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Abstract

Despite the established link between oil rent fluctuations and remittances received, its plausible joint effect on economic growth in Sub-Saharan Africa (SSA) remains unexplored. To fill this gap, first we determine whether natural resource rent (composed of oil rent, forest rent and natural gas rent) reduces economic growth in SSA. Second, we examine whether positive macroeconomic signals such as remittances mitigate the negative effect of oil rents on economic growth in a sample of 43 SSA countries spanning 1990-2017. We employ the pooled ordinary least squares, fixed-effects and random-effects, and generalized method of moments. The resulting empirical evidence established are; (1) There is a positive impact of forest rent on economic growth whilst oil rent and natural gas rent have a negative impact on economic growth. (2) There is a positive marginal and net effect on economic growth from the interaction between remittances and oil rent. Also, the unconditional effect of remittances on growth is positive. We further perform a threshold analysis to establish a critical ground that could also influence economic growth positively. This threshold is crucial because above these critical mass remittance inflows mitigate the negative incidence of oil rent on economic growth and below the threshold negative oil rent on growth is completely nullified. This is relevant for policy implications because policy makers are provided with actionable levels of remittances which are easily attainable in sampled countries

Keywords: Remittances, Natural resource rent, oil rent, Economic growth, Sub-Saharan Africa.

1.0 Introduction

The presumption of this study on the salient role of remittance inflows mitigating negative effect of oil rent on economic growth in Sub-Saharan Africa is motivated by three main fundamentals in ranked journals and policy literature, particularly: (1) the relevance of remittance inflows on economic growth; (2) the negative effect of natural resource rent on economic growth; (3) gaps and contributing literature on the linkages between remittances, oil rent and economic growth. The underpinning elements of the motivation triggering the focus of the study are elaborated below.

First, with respect to the goal of every country to achieve high rate of sustained economic growth remittances as an international aid is one of the largest financial inflows to developing countries after foreign direct investment (Aggarwal, *et al*., 2011). According to the Migration Policy Institute (2019), remittances have been the most stable source of external finance in the developing world. Based on recent information, inflows to remittances projected are likely to exceed foreign direct investment (FDI) and Official Development Assistance in sub-Saharan Africa (World Bank, 2019) which has been visualized in figure 1. The growth-inducing effects of remittances in the developing world cannot be overemphasized. For example, the share of remittance inflow in Africa's GDP reached 2.6 per cent in 2009 (Population Reference Bureau, 2012), rising significantly to 10 per cent in 2018. Further, remittances have been highlighted as a key source of economic growth in the developing world (Feeny *et al.*, 2014; Chowdhury, 2016; Meyer & Shera, 2017; Eggoh *et al*., 2019; Sobiech, 2019). Remittance inflows also affect economic growth through various pathways like investment (Guiliano and Ruiz-Arranz, 2009) and governance (Adams and Klobodu, 2016). Despite the positive trend in remittance inflows to Africa, it declined by at least 23.1 per cent in 2020 following the coronavirus (COVID-19) disease (World Bank, 2020c) and Orozco (2020) proving that the amount migrants' remit to their home country have been reduced in 2020. However, remittance inflows can have an adverse effect on economic growth (Chami et al., 2005; Karagoz, 2009; Koyame-Marsh, 2012) but IMF (2005) Ahamada & Coulibaly (2013) posit that the impact of remittances on growth is statistically null.

Second, natural resources have an adverse impact on economic growth in developing country specifically Africa as a result of the resource curse (Tiba, 2019). On the other hand, natural resource rent has not been recognised as a driver of economic growth in SSA from the

past. Since, the Dutch disease[1] lead to the most common economic reasons of resource curse which resulted to a fall in GDP growth (Sachs & Warner, 1995) but oil and natural resources foster growth indirectly through foreign direct investment and portfolio investment (Akinlo, 2012); through institution quality (Arezki and Van der Ploeg, 2010; Abdulahi *et al.*, 2019; Epo and Faha, 2020). On the contrary studies by Ogbonna and Ebimobowei, 2012; Olayungbo, 2017; Olayungbo, 2019) show a positive impact of resource revenue on growth.

Third, the contribution to literature motivating our study can be elaborated in two folds, possibly; studies on economic growth and resource revenue have focused on institutional quality and other financial inflows as pointed above. On one hand, related literature has established the fact that resource revenue and remittances increase growth and remittances, and oil prices are connected (Makhlouf and Kasmaoui, 2017; Zahran, 2019). These studies focused on the unconditional effect, conditioned by financial inflows and employing time series data. However, this classical approach does not account for financial inflow such as remittances and do not account for thresholds which can help in policy implications. Hence the relevant of our study rests on these gaps pointed above by investigating remittances, natural resource rent and economic growth. To the best of knowledge studies have not been explored or few existing studies on the joint effect of remittances and natural resource rent on economic growth in SSA.

The paper fills and contributes to extant literature on the importance of remittances on economic growth. More particularly, (1) Unconditional impact to remittances on growth (Eggoh *et al*., 2019; Sobiech, 2019) (2) the effect of natural resource rent on growth (Epo and Faha, 2020; Olayungbo, 2019). (3) Channels through which remittances affect growth (Adams and Klobodu, 2016). Eliminating natural resource curse (Tiba, 2019).

The study widens the above stream of literature by examining policy thresholds at which remittances can complement negative oil rent on growth in SSA. In other words, we seek to investigate the role of remittances in modulating the negative effect of oil rent economic growth. The concept of threshold represents the minimum requirements in remittances need to achieve economic growth with oil rent. In order to initiate policies that require less effort for policy implications. Our empirical approach is diverse in several ways. First, we explore the unconditional effects of remittances and natural resources rent on economic growth by using the Generalized System Method of Moments (SGMM), which

[1] The Dutch disease describes an economic phenomenon when natural resource boom causes an increase in domestic income and demand of goods. This increase often generates an inflation and appreciation of the domestic currency. The Dutch disease is a situation where an increase in discovery of natural resources in one sector of the economy results in a negative effect on the country's overall economy.

controls endogeneity, biases and unobserved country heterogeneity. Second, we determine the indirect pathway effect of oil rent to economic growth through remittances in SSA by constructing a panel data of 44 SSA countries from 1990-2017. The study was limited to these periods due to availability of data.

The rest of the study is organised as follows. The next section presents the review of relevant literature on remittances, natural resources and economic growth. Section 3 describes the data and methods underpinning the study. Section 4 presents the results and discussions of findings. Section 5 concludes with some policy implications.

2.0 Literature survey on remittances on economic growth

The link between remittances and economic growth has gained attention over the past years. The literature identifies several pathways through which remittances can potentially impact economic growth. Remittances enhance economic growth through channels like consumption, financial development, investment and governance neglecting natural resources. For example, a survey of literature up to date shows some conflicting findings plausibly due to differences in methodological focus and study settings. There are several empirical and theoretical evidence that remittances improve economic growth. Guiliano and Ruiz-Arranz (2009) use a dataset of more than 100 developing countries from 1975-2002 and concluded that remittances improve economic growth in countries which are less financially developed. In the same way Sobiech, (2019) concludes that the remittances positively affect only when the financial sector is not advanced using 203 countries and data from 1960-2011 and employing SGMM. The positive impact of international remittances points out key multiplier effect of consumption and the enhancement of financial institutions which use remittances as; foreign exchange, remittances payments as well as debt that improves individual credit constraint in countries with absence of micro-financing. Adams and Klobodu (2016) found no relationship between remittances and economic growth for 33 SSA countries over the period 1970-2012 using the SGMM estimation technique. The study further shows that the remittances enhance growth with stable governance by investigating the joint effect of remittances and regime durability and democracy on economic growth.

In the same way, Peprah *et al.* (2019) also use macro data for from 1984 to 2015 on remittances and financial development from Ghana to analyse the effect of remittances and financial development on growth and conclude that the combined effect of financial development and remittances is greater than their direct effect using the ARDL estimation technique.

Looking at the unconditional effect of remittances on growth, a study conducted by Meyer and Shera (2017) using 6 panel data of developing countries in Europe from 1999 to 2013 covering 39 developing countries show that remittances have a positive impact on growth employing the fixed and random effect for estimation. In a more recent paper, Chowdhury (2016) uses a panel data from1979-2011 and generalized method of moments of top 33 remittance receiving developing countries to state that remittances significantly affect economic growth without financial development inducing growth. Considering a study Eggoh *et al*. (2019) using a panel sample of 49 developing countries from 2001-2013 and employing Panel Smooth Transition Regression, difference and SGMM to conclude that remittances have a positive effect on economic growth. In addition, Feeny *et al*. (2014) uses a sample dataset of 136 Small Island Developing States (SIDs) data spanning 1971-2010 by finding that remittances is positively associated with growth to SIDS using GMM.

