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Human Capital Flight and Economic Growth in Nigeria

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Abstract

This study empirically investigated the effect of human capital flights on economic growth in Nigeria from 1981 to 2020. It used recent advances in time series analysis, which are fractional integration and co-integration framework. The net migration rate and remittance were used to capture human capital flight. The results show that shocks and spikes in human capital flight variables have a lasting effect. However, the Hausman test of fractional co-integration revealed that a long-run relationship does not exist between human capital flight and economic growth. This may be due to an increasing youth population and an abundant labor market. Therefore, this study eases the fear of a detrimental human capital flight on Nigeria's economic growth over the study period and does not find evidence of a gain through remittances. Hence, the government should facilitate the productive use of migrant remittances by improving financial literacy, encouraging investment in productive assets, and providing a favorable environment for small enterprises.

Keywords: Human capital flight, economic growth, fractional co-integration, Nigeria

Introduction

To achieve sustainable economic development, governments continue to prioritize economic growth, which is a crucial indicator of rising standards of living and welfare in a nation. Economic growth is the increase in real national income over time, captured as an increment in the market value of goods and services produced by a country over time, as depicted by the production possibility frontier upward move (Egbulonu & Ajudua, 2017). Consequently, the determinants of economic growth are at the forefront of economist studies. Education or acquired skills that epitomize outlay in human capital have been acknowledged as one of the determinants of long-term economic growth. However, since its delivery is frequently labor-intensive, its acquisition is more affordable in underdeveloped nations with abundant labor. At the same time, skilled workers migrate to advanced nations with relatively higher returns on human capital, helping the economies reduce the cost of educating and training workers.(Ojo et al, 2011).

Several factors contribute to the persistence of migration in sub-Saharan Africa, particularly in low-to medium-income countries. These factors include but are not restricted to, an unfavorable socioeconomic environment, loss of confidence in the government's genuineness and capability to combat issues of poverty, high level of corruption, deficient hiring and promoting systems for employees in the formal employment sector, inadequate security, and poor infrastructure. According to the Government of Canada (2019), about 12,000 eligible immigrants left the coasts of Nigeria for Canada in 2019, signifying the consistency with which established economies such as Canada, the United States, the United Kingdom, and Australia have recently opened their borders to skilled immigrants. Some 1.24 million migrants from Nigeria are believed to live abroad (United Nations, 2017). Given the current trend in migration

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out of the country, this number will probably increase by 2024 and beyond. According to a survey, around 45% of people in Nigeria (aged 25 and older) say they want to relocate within the next five years. This is the largest percentage among the 12 nations studied across the four continents (Onyekwere & Egenuka, 2019; Pew Research Centre, 2018).

In Nigeria, the striking disparity in the inter-state level of development encourages internal movement within the country; however, this study focused on international movement, specifically emigration, which is considered detrimental to development and negatively influences economic growth in developing societies (Imafidon, 2018; Raji et al., 2018; Adeosun & Popogbe, 2021).In contrast, researchers (Odinoye & Emerole, 2015; Loto & Alao, 2016) have also found that emigration of human capital can benefit economic growth in terms of remittance, which is the money sent home from emigrants. Among scholars, this argument is insistently dynamic and inconclusive, with a large majority concluding that human capital flight, loosely termed brain drain, has a detrimental effect on growth. The fear of the influx of skilled workers has led to international policies restricting their flow. Algeria restricted study-abroad scholarships in 2009 (Gibson &McKenzie, 2012), and mandatory commitments for Uganda doctors and the World Federation of Public Health Associations supported ethical restrictions on international health professional recruitment from developing countries (Taylor & Dhillion, 2011). Conversely, concerning remittance inflow, foreign direct investment (FDI), trade, and transfers of knowledge from the workforce in the diaspora, scholars (Obiezu, 2019; Adela & Dietmar, 2016) have also reported that the possibility of migration may stimulate the accumulation of human capital, subsequently leading to a net increase in the level of education of those in the sending country and promoting economic growth, as is evident in countries such as China and India in the springing up of technology firms associated with emigrants working in Silicon Valley.

