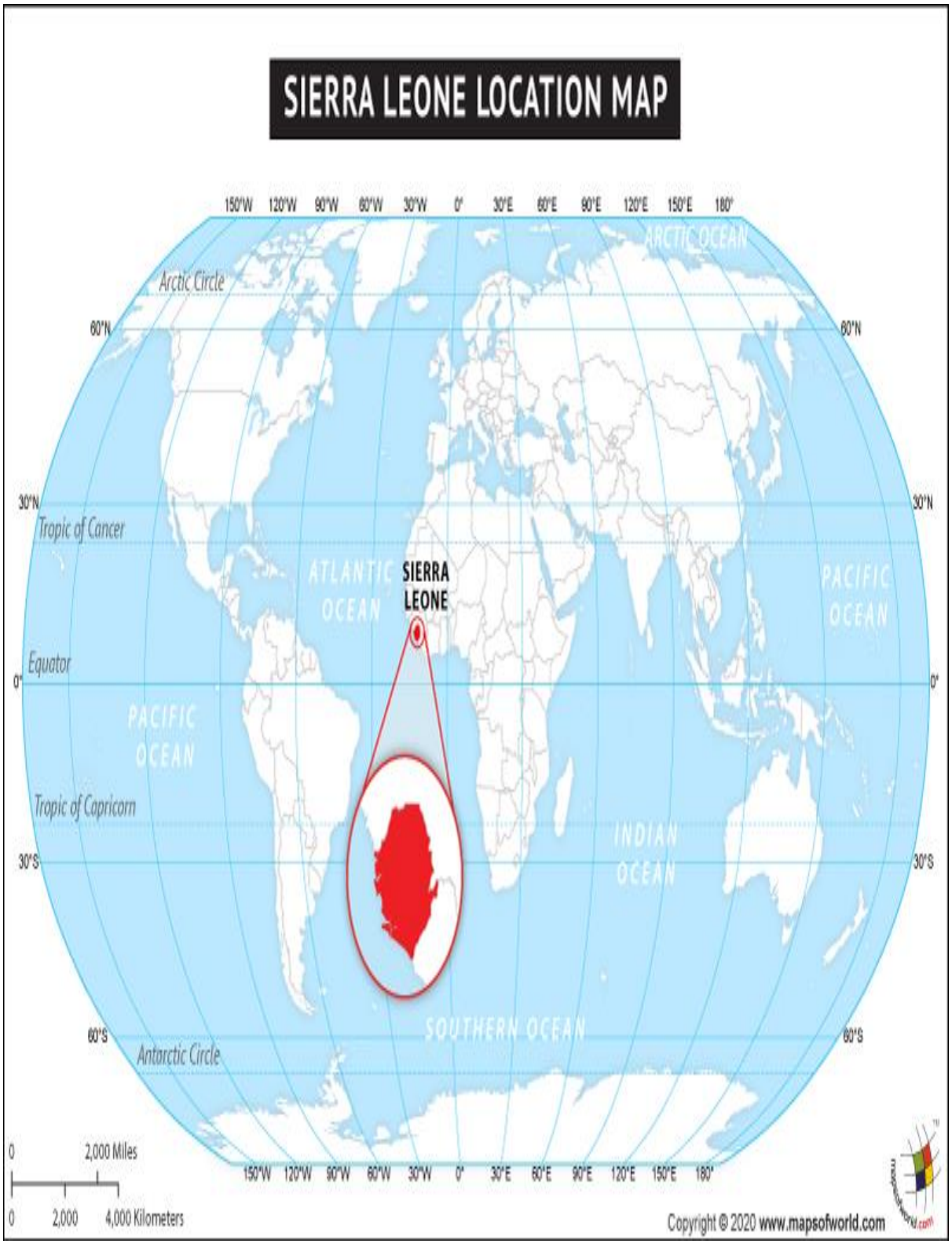
Variance Decomposition of BM: Period	S.E.	REM	GDP	BM	INF	AGE
1	9.438409	0.343787	12.16758	87.48863	0.000000	0.000000
2	10.14932	0.282517	17.37772	76.63425	1.995423	3.710091
3	10.35526	0.707970	18.79028	73.13447	3.140605	4.226682
4	10.52315	0.857743	24.03458	66.36078	3.217159	5.529743
5	10.68741	0.884809	23.26767	64.38303	3.739900	7.724595
6	11.11810	0.866575	24.77320	63.32663	3.546348	7.487252
7	11.34024	2.063831	25.24148	62.90027	3.201556	6.592864
8	11.37430	3.670715	25.36534	60.97134	3.134057	6.858545
9	11.48883	4.866613	24.45402	58.28713	2.996585	9.395652
10	11.76784	8.432391	21.79573	53.55293	2.872300	13.34665

Variance Decomposition of INF: Period	S.E.	REM	GDP	BM	INF	AGE
1	2.454425	0.872841	9.129465	18.56028	71.43741	0.000000
2	2.863486	6.497400	6.061169	43.19876	42.21054	2.032131
3	2.931204	3.977428	11.02437	53.27627	27.77151	3.950419
4	3.109368	5.091705	10.58117	50.69513	28.60974	5.022261
5	3.160968	5.643692	21.62022	43.40403	24.95756	4.374494
6	3.250266	5.492165	23.81902	41.66126	24.06522	4.962332
7	3.472330	5.546811	24.69884	41.09087	23.78283	4.880655
8	3.556350	6.363696	26.21907	39.31553	22.69820	5.403499
9	3.637417	6.687593	25.92580	38.70660	22.41238	6.267633
10	3.867024	6.528358	26.32161	39.46705	21.56660	6.116378

Variance Decomposition of AGE: Period	S.E.	REM	GDP	BM	INF	AGE
1	15.74699	12.85403	0.358799	0.960348	0.136735	85.69008
2	20.73436	17.20996	6.809413	0.906530	0.717699	74.35640
3	28.33432	29.61504	12.75344	11.75599	0.995843	44.87969
4	29.04723	34.36670	15.73980	21.32193	0.772483	27.79909
5	31.39578	36.68224	14.74412	20.92153	0.516003	27.13611
6	32.10427	37.98563	10.43015	21.24707	0.346736	29.99042
7	32.37612	39.07633	6.931827	24.39402	0.362851	29.23497
8	33.31217	38.09410	7.546178	26.50768	0.227470	27.62457
9	33.60228	36.41455	8.559166	28.51085	0.141544	26.37389
10	34.25563	36.26676	7.847048	29.87637	0.091135	25.91868

Cholesky Ordering: REM GDP BM INF AGE

Sierra Leone On The World Map



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