On the other hand, Chami *et al.* (2003) use a dataset of 113 large countries over the period 1970 to 1998, provide a convincing evidence of a negative effect of remittances on economic growth using panel estimation techniques. Similar results are found by Ahmed (2010) using a time series data for the period 1995-2006 in Bangladesh. This evidence is also corroborated by that of Karagoz (2009) using a time series data over the period 1970 to 2005 in Turkey. For instance, Koyame-Marsh (2012) further argues that workers' remittances have a significant negative effect on real output growth in Benin only. The study uses a time series and panel analysis from 1976 – 2007 for each of the chosen countries ((Benin, Burkina Faso, Cote D'Ivoire, Gambia, Ghana, Mali, Niger, Nigeria, Senegal, and Togo) but workers' remittances do not stimulate growth in the rest of the countries.

A study conducted by IMF (2005) conclude that there is no link between remittances and per capita output growth over an extended period (1970-2003) for 101 developing countries. Also, Ahamada and Coulibaly (2013) use a yearly data spanning 1980-2007 to show that there is no causality between remittances and economic growth. So, we show the trend of remittance inflow as a percentage of GDP growth in SSA over the study period in figure 1 and figure 2.

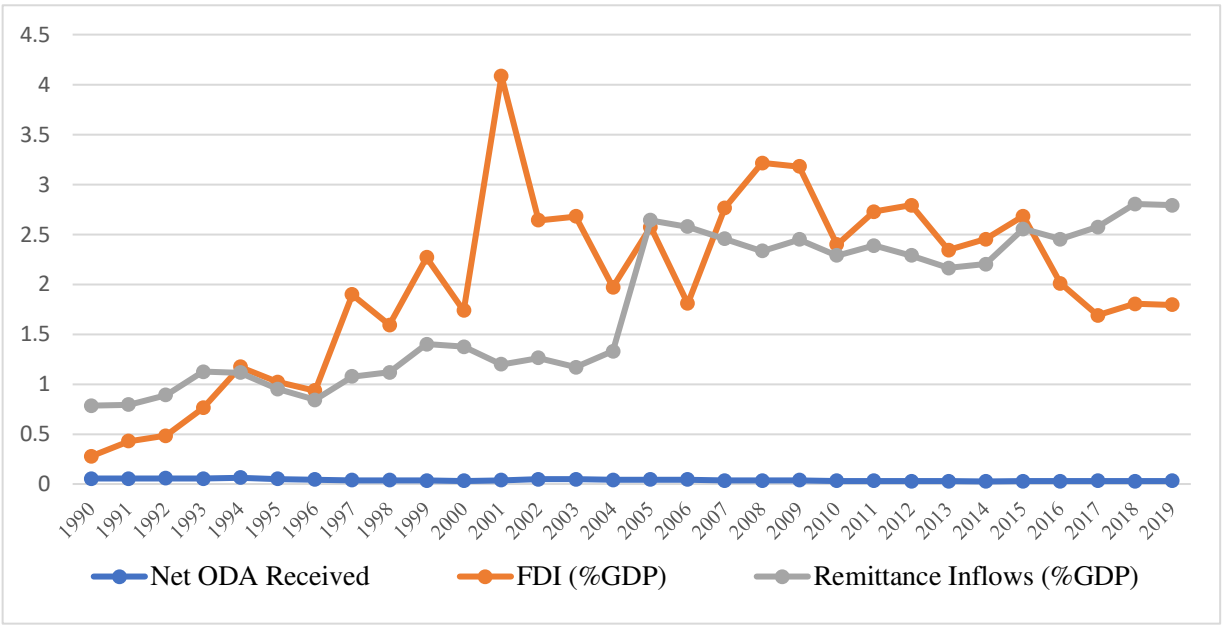

Figure 1: Trend of FDI, Remittances and ODA inflows in SSA, 1990-2019

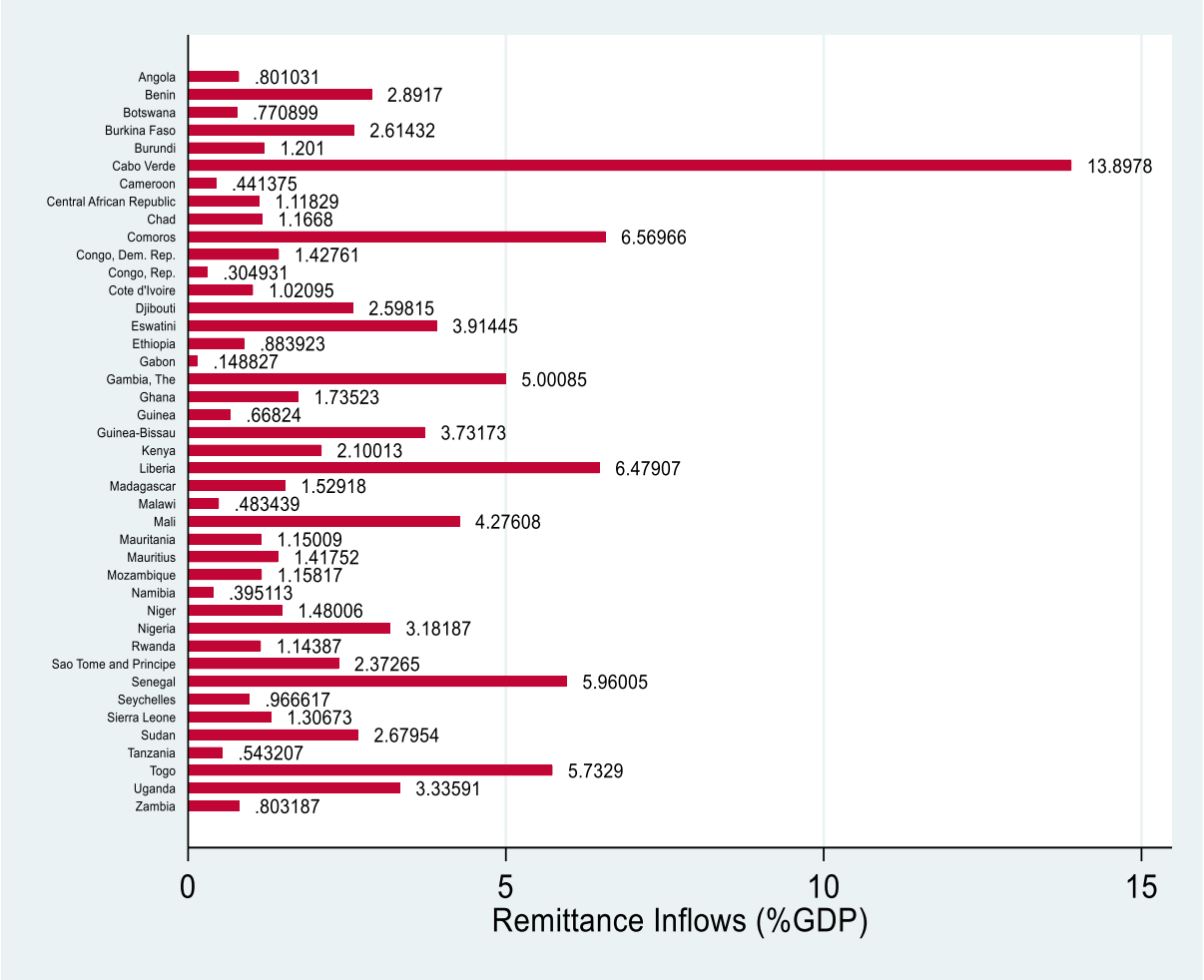

Figure 2: Within-Country remittances inflow (Average) in Sub-Saharan Africa, 1990-2017

The figure shows that from 1990 to 2017, countries like Cabo Verde, Comoros, Liberia, The Gambia, Mali and Togo have the highest average remittances from 1990 to 2017. Remittance inflows to SSA would be expected to drop by over 7 percent in 2020. Within the region, migrant's workers based in Cabo Verde is the largest sender of remittances in 2017 followed by Comoros, Liberia, Gambia, Mali and Togo while Congo Republic, Gabon, Namibia, Malawi and Tanzania all received remittances inflows to GDP lower than 5% in 2017. According to Allen (2021) countries with lower macroeconomic level of remittances can have a large share of households that rely on these flows. Further, Other studies show that remittances are spent on consumption, investment in physical and human capital which have played a key role in development and growth (Grupta *et al*. 2009).

2.1 Natural resources-economic growth nexus

The debate on the effect of natural resources on growth is ambiguous. One strand of the literature points to strong and durable growth effects of natural resources like in the case of Qatar and Saudi Arabia. Another strand of literature argues on grounds of the resource curse or Dutch disease as evident in countries such as Congo DR. and Central African Republic. For instance, a study conducted by Tiba (2019) show that oil rent has an adverse effect on economic growth supporting studies on resource curse using 12 oil exporting countries spanning 1990-2015 by hiring the panel smooth transition model for estimation.