Nigeria is among the top 13 African countries whose inhabitants aspire to move to Europe and other countries in search of a higher quality of life, ranking second on the continent in terms of the loss of human capital to brain drain(Onyekwere & Egenuka 2019). Nonetheless, the Minister of Labor and Employment purportedly stated that the country was exporting its brightest brains because it had an excess of endowment and that they go abroad, earn money and send back home in any event (Akinkuotu, 2019). The emigration of skilled professionals can result in labor shortages in vital sectors such as healthcare, technology, and education, affecting productivity, innovation, and economic growth. Therefore, it is crucial to explore how human capital flight affects economic growth. Furthermore, in comparison to previous studies, this study extended the univariate analysis of co-integration from the I (1) or I (0) order of integration cases to the more wide-ranging case of fractional integration and co-integration, which is more flexible in the dynamic specification as a result of the relaxation of the restrictive assumption that d equals 0 or 1 in the standard unit root analysis.

What impact does human capital flights have on Nigeria's economic development? Are remittances from abroad a considerable compensation for a country's migration of highly qualified human capital? Should the Nigerian government commit economic resources to prevent the exodus of human capital? This study empirically determined the long-run effect of the net migration rate and remittances on economic growth using the Fractional Cointegration Framework. The study is organized into the following sections: Introduction, review of relevant literature, data and methodology, results and discussion, conclusion, and recommendations.

Literature Review

The Neo-classical Growth Theory

Neoclassical growth theories emerged in the 19th century to address the challenge of

dynamic equilibrium and to achieve potential growth by introducing new technology and improved production organizations (Sharipov, 2015). The model assumes a steady-state economy, diminishing capital returns, and a less significant effect of capital on the total output. Critics argue that this model fails to explain diverse investment levels and that positive externalities, such as corruption and infrastructure, can hinder investment in developing countries. Additionally, growth theory offered little to those working in government because what the government does is irrelevant in the face of external technical advancement and population growth. (Romer, 1989a, p.51).

Despite criticism, the neoclassical economic approach has been a reference point for comprehending developmental issues regarding migration since the 1900s (Castles, 2009).To attain balanced growth and development, it is presupposed that labor must be relocated from rural and semi-urban areas to urban or developed areas. (de Hass, 2010). According to Massey et al. (1993), people migrate from low-to high-pay countries because of wage and/or unemployment disparities across regions or continents, which brings about a market equilibrium. As a result, human capital will shift from areas with low market wages to areas with high market wages to attain market equilibrium, which market forces constantly adjust to establish (Krüger, 2015). This readjustment process continues until a balance is reached. When this happens, migration stops as the wages in both the country of origin and the country of immigration converge (de Hass, 2010). Neo-classical economists hold that migration back to the country of origin will result in growth and progress since these people will have better ideas for their country.

Empirical Review

Human capital is crucial for growth, and brain drain could negatively impact a nation's advancement (Bouhari & Soussi, 2017). Studies have shown that the rate of skilled emigration is high (43.2%) in small countries with populations under 1.5 million (Beine, et al., 2008), concluding that undersized countries because of high responsiveness to push factors are the major losers from brain drain due to their small country size. Among other factors, Tabassum et al. (2017) and Egbefo (2014) found that poor leadership escalates brain drain. Other push factors identified as significant causes of brain drain include high levels of unemployment (Yamin & Luna, 2016), poor remuneration and service conditions (Emeghara, 2013), increasing poverty, religious crises, and communal and political instability (Ajide & Alimi, 2018). Furthermore, Popogbe and Adeosun (2020) revealed that the rising population growth rate and poor life expectancy intensify the possibility of migration out of Nigeria.

There have been divergent views regarding the consequences of human capital flight on economic growth, with a class opining that the effect is always negative, in this case, brain drain (Aravossitas & Sugiman, 2019), while an opposing class opines that the effect can be beneficial to the sending country, in this case, brain gain (Bredtman et al., 2019). Imafidon (2018) compared the experiences of Nigerian medical doctors in Nigeria and the US to examine the effects of brain drain on Nigeria's health care system (HCs).The socioeconomic model study showed that 94% (17 out of 18) of the participants agreed that brain drain worsens the medical doctor shortage, which has a terrible impact on the healthcare system and health outcomes, particularly maternal and child health in rural or low-income countries.

Raji et al. (2018) employed the pool or binary least squares technique to explore the origin, impact, and implications of brain drain on Africa's economic development, particularly in Kenya, Ethiopia, and Nigeria. The findings showed that while there is a negative association between brain drain, remittances, and economic growth in the selected nations, a positive correlation exists between human capital development and economic growth.