However, Sachs and Warner (1995) from their empirical result show that there is an inverse relationship between natural resource and economic growth. A survey undertaken by Asekunowo and Olaiya (2012) posit that the link between oil revenue and economic development in Nigeria is uncertain due to the Dutch disease. The study employs a multivariate vector and auto regression model with data from Nigeria spanning 1974 to 2008.

A recent study conducted by Arezki and Van der Ploeg (2010) postulate that the adverse effect of the natural resource curse on economic growth can be converted as blessing for countries with existence of good institutions and open to trade. The study uses OLS and instrumental variable estimates and a cross-country data relying on seminar paper by Sachs and Wachs spanning 1965-2000. In addition, Abdulahi *et al.* (2019) highlights resource rent has a positive impact on growth till a certain threshold and resource curse starts to affect growth negatively using institutional quality as a threshold variable. The study employs a SGMM estimation techniques and a panel data from 1998-2016 of 13 resource rich countries in SSA. In the same way, Epo and Faha (2020) investigate the impact of institutions between natural resources and economic growth. The study makes use of a panel data of 44 African

countries over the period 1996-2016 and system dynamic panel-data instrumental regression and panel smooth transition regression to show that the effect of natural resource and economic growth significantly restore when we inculcate quality rule of law regulations.

On the contrary, Ogbonna and Ebimobowei (2012) show that there is a positive relationship between petroleum income and Nigeria economic growth using a time series data spanning 2000 to 2009 and a simple regression model. Similarly, Olayungbo (2019) applies the Bayesian time-varying parameter model using a cross sectional regression yearly data from 1970-2015 in Nigeria to conclude that oil revenue export has a positive and significant impact on economic growth and thus Nigeria is known to be a resource dependent economy. Further, Hao *et al*. (2019) finds that there is a positive relationship for forest resources and a more balanced growth using a panel data with 30 provinces from 2002 to 2015 and GMM considering the basis of the environmental Kuznets curve hypothesis (EKC). A recent study by Cavalcanti and Raissi (2011) argue that oil abundance positively improves economic growth using an heterogenous panel data over the period 1980-2006 and 53 oil exporting and importing countries employing Common Correlated Effects type estimators and OLS.

These literatures show that natural resources are in a way related with economic growth and through possible channels even though there are diverse conclusions due to their sample size, methodology and empirical methodology adopted. However, since both remittances and oil revenue have an impact on growth, we can find out whether countries with higher remittances can decrease the negative effect of oil revenue on growth. So, this study contributes to this stream of literature by looking at the unconditional impact of remittances and natural resource rent on growth and further combining the natural resource revenue (oil rent) and remittances in the analysis. Looking at their potential joint effect on economic growth controlling for country and time fixed effects. Figure 3 presents the average of oil rent, forest rent and natural gas rent in SSA over the study period.

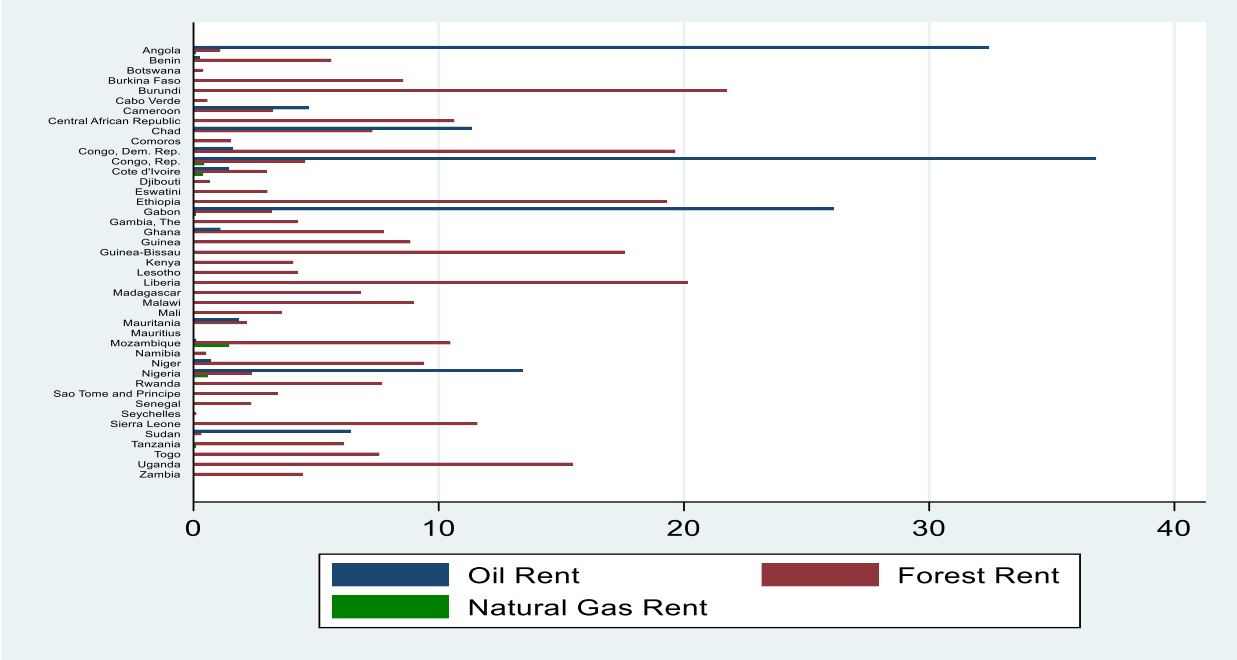

Figure 3: Within-Country natural resource rent (Average) in Sub-Saharan Africa, 1990–2017

Figure 3 suggests that oil revenue has the highest average from 1990 to 2017. With countries like Congo Republic, Angola, Gabon, Nigeria and Sudan being the highest performers as compared to the rest of the countries.

2.2 Relationship Between Remittances and Oil: A brief review

Literature shows that much attention have not been paid to remittances and oil in SSA. Most studies that have looked at the unconditional effect remittances and oil are normally on the relationship between remittances and oil prices in Gulf Cooperation Council (GCC) Countries. Like, De *et al.* (2019) use OLS, FE and RE to show that oil prices and remittances move in the same direction and non-GDP oil is a key determinant of remittances in GCC countries. This same direction of oil and remittances could potentially be caused by better economic performance of the GCC countries. Also, a study by Zahran (2019) in Egypt over the period 1960-2016 shows that remittance inflows have various responses to oil price shocks as well as a pro-cyclical relationship. Implying that more than one-half of those remittances received from GCC countries where real economic growth is very pro-cyclical with oil prices. In the same way, Makhlouf and Kasmaoui (2017) uses a static and dynamic regression with dataset spanning 2004-2010 in Morocco to argue that remittances react positively to increase in oil prices. However, a sharp increase in oil prices, raise the amount of oil to be exported which may increase oil revenue. So, an increase in oil prices

simultaneously increase oil export and remittances inflows thus there is a potential for oil and remittances to affect growth (see, Daly, 2020).

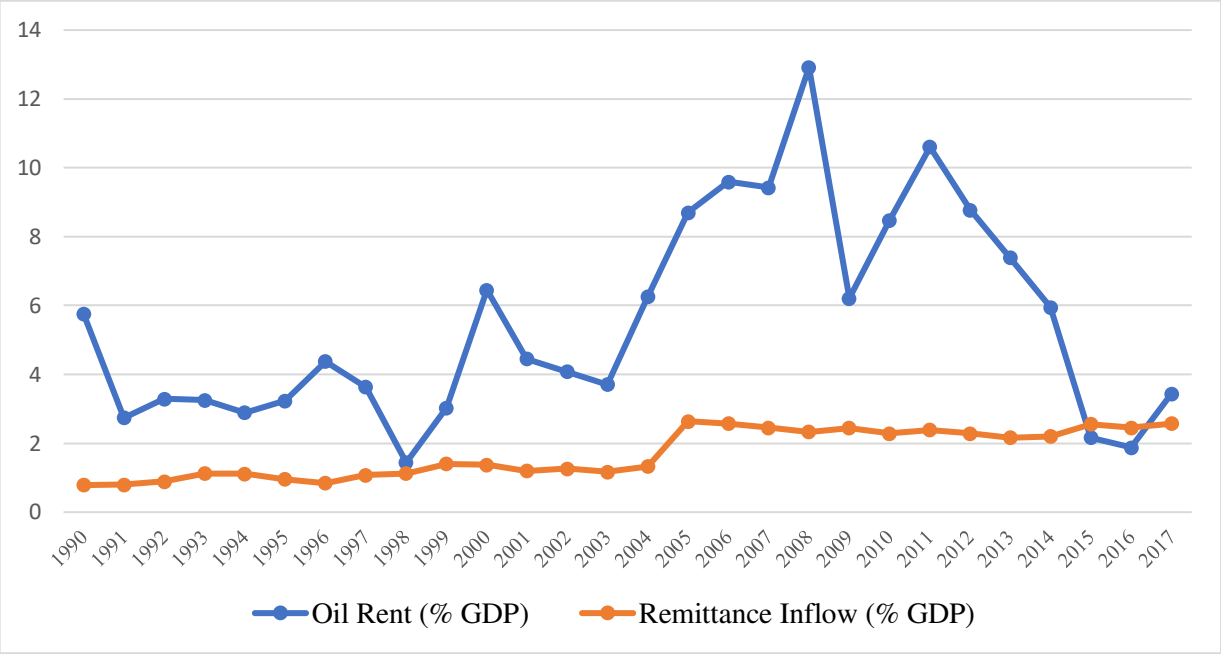

Figure 4: Trend of Oil rent and Remittance's inflows in SSA, 1990-2017

From these studies we observe that the authors do not consider the impact of remittances through oil revenue on economic growth. Since if there exist a relationship between remittances and oil, they can be a possible pathway to improve growth or not. This paper contributes to this extant literature by looking at the single effect of remittance and natural resource revenue on economic growth. In addition, combining the oil rent and remittances in the analysis to determine their potential joint impact on economic growth, controlling for country, time fixed effects and potential endogeneity.

From the review of empirical literature, we observe that the effect of remittances and natural resource on economic growth is influenced by heterogeneity of cross-section units' overtime, potential endogeneity problems, observed and unobserved country specific effects and unbiased estimation issues. Further, studies that use time series data suffer with generalization from single studies, difficulty in identifying appropriate measures as well as correct model to represent the data. The study fills the gap in most studies by controlling for all these factors in our analysis. In addition, oil rent of the natural resource revenue environment in Sub-Saharan Africa countries is considered since most studies that have looked at economic growth and remittances concentrate on the joint effect between consumption, investment, trade, financial development and governance but have neglected the joint effect of remittances and natural resource revenue focusing on oil rent on economic

growth, which can be a very salient factor in policy implications (see, Appendix section for summary of review). The data and empirical methodology used are described in the next section. Appendix C and D summarize the previous studies that are mostly based on the impact of remittances on economic growth, Natural resources revenue and oil on economic growth (see, appendix C&D). Finally, we build the following hypothesis from the literature review.

2.3. Hypothesis

The Hypothesis of the study is as follows:

H1: Remittances and natural resources rent have an impact on economic growth.

H2: Remittances mitigate the negative effect of oil rent on economic growth

3.0 Data and Methodology

3.1 Data

We use a panel dataset over the period 1990 to 2017 for 44 SSA[2] countries. The choice of the study period is due to the availability of data. The choice of the study setting is because the countries are largely homogeneous in that their rates of growth and remittances are likely to be driven by similar factors (Coulibaly, 2015). We proxy the dependent variable, economic growth, by real GDP per capita growth (see, Guiliano and Ruiz-Arranz, 2009). Together with remittances, oil rent, forest rent and natural gas rent, the data on GDP per capita are drawn from the World Bank's and World Development Indicators (WDI). Further, we control for macroeconomic stability using inflation, capital (proxied investment), labour supply (proxied by labour participation rate), foreign direct investment, and financial deepening. We capture natural resources as one of our variables of interest composed of forest rent, natural gas rent, and oil rent. We use natural resource rent (% of GDP) as a measure of natural resources revenue (Bjorvatn *et al*. 2012; Arezki & Brückner, 2011). The other variable of interest is remittances captured as net inflow of remittances as a share of GDP (Peprah *et al.* 2019; Feeny *et al.* 2014). The description of the variables and the data sources are provided in Appendix A.

[2]Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Congo, DR., Congo, Cote d'Ivoire, Djibouti, Eswatini, Ethiopia, Gabon, The Gambia, Guinea, Ghana, Guinea Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Sudan, South Africa, Tanzania, Togo, Uganda, Zambia.

3.2 Theoretical and empirical model specifications

3.3 Theoretical model

The theoretical background of this paper rest on the neoclassical Solow-growth (1956). The analysis and explanation of economic growth determinants has always been a key issue in economics. However, the traditional focus on quantitative changes in inputs (labour and capital) and the improvement of technologies (APF) must be considered. The APF which captures the connections between output and inputs used in production (Peprah *et al*., 2019). The study specifies the APF model as:

$$Y_{it} = A_{it} f(K_{it} L_{it}) \quad (1)$$

Where Y_{it} is GDP per capita growth in country i at time t, K_{it} denotes capital in country i at time t; L_{it} denotes labour country i at time t; and A is the Total Factor Productivity (TFP) defined as the covariates of foreign direct investment, natural resource rent, inflation, remittances, and financial deepening in SSA as:

$$A_{it} = f(FDI_{it}, REM_{it}, NATRENT_{it}, FINDEP_{it}, INFL_{it}) \quad (2)$$

Incorporating equation (2) into equation (1) we obtain the model as:

$$Y_{it} = f(FDI_{it}\ REM_{it}\ NATRENT_{it}\ FINDEP_{it}\ INFL_{it} K_{it} L_{it}) \quad (3)$$

Modelling equation (3) in econometric form we obtain:

$$Y_{it} = \beta_o + \beta_1 K_{i,t} + \beta_2 L_{it} + \beta_3 REM_{it} + \beta_4 NATRENT_{it} + \beta_5 INDEP_{it} + \beta_6 INFL_{it} + \beta_7 FDI_{it} + \varepsilon_{it} \quad (4)$$

3.4 Empirical model

In line with the theoretical model, we incorporate panel specifics and log-transform equation (4) to obtain equation (5):

$$lnY_{it} = \beta_o + \alpha_1 lnY_{i,t-1} + \beta_1 lnK_{i,t} + \beta_2 lnL_{it} + \beta_3 lnREM_{it} + \beta_4 lnNATRENT_{it} + \beta_5 lnFINDEP_{it} + \beta_6 lnINFL_{it} + \beta_7 lnFDI_{it} + \theta_t + \rho_i + \varepsilon_{it} \quad (5)$$

To capture the joint effect of remittances and oil rent, equation (5) is modified to obtain equation (6)

$$lnY_{it} = \beta_o + \alpha_1 lnY_{i,t-1} + \beta_1 猛nK_{i,t} + \beta_2 lnL_{it} + \beta_3 lnREM_{it} + \beta_4 lnNATRENT_{it} + \beta_5 lnFINDEP_{it} + \beta_6 lnINFL_{it} + \beta_7 lnFDI_{it} + \beta_8 ln(OILRENT_{it} \times REM_{it}) + \theta_t + \rho_i + \varepsilon_{it} \quad (6),$$

Where Y_{it} denotes the current GDP per capita growth in country i over time t captures the years; $Y_{i,t-1}$ is lagged economic growth; K is investment; L is labour participation rate; i captures countries; t captures the years; $NATRENT$ captures oil rent, forest rent and natural

gas rent, which are introduced step wisely in all models; $oilrent$ is oil rent; REM captures remittances received as a share of GDP; $FINDEP$ is financial deepening; $INFL$ captures inflation; FDI is the foreign direct investment θ_t is the time specific effect; ρ_i is the unobserved country-specific fixed effect; ε_{it} is the error term; ln is the natural logarithm; and $(OILRENT_{it} \times REM_{it})$ captures our hypothesized pathway of oil rent and remittances. The empirical strategy is thus the exploration of the joint effects of remittances and oil rent on economic growth.

The empirical analysis of this study begins with the specification of bivariate models, testing the relationship between remittances, natural resources and economic growth. Next, we specify the baseline model to explore the effects of the control variables on economic growth. Finally, we introduce the interaction term between remittances and oil rent in the model. We first estimate equation (5 and 6) via the pooled least squares under the a priori expectations of $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_7, \beta_8 > 0 \; and \; \beta_6 < 0$. However, using OLS estimator of β's in the equations will yield unreliable and bias results because the lagged GDP per capita growth ($Y_{i,t-1}$) will be correlated with the error term due to the presence of individual effects. In addition, we have panel data that permits to account for country endogeneity and correlated errors. The endogeneity problem consists, for example, the possibility that there is a correlation between the observed remittances and natural resource rent variables and the unobserved country specific effect, thus the model can generate unreliable results. Also, using a fixed effect estimation is not unreliable because it captures fixed individual effects as well as country specific factors. On the contrary, there is another problem with the fixed effect since it does not account for the correlation between the transformed lagged GDP per capita growth and the transformed error term. According to Bond (2002) biases can be used to provide an indirect test of an estimator of the lagged dependent variable where the coefficient should be bounded below from the results of OLS and above from the estimates of fixed effect.

Nonetheless, applying the System Generalized Method of Moments technique proposed by Arellano and Bover (1995) will be the suitable approach to take account of these problems. Since it finds suitable instruments that are endogenous but not correlated with the error term. Also, introducing the unobserved country specific fixed effects (ρ_i) in the models is a major step forward in estimating the causal impact of remittances and other independent variables since they reduce potential endogeneity arising from time invariant and biasness which can affect the results. Further, the system-GMM estimator is employed since it

provides more instrument that can improve the efficiency of the data (Roodman 2009, p.86) and remittances and natural resource rent are not strictly exogeneous. Additionally, many gaps in the panel data for SSA countries are being reduced ((Roodman 2009b, p.104). Unlike the OLS, FE and RE estimation, the system-GMM do not require distributional analysis of any form (Greene, 2002). Finally, SGMM takes account of heteroscedasticity and autocorrelation within individuals but not across them.

Considering all these factors that can bias our results, we address it by the system-GMM. The net effects from the interaction terms of remittances and oil rent on growth from equations (6) are expressed in equations (7) and (8) as:

$$\frac{\partial(Y)}{\partial(REM)} = \beta_6 + \beta_7\overline{OILRENT} \quad (7)$$

$$\frac{\partial(Y)}{\partial(OILRENT)} = \beta_6 + \beta_7\overline{REM} \quad (8),$$

Where $\overline{OILRENT}$ is the mean of oil rent as a share of GDP and $\overline{REM}$ also denotes the average of remittances received over the study period. It is important to note that in evaluating the reliability of the estimates, several post estimation tests are conducted to test whether — First, there is presence of second-order serial correlation in the residuals or not; Second, whether our instruments are valid or exogenous; Third, whether the interaction terms are significant, and finally the overall model is significant.

4.0 Results and discussion

4.1 Descriptive statistic

Table 1: Summary statistics (1990 – 2017)

Variables	N	Mean	Std. Dev.	min	Max
GDP per capita growth	1176	1.426	5.003	-47.503	37.536
Oil rent	1155	3.353	9.382	0	56.285
Remittances	1176	2.414	3.255	0	21.81
Inflation	1176	38.813	708.883	-60.496	23773.132
Forest rent	1155	6.583	6.465	0	40.427
Natural gas rent	1176	.076	.384	0	4.861
FDI	1176	42.632	10.915	15.7	85.2
Financial deepening	1154	3.817	7.657	-8.703	103.337
Labor participation rate	1176	68.179	11.737	41.783	91.102
Capital	1176	20.31	8.319	-2.424	61.469

Note: Obs. represent observations, Std Dev. represents standard deviation, Min. represents minimum, and Max. represents maximum.

We provide the overview of the dataset by presenting the summary statistics in Table 1. The summary statistics gives a perspective on the distribution, mean value and the variability of the data based on the values of the relevant variables involved. The descriptive statistics

include the number of observations, mean, standard deviation, minimum and maximum. Table 1 shows comprehensively these statistics. It can be observed from Table 1 that all the variables have a positive average and a negative minimum except for oil rent, remittances, forest rent, natural gas rent, foreign direct investment and labour participation rate with positive and zero minimum value, respectively. From Table 1, the dataset reveals an average GDP per capita growth of 1.43. The average values of remittances, oil rent, forest rent, and natural gas amounted to $2.41 and 3.35, $6.58 and $0.08, respectively. For the control variables such as inflation, foreign direct investment, labour participation rate, investment and financial deepening, the mean values are $38.81, $42.63, $68.18, $20.31 and $3.82, respectively. Also, these statistics indicates that the variables have some variations which are economic growth, oil rent, remittances, inflation, forest rent, natural gas rent, foreign direct investment, financial deepening and labour participation rate with 5.00%, 9.38%, 3.26%, 708.88%, 6.47%, 0.38%, 10.92%, 7.66%, 11.74% and 8.32% respectively. The correlations between the variables are presented in Appendix B.

4.2 Correlation matrix Test Results

The correlation matrix reports the correlation coefficients of the variables of interest; it is useful in a quantitative research that examine the relationship among two or more variables. Results indicate that each variable perfectly correlates perfectly with itself and all the coefficients in the triangle indicate the correlation between different variables. We observe that all the variables are not strongly correlated with each other (weak correlation) since the coefficients are less than 0.5 (see Appendix B).

4.3 Bivariate results on the effect of remittance and Natural resource rent on economic growth

In this section, we focus on the presentation and discussion of the results. We begin with the presentation of our bivariate results on the effect of remittances and natural resource rent on growth. The aim of this exercise is to test whether there is a relationship between the dependent variables (GDP per capita growth) and remittances, oil rent, natural gas rent and forest rent. The result as presented in Table 3 show that there is a positive and statistically significant relationship between remittances and natural gas rent with GDP per capita growth. On the contrary, forest rent and oil rent have a negative relationship with GDP per capita and is statistically significant. The relationships are strong at 1 per cent level of significance, with the effect of natural gas rent being the most remarkable. Due to this relationship, there is a potential to determine it impact by including the control variables.

Table 3: Bivariate results on the effects of remittances and natural resource rent on economic growth in SSA (Dependent variable: GDP per capita growth)

Variables	(1)	(2)	(3)	(4)
Remittances	0.0270**			
	(0.0124)			
Oil rent		-0.0041**		
		(0.0157)		
Forest rent			-0.1031***	
			(0.0226)	
Natural gas rent				0.6527*
				(0.3766)
Constant	1.3609***	1.4737***	2.1336***	1.4143***
	(0.1502)	(0.1544)	(0.2062)	(0.1455)
Observations	1,204	1,183	1,183	1,204
R-squared	0.0039	0.0001	0.0174	0.0025
Adjusted R-Squared	0.00311	0.000790	0.0166	0.00166

Standard errors in parentheses; ***, **, *: significance levels at 1%, 5% and 10% respectively.

4.4 Pooled OLS results on the effects of remittances and natural resource rent on economic growth in Sub-Saharan Africa

Table 4 reports estimates of the traditional regression model using pooled OLS. It shows that the impact of remittances and natural resource rent on economic growth in SSA is statistically significant when added as additional explanatory variables in a standard growth model regression. The Ordinary Least Squares estimate finds that inflation is negative and statistically significant. Also, we find that financial deepening and investment have positive and statistically significant effects on economic growth (column 5). For the variables of interest, the results reveal that remittances have a positive effect on growth. These results are in line with some recent literature which has identified positive effects of remittances on financial development, investment, poverty and education. In addition, oil rent and natural gas rent have deleterious effects on growth. Though forest rent shows the expected positive relationship, its effect on growth is null. Further, the positive effect of remittance on economic growth conforms to our expectation. Finally, the interaction term for remittances and oil rent is statistically significant and positive on economic growth. Following other studies of economic growth, we include lagged GDP per capita growth which allow for convergence. As expected, we obtain a statistically significant negative coefficient for the

lagged of GDP per capita growth in all the model which confirms the conditional convergence hypothesis[3].

Table 4: Pooled OLS results of effect of remittances, oil rent, forest rent and natural gas rent on economic growth (Dependent variable: GDP per capita growth)

Variables	(1)	(2)	(3)	(4)	(5)
GDP per capita growth	-0.1397***	-0.1413***	-0.1383***	-0.1394***	-0.1327***
	(0.0290)	(0.0290)	(0.0289)	(0.0290)	(0.0290)
Inflation	-0.0005**	-0.0005**	-0.0005**	-0.0005**	-0.0005**
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
FDI	-0.0069	0.0064	0.0037	0.0167	-0.0068
	(0.0209)	(0.0205)	(0.0209)	(0.0208)	(0.0208)
Financial deepening	0.0390***	0.0414***	0.0380**	0.0256	0.0417***
	(0.0147)	(0.0148)	(0.0148)	(0.0158)	(0.0147)
Labour participation rate	0.0103	-0.0007	-0.0006	0.0139	0.0096
	(0.0130)	(0.0127)	(0.0127)	(0.0138)	(0.0130)
Capital	0.0870***	0.0846***	0.0793***	0.0720***	0.0901***
	(0.0190)	(0.0192)	(0.0189)	(0.0191)	(0.0192)
Remittances	0.1503***				0.1260***
	(0.0467)				(0.0479)
Oil rent		-0.0267*			-0.0398**
		(0.0160)			(0.0193)
Forest rent			0.3383		
			(0.3918)		
Natural gas rent				-0.0670**	
				(0.0280)	
Remittances*oil rent					0.0297**
					(0.0144)
Net effect	n.a	n.a	n.a	n.a	0.0598
Threshold	n.a	n.a	n.a	n.a	1.340
Constant	-3.0261**	-1.9193*	-1.7817	-1.6819	-3.0621**
	(1.2107)	(1.1617)	(1.1689)	(1.1632)	(1.2103)
Observations	1,154	1,154	1,154	1,154	1,154
R-squared	0.0494	0.0431	0.0414	0.0455	0.0539
Adjusted R-Squared	0.0444	0.0381	0.0364	0.0406	0.0473

Standard errors in parentheses; ***, **, *: significance levels at 1%, 5% and 10% respectively.

4.5 Fixed-effect and random-effect results on the effects of remittances and natural resource rent on economic growth in Sub-Saharan Africa

In this section, we present the results from the fixed-effect and random-effect estimators which control for fixed country specific effect. The presentation of the result is to determine whether the variables of interest are correlated with the country-specific errors or not, which is based on Hausman tests in Table 5. The Hausman test shows clear evidence of correlation

[3] This hypothesis posits that poor economies tend to grow faster than rich economies.

between the regressors and the unique errors, indicating the presence of endogeneity, which we address using the system GMM. Also, it shows dominancy of the fixed effect over the random effect. Table 5 shows that forest rent and natural gas rent have statistically significant effects on growth. Oil rent is however insignificant. Also, the pathway between remittances and oil rent is positive implying that remittances improve economic growth through oil rent.

Table 5: Fixed-effect and random-effect results on the effect of remittances, oil rent, forest rent and natural gas rent on economic growth in sub-Saharan Africa (Dependent variable is the GDP per Capital Growth)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Lag GDP per capita growth	-0.0614**	-0.1397***	-0.0625**	-0.1413***	-0.0554*	-0.1383***	-0.0505*	-0.1394***	-0.0441*	-0.133***
	(0.0297)	(0.0290)	(0.0297)	(0.0290)	(0.0296)	(0.0289)	(0.0296)	(0.0290)	(0.0296)	(0.0290)
Inflation	-0.0004*	-0.0004**	-0.0004*	-0.0004**	-0.0004*	-0.0004**	-0.0004*	-0.0004**	-0.0004*	-0.0004**
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
FDI	0.0086	0.0005	0.0221	0.0114	0.0166	0.0202	0.0266	0.0128	0.0162	-0.0008
	(0.0237)	(0.0220)	(0.0239)	(0.0220)	(0.0232)	(0.0217)	(0.0232)	(0.0215)	(0.0236)	(0.0219)
Financial deepening	0.0547*	0.0457**	0.0606**	0.0466**	0.0710**	0.0360*	0.0408	0.0457**	0.0375	0.0436**
	(0.0293)	(0.0192)	(0.0294)	(0.0194)	(0.0293)	(0.0200)	(0.0294)	(0.0188)	(0.0295)	(0.0187)
Labour participation rate	-0.1626**	0.0027	-0.1708**	-0.0075	-0.1502**	0.0115	-0.1765**	-0.0055	-0.1719**	0.0049
	(0.0722)	(0.0193)	(0.0730)	(0.0192)	(0.0721)	(0.0208)	(0.0719)	(0.0180)	(0.0718)	(0.0183)
Capital	0.0683***	0.0819***	0.0614***	0.0748***	0.0562**	0.0691***	0.0574**	0.0747***	0.0626***	0.0823***
	(0.0234)	(0.0209)	(0.0233)	(0.0209)	(0.0232)	(0.0210)	(0.0231)	(0.0208)	(0.0234)	(0.0209)
Remittances	0.1790**	0.1539***							0.1770**	0.144**
	(0.0723)	(0.0568)							(0.0733)	(0.0568)
Oil rent			0.1486***	-0.0235					0.1381***	-0.0275*
			(0.0367)	(0.0157)					(0.0364)	(0.0159)
Forest rent					-0.1989***	-0.0912**				
					(0.0535)	(0.0354)				
Natural gas rent							0.1552***	0.0049	0.1618***	-0.00437
							(0.0368)	(0.0210)	(0.0417)	(0.0246)
Remittances*oil rent									-0.0086	0.0203
									(0.0187)	(0.0160)
Constant	8.3472	-2.7354	9.1990*	-1.6073	8.7703	-1.7601	9.9578*	-1.7107	9.2922*	-2.829*
	(5.4017)	(1.6998)	(5.4397)	(1.6776)	(5.3774)	(1.6895)	(5.3728)	(1.5863)	(5.3708)	(1.623)
Net effect	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
Threshold	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
Observations	1,154	1,154	1,154	1,154	1,154	1,154	1,154	1,154	1,154	1,154
Countries	42	42	42	42	42	42	42	42	42	42
R-squared	0.0382	-	0.0330	-	0.0449	-	0.0482	-	0.0532	-
Adjusted R-Squared	-0.0026	-	-0.0081	-	0.0043	-	0.0077	-	0.0112	-

Standard errors in parentheses; ***, **, *: significance levels at 1%, 5% and 10% respectively; n.a: not available

FE (1), ……., FE (7) are fixed effect models while RE (1), ……, RE (7) are random effect models

4.6 System GMM results on the effects of remittances and natural resource rent on economic growth in Sub-Saharan Africa

Table 6 reports the main results. In this section, the result of the study shows that remittance inflows induce economic growth. Also, we find that oil rent and natural gas rent have a negative significant impact on growth and forest rent has a positive impact on growth. In addition, we find evidence of the joint effect of remittances and oil rent in fostering economic growth in SSA. The results further show that, inflation, labour participation rate, financial deepening and investment are also significant drivers of economic growth in SSA. FDI are however insignificant in driving growth. In specifics, the coefficient of remittances is positive and statistically significant, indicating that for every 1 per cent increase in remittances, economic growth increases by 0.0017 per cent (see, columns 5). The results indicate that remittances are relevant contributors to the growth of SSA over the study period 1990 to 2017. The importance of remittances to economic growth may be due to remittance inflows through formal financial channels other than being accumulated at home, which is later or never invested in economic activities (World Bank, 2009C). On the contrary, this is conflicting with the results of Barajas *et al*., 2010; Adams & Klobodu, 2016).

The independent effect of oil rent and forest rent are negative and significant (see columns 5) while natural gas rent is statistically nil on economic growth. The negative coefficient of oil rent indicates that a 1 per cent change in oil rent decreases economic growth by 3.19. This negative association between oil rent and economic growth is not surprising because of the resource curse and the absence of market and institutional failures (Boyce & Emery, 2011). In addition, our result of oil rent reducing growth can be attributed to the Dutch effect. Further, we provide a strong empirical evidence to show that forest rent has a 1 per cent increasing effect on economic growth by 0.90 and natural gas rent has a supressing effect on growth by 24.07 holding all other variables constant (see column 5). The evidence we provide suggests that forest rent does induce growth in the SSA. This is plausibly due to that fact that countries' reliance on forest resources has been a source revenue to the country which benefits the ordinary.

The coefficient of the conditional effect of oil rent and remittances is positive, implying that remittances reduce the negative impact of oil rent on economic growth. The result show that a 1 per cent increase in remittances reduces the adverse effect of oil rent on economic growth by 0.48 per cent holding all other variables constant (see column 5). We find evidence that policies targeting both remittances and oil rent are rather higher in fostering economic growth in SSA compared to the individual effect. Thus, this result

motivates the computations of thresholds at which further improving the conditional effect of remittances and oil rent increases economic growth. These thresholds in the interactive regression are meaningful for policy implications instead of net effects. Clarifying this, in column 5 of table 6, a threshold of 0.67 [-0.3168/0.4794] and the net effect of enhancing oil revenue given current average of remittances in SSA is 1.129 [-0.0275+ 0.4794(2.414)]. Hence, above the computed threshold of 0.67, further increasing the negative effect of oil rent on economic growth will completely be nullified. It follows that below the threshold boundary, the positive effect of remittances will completely alleviate the unfavorable effect of oil rent on economic prosperity. The threshold is within the minimum and maximum value which makes it acceptable.

The result indicates that the adverse effect oil revenue sends a positive signal to the recipients, and hence promoting economic growth in a number of ways. Theoretically, when remittances enter oil rent, it reduces the resource curse since abundance of oil revenue plays a significant role in declining economic growth (resource curse). In other words, more remittance inflow policies improve the welfare of both the residents receiving the inflow and the other remaining residents in home country. The growth effect of remittance inflow is seen in its ability to lessen poverty by enhancing consumption or providing opportunities for family businesses or small-scale enterprises. However, remittances and oil rent are complements since a marginal increase in one increases the impact of the other.

For our ancillary findings, there is empirical evidence to show that the effect of capital on growth in SSA is positive. From Table 6, we show that a 1 per cent increase in capital (investment) stimulates economic growth by 1.86 per cent. This suggests that investment improves economic growth in SSA. This supports the findings of Dort *et al.* (2014) who confirm positive linkages between investment and economic growth. Like capital, FDI is positive and statistically significant in (columns, 1-4). This reinforces the point that FDI in developing and developed countries takes vibrant part of GDP acceleration and rapid growth. This is in line with studies by Pegkas (2015). On the contrary, Inflation is also negative and statistically significant in (columns, 1-5). Signifying that as inflation increases by 1 per cent, growth decreases by approximately 0.003 per cent. This buttresses the point that inflation in developing countries massively reduces the GDP acceleration and rapid economic growth. Financial deepening is positive and statistically significant at 5 per cent. Turning to financial deepening, the results indicate that changes in financial deepening by one per cent exhibits significant positive link with growth in (columns, 1, 3-4), which implies that financial deepening boosts economic growth in SSA countries.

The appropriateness of our SGMM estimates is evident in the AR (2) statistics showing the absence of second-order serial correlation in the residuals, and the Hansen P-value providing evidence of the validity of our instruments. Overall, based on our empirical findings, we can say that policymakers should concentrate on how they can attain remittance inflows up to the threshold level which can be easily attained by most African economy.

Table 6: Dynamic system GMM results on the effects of remittances, oil rent, forest rent and natural gas rent on economic growth in SSA (Dependent variable: GDP per capita growth)

Variables	(1)	(3)	(2)	(4)	(5)
Economic growth (-1)	0.1477***	0.1391***	0.1459***	0.1487***	-0.2177***
	(0.0107)	(0.0083)	(0.0107)	(0.0109)	(0.0304)
Inflation	-0.0004***	-0.0004***	-0.0004***	-0.0004***	-0.0025
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0027)
FDI	0.0078	0.0138**	0.0035	0.0063	0.1671
	(0.0074)	(0.0066)	(0.0072)	(0.0069)	(0.1203)
Financial Deepening	0.0333***	0.0303***	0.0399***	0.0375***	0.3822
	(0.0063)	(0.0062)	(0.0054)	(0.0054)	(0.3442)
Labour Participation rate	-0.0037	0.0070	-0.0002	-0.0027	3.2180***
	(0.0062)	(0.0072)	(0.0062)	(0.0061)	(0.8567)
Investment	0.0678***	0.0608***	0.0629***	0.0720***	1.8280***
	(0.0083)	(0.0087)	(0.0080)	(0.0077)	(0.2164)
Remittances	0.0145***				0.0017
	(0.0049)				(0.2157)
Forest rent		-0.0461***			0.8967**
		(0.0133)			(0.3848)
Natural gas rent			0.1217		-24.0676***
			(0.0893)		(6.9179)
Oil rent				-0.0226***	-0.3168*
				(0.0035)	(0.1598)
Remittances*Oil rent					0.4794***
					(0.0966)
Constant	-1.3445**	-1.4947***	-1.6858***	-1.5340***	-273.5065***
	(0.5703)	(0.5144)	(0.5466)	(0.5271)	(64.0810)
Net effect	n.a	n.a	n.a	n.a	1.129
Threshold	n.a	n.a	n.a	n.a	0.6608
Hansen P-Value	**0.276**	**0.255**	**0.262**	**0.277**	**0.196**
Sargan P-Value	0.000	0.000	0.000	0.000	0.000
AR (1)	0.000394	0.000466	0.000434	0.000385	0.00158
AR (2)	**0.940**	**0.866**	**0.930**	**0.944**	0.0287
Countries	43	43	43	43	43
No. of Instruments	42	42	42	42	39
Observations	1,182	1,182	1,182	1,182	1,182

Standard errors in parentheses; ***, **, *: significance levels at 1%, 5% and 10% respectively. Test the significance are the bolden values are in two ways. (1) The significance of estimated coefficients and the Wald test. (2) Failing to reject the null hypotheses of: (a) no autocorrelation in the AR (1) and (AR (2) tests and; (b) the validity of the selected instruments lies in the Sargan and Hansen tests. na: not available because at least one estimated coefficient is needed for the calculation of net effects or thresholds.

4.7 Evaluation of Hypotheses

Our hypothesis 1 shows the unconditional effect of remittances, natural resource rent on economic growth (see Column 5 of Table 6). We observe remittances induce economic growth and natural resource rent reduces economic growth excluding forest rent which provides support for the alternate hypothesis (Hypothesis 1). This result of positive effect of remittances on growth is in line with studies like Peprah *et al.* (2019); Meyer and Shera (2017). Further, we observe oil rent and natural gas rent negatively affect economic growth which is in line with studies by Tiba, 2019 and contradicts with studies Hao *et al* (2019) and Olayungbo (2019) respectively. For our hypothesis 2, the positive unconditional effect of remittances and oil rent on growth imply that remittances improve growth by mitigating the adverse effect of oil rent (see columns 5). These findings show that remittances and oil rent are complements and it provides support for the alternate hypothesis. Studies from De *et al.* (2019) have shown that remittances and oil move in the same direction to improve growth and large oil price reduces remittances flows to receiving countries.

4.8 Robustness checks for the results

We check the robustness of our estimates in table 7 using a new measure of economic growth which is GDP growth as an alternative dependent variable. Further, FDI, inflation, financial deepening and capital are key drivers of economic growth in SSA. The results show that labour participation rate does not have a substantial impact on growth. We also find that irrespective of the model specification type, the lagged of economic growth is statistically significant at one percent, implying the importance of previous year's economic growth drive in current growth. We find strong empirical evidence for hypothesis one and two (see columns 1-4). The results show that for every 1 per cent increase in remittances to SSA, GDP growth is enhanced by 0.008 (see columns 1 and 5). Similarly, natural gas rent is statistically significant and has a positive impact on GDP growth. In contrast, oil rent and forest rent have a negative impact on GDP growth and the results are statistically significant (see column 2,4 and 5). We find empirical evidence for our third hypothesis as well. As the results in columns 5 indicate, irrespective of the type of model used as growth, oil rent as a percentage of GDP is complementary, pathway through which remittances stimulates growth in SSA. We report a net effect of 0.09 per cent and 0.03 per cent for remittances and oil rent, respectively. For the controls, the results show that FDI, financial deepening and capital improves growth and inflation suppress growth. So, we observe that irrespective of the model specification the results are same. All robustness findings are presented in Table 7.

Table 7: Dynamic system GMM results on the effects of remittances and natural resource rent on economic growth in sub-Saharan Africa (Dependent variable: GDP growth)

Variables	(1)	(2)	(3)	(4)	(5)
Lagged GDP growth	0.1860***	0.1820***	0.1875***	0.1866***	0.1794***
	(0.0116)	(0.0113)	(0.0116)	(0.0115)	(0.0118)
Inflation	-0.0003***	-0.0003***	-0.0003***	-0.0003***	-0.0003***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0001)
FDI	0.0148***	0.0225***	0.0117*	0.0142***	0.0235
	(0.0054)	(0.0050)	(0.0059)	(0.0050)	(0.0235)
Financial deepening	0.0111**	0.0044	0.0123***	0.0134***	-0.0077
	(0.0041)	(0.0044)	(0.0039)	(0.0042)	(0.0545)
Labour participation rate	0.0095	0.0171**	0.0086	0.0098	0.0050
	(0.0066)	(0.0082)	(0.0064)	(0.0066)	(0.0687)
Capital	0.0718***	0.0675***	0.0699***	0.0726***	0.0613*
	(0.0067)	(0.0060)	(0.0061)	(0.0061)	(0.0352)
Remittances	0.0080*				0.0086*
	(0.0046)				(0.0055)
Forest rent		-0.0416***			-0.0445**
		(0.0126)			(0.0203)
Natural gas rent			0.2712***		0.6059
			(0.0969)		(0.6230)
Oil rent				-0.0060	-0.0232***
				(0.0037)	(0.0066)
Remittances*oil rent					0.0233***
					(0.0141)
Constant	0.6215	0.7524	0.6966	0.5417	2.2090
	(0.5166)	(0.4660)	(0.4844)	(0.5080)	(7.8098)
Net effects	n.a	n.a	n.a	n.a	0.0867
Thresholds	n.a	a.a	n.a	n.a	1.005
Observations	1,182	1,182	1,182	1,182	1,182
Countries	43	43	43	43	43
Number of Instruments	42	42	42	42	39
Hansen P-Value	0.288	0.307	0.299	0.288	0.339
AR (1)	0.00019	0.0002	0.0002	0.0002	0.0002
AR (2)	0.8350	0.8720	0.8250	0.8310	0.8530

Standard errors in parentheses; ***, **, *: significance levels at 1%, 5% and 10% respectively. Test the significance are the bolden values are in two ways. (1) The significance of estimated coefficients and the Wald test. (2) Failing to reject the null hypotheses of: (a) no autocorrelation in the AR (1) and (AR (2) tests and; (b) the validity of the selected instruments lies in the Sargan and Hansen tests. na: not available because at least one estimated coefficient is needed for the calculation of net effects or thresholds.

6.0 Conclusion and policy recommendations

In this study, we analyse the impact of remittances and natural resource rent on economic growth in SSA countries. First, we explored the unconditional impact of natural resource rent on economic growth. Second, we examine the joint effect of remittances and oil rent on economic growth. To do this, we use dataset covering 43 developing countries in SSA from 1990-2017. We provide evidence robust to several specifications from the system GMM to

show that: (1) Forest rent has a positive impact on economic growth and economic growth decreases with the increase of oil rent and natural gas rent as a result of the resource curse. (2) the study further finds that, on average, the positive effect of remittance inflows mitigates the negative effect of oil rent on economic growth. Further we compute thresholds in the interactive regressions and the results gives a value of 0.6608. Which indicate that above the threshold value the negative effect of oil rent on economic growth is completely nullified and below the threshold the positive impact of remittances mitigate the negative effect of oil rent on economic growth. The study also shows a positive unconditional effect of remittances on economic growth

A vital policy implication derived from this research is that government and policymakers are provided with actionable levels of remittances that should be attained in sampled countries in order for the unfavourable effect of oil rents on economic prosperity to be completely mitigated. Encouraging measures that attract and enhance remittances inflows. Further, government should encourage individuals to own repatriable foreign accounts with the local banks to grant them permission to make deposit into such accounts when outside the country. In order to encourage direct remittances, which would therefore contribute to economic growth. Remittances play an important role in reallocating resources in countries where oil rent are low. This increase in remittances would help reduce income inequality and spurs economic growth.

The study makes room for future research which would contribute to literature by decomposing the SSA countries into sub-group which are high receiving remittance countries and low receiving remittance countries in order to assess which threshold boundary to set for each group. Further, we can possibly include governance as an additional explanatory variable since it can have adverse effect on oil revenue to increase economic growth in SSA. This further research builds on the premise that oil rent has a link with remittance inflows and governance which can be a potential pathway to economic growth.

Also, this study is not free of limitations. In particular, it is likely that data on growth in countries that are less developed under-report their data which could be more sensitive to remittances flows and oil rent. Also, not all SSA countries were included since there are many missing values for remittances and oil rent for the countries which were not included, and this restriction can be restraining since missing values can be treated using machine learning algorithms. Also, unfortunately the study is limited to SSA eliminating potential comparisons with advanced countries.

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Appendix A: Description of Variables

Variables	Description of Variables and Sources	Expected Sign
GDP	Computed as lagged GDP at constant 2010 US$. Source: World Positive Development Indicators, World Bank.	Positive
Economic Growth	Growth as real GDP per capital growth in annual Percentages of US$. Source: World Development Indicators.	Positive
Inflation	Annual percentage of GDP deflator Source: World Development Indicators, World Bank.	Negative
Oil rent	Annual percentage difference between the values of crude oil and total cost of production. Source: World Development Indicators	Positive
Capital	Gross fixed capital formation as a percentage of GDP. Source: World Development Indicators	Positive
Financial deepening	Domestic credit to the private sector as percentage of GDP. Source: World Development Indicators, World Bank	Positive
Remittances	Ratio of personal transfer and compensation of Employees and GDP at current US$. Source: World Bank	Positive
Foreign Direct Investment	Net inflows of investments as a percentage of GDP. Source: International Monetary Fund International Financial Service and Balance of Payment Statistics	Positive
Forest rent	Forest rents are round wood harvest times the product of average prices and a region-specific rental rate. Source: World Bank	Positive
Natural gas rent	Total revenue that can be generated from the extraction of the natural gas, less the cost of extracting the gas. Source: World Bank	Positive

Appendix B: Pairwise correlations matrix (1990 – 2017)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
GDP per capita growth	1.000									
Oil rent	-0.005	1.000								
Remittances	0.091	-0.159	1.000							
Inflation	-0.085	-0.011	-0.016	1.000						
Forest rent	-0.130	-0.191	-0.061	0.087	1.000					
Natural gas rent	0.052	0.134	-0.051	-0.009	-0.037	1.000				
FDI	0.076	0.053	0.182	-0.021	0.025	0.242	1.000			
Financial deepening	0.138	0.149	0.068	-0.063	-0.412	0.162	0.300	1.000		
Capital	0.168	0.212	-0.042	-0.054	-0.249	0.078	0.284	0.337	1.000	
Population growth	-0.028	-0.082	-0.222	0.012	0.445	0.064	0.010	-0.163	-0.102	1.000

Where Y: Economic growth; OILRENT: oil rent; REM: Remittances; INFL: Inflation; F. RENT: Forest Rent; NATG.RENT: Natural gas rent; FDI: Foreign Direct Investment; FINDEP: Financial Deepening; L: labor participation rate; K: Investment.

Appendix C: Summary of literature on impact of remittances on economic growth and Channels with remittances influence economic growth

Author(s) and Year	Data	Objective	Time	Methodology	Result
Guiliano & Ruiz-Arranz (2009)	Panel data of 100 developing countries	Importance of remittances in promoting economic growth through financial sector.	1975-2002	Dynamic Panel data analysis	Positive joint effect
Sobiech (2019)	Panel data of 203 countries	Remittances and financial institutions on economic growth	1960-2011	SGMM	Positive joint effect
Meyer & Shera (2017)	Balanced panel data with six developing countries in Europe	Determine whether remittances have a negative or positive effect on growth.	1999-2013	OLS, Fixed-effects and Random effects	Positive
Feeny *et al.* (2014)	209 countries including 25 SIDs	Impact of remittances on economic growth in SIDs	1971-2010	OLS and GMM estimates	Positive
Peprah *et al.* (2019)	Macrodata in Ghana	Determine the joint effect of financial development and remittances on economic growth.	1984-2015	Dynamic heterogeneous ARDL model	Negative
Adams and Klobodu (2016)	33 SSA countries	Joint effect of remittances and governance on economic growth	1970-2012	SGMM	No impact
Chowdhury (2016)	33 remittance receiving countries	Joint effect of remittances and financial development on growth	1979-2011	SGMM	Positive joint effect
Eggoh *et al*. (2019)	49 developing countries	Remittances and growth	2001-2013	Panel Smooth Transition and SGMM	Positive
Chami *et al.* (2005)	Panel aggregate data that includes up to 113 countries over 29 years	Examine whether remittances can be a source of capital for economic development	1970-1998	Panel estimation	Negative
Ahmed (2010)	Time series data of Bangladesh	Worker's remittances have growth impact on Bangladesh economy	1995-2006	Modified version of the model developed by Chami *et al.,* 2003	Negative
Karagoz (2009)	Time series data in Turkey	Whether workers remittances have growth impact on Turkish economy	1970-2005	Modified version of the model developed by Chami *et al*., 2003	Negative
Koyame-Marsh (2012)	Time series data of each 10 members of ECOWAS	Impact of workers' remittances on real GDP growth	1976-2007	Time series and panel analysis	Negative
Nyeadi and Atiga (2014)	Time series data of Ghana	Linkage between remittances and economic growth in Ghana	1980-2012	Granger-causality and cointegration tests under VAR framework	Unidirectional link
IMF (2005)	101 developing countries	Impact of remittances on economic growth	1970-2003	Panel analysis	No impact
Adams & Klobodu (2016)	33 SSA countries	Relationship between Remittances and growth	1970-2012	Using SGMM	No relationship
Ahamada & Coulibaly (2013)	20 SSA countries	Relationship between remittances and growth	1980-2007	Panel Granger Causality	No impact

Appendix D: Summary of Literature on Natural resources Rent, Transmission Channels and Economic Growth

Authors and Year	Data	Objective	Time	Methodology	Result
Tiba (2019)	12 oil exporting countries	Impact of oil rent on economic growth	1990-2015	Smooth Transition model	Negative
Arezki and Van der Ploeg (2010)	Cross country data of Sachs and Wachs	Natural resource curse, institutional quality and growth	1965-2000	OLS and Instrumental variables	Joint positive effect
Ogbonna and Ebimobowei (2012)	Nigeria	Link between petroleum income and economic growth	2000-2009	Simple Regression Model	Positive
Abdulahi *et al.* (2019)	13 rich resource country in SSA	Resource rent and growth nexus	1998-2016	SGMM	Positive till a certain threshold
Epo and Faha (2020)	44 African countries	Institutions, natural resources and economic growth	1996-2016	dynamic panel-data instrumental / smooth transition regression	Positive joint effect
Cavalcanti and Raissi (2011)	53 oil exporting and importing countries	Effect of oil abundance on economic growth	1980-2006	Common Correlated Effects and OLS	Positive
Hao et. al (2019	30 provinces in China	Relationship between forest resources and economic growth in China based on environmental Kuznets curve hypothesis	2002-2015	SGMM	Positive
Joshi and Beck (2016)	OECD and non-OECD countries	Relationship between resources and growth	1974-2013	GMM model	U-shaped in Africa and N-shaped in OECD income countries
Olayungbo (2019)	Cross-section data of Nigeria	Impact of oil export revenue on economic growth	1970-2015	Bayesian time-varying parameter model	Positive
Asekunowo & Olaiya (2012)	Nigeria	relationship between natural resource and economic growth	1974 - 2008	multivariate vector and auto regression model	Positive
Sachs and Warner (1995)	Botswana, Oman and Saudi	relationship between natural resource and economic growth	1970-1989	Cross-country growth regressions	Negative
De *et al.* (2019)	Gulf Cooperation Council Countries	Oil prices and Remittance outflow	1971-2017	OLS, FE and RE	Positive relationship
Zahran (2019)	Egypt	Relationship between Oil prices and remittances	1960-2016	Vector Autoregressive	Positive relationship
Makhlouf & Kasmaoui (2017)	Morocco	The impact of remittances on oil prices	2004-2010	Static and Dynamic Regression	Positive relationship