These findings are corroborated by Adeosun and Popogbe (2021), who found the net migration

rate to be more detrimental to Nigeria's economy due to its negative effect on economic growth despite remittances (income from abroad).In addition, Okafor and Chomereze (2020) found that the negative impacts of nurse migration outweighed remittances, improved health, quality of life, etc., which have been argued to be the positive offshoots of brain drain as it has resulted in a shortage of nurses within the country, leaving its citizens to experience poor healthcare service delivery.

On the other hand, several studies have investigated how and when human capital flights are advantageous for sending countries. Some studies on this topic have empirically shown that gains from human capital flight are only feasible if there is an increase in human capital, investment in education, remittances, brain exchange, and return migration (Beine et al., 2008). Investments in education are also possible, because households with international migrants typically have higher levels of education (FAO, 2017).

Odinoye and Emerole (2015) study the effect of international remittances on the Nigerian economy based on the rising inflow of remittances globally and the inherent repercussions of migration and remittances on economic development. They observed a positive and significant association between remittances and Nigerian economic growth using the Autoregressive Distributed Lag model (ARDL), highlighting a long-term relationship between the two variables.

Furthermore, Loto and Alao (2016) disaggregated foreign remittances into migrants' and workers' remittances to examine their effects on economic growth in Nigeria from 1980 to 201.A difference in the performance of the two components of remittances was observed with migrants' remittances, showing a positive statistically significant long-run relationship with economic growth. In contrast, worker remittances were shown to have a negative statistically significant impact in the long run and short run. Therefore, to establish a favorable relationship with economic growth in Nigeria, it was advised that workers' remittances be strategically harnessed by ensuring that money is spent on locally made items rather than imported ones.

Methods

Data source

The data required for this study were gathered from the International Monetary Fund (IMF), World Development Bank indicators (WDI), and the Central Bank of Nigeria (CBN).It comprises the real GDP growth rate, a proxy for economic growth (Raji et al., 2018); emigration rate, a proxy for the exodus of human capital (Adeosun and Popoogbe, 2021); international remittances; school enrolment, which is a proxy for the development of human capital (Bareke et al., 2021); and the unemployment rate. Data was obtained from 1981 to 2019. This period is justified because it captures the historical, economic, political, and social trends that have influenced human capital flights in Nigeria. It provides an in-depth look at how brain drain has grown and continues to alter a country's human capital landscape.

The variables employed agree with neoclassical growth theories, which assume that economic growth is dependent on investment (physical and human capital) and population growth.

Model Specification

This study adapted the neoclassical growth model to depict the relationship between human capital flight and economic growth in Nigeria, and specified the model as follows:

Where: = Real GDP

= Net migration rate

= Remittances

= Population growth rate

= school enrollment which is a proxy for human capital = Unemployment rate

Estimation Methods and Techniques

The study adopted the fractional and fractional co-integration techniques to estimate a model of the relationship between human capital flight and economic growth in Nigeria using a time series. The stationarity qualities of the sets were determined to avoid inaccurate conclusions due to spurious and inconsistent estimates that would make it unsuitable for generalization at a period beyond the present. This ensured that the estimated relationships are stationarity and time invariant. By treating data as fractionally integrated appropriately when modeling time-series data, researchers are better equipped with accurate tools to differentiate time series. Thus, considerable insights can be gained regarding the nature of human capital flight and economic growth. Fractional cointegration was performed because the variables were fractionally integrated. The hypothesis to be tested is that there are no long-run relationships H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$, as opposed to the alternative hypothesis: H1 = H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 \neq 0$.

Results

Descriptive Statistics

The descriptive statistics for real GDP, remittances, tertiary school enrolment, net migration rate, tertiary school enrolment, and population growth rate showing their mean, maximum, minimum, skewness, kurtosis, and Jarque Berra values are given in Table 1.

Table 1

Descriptive Statistics Results

	RGDP	REM	TER	NMR	PNG
Mean	3506.292	7.997134	1316994.	-0.391359	2.581738
Maximum	24700.99	24.31102	3229399.	-0.075000	2.709843
Minimum	222.1494	0.002425	48353.00	-1.725000	2.488785
Std.Dev.	6729.421	9.759236	1142770.	0.346974	0.066914
Skewness	2.150589	0.537265	0.379981	-2.487148	0.107075
Kurtosis	6.088760	1.387726	1.586196	8.754497	1.748068
Jarque-Bera	45.56594	6.100316	4.186626	94.01902	2.621443
Probability	0.000000	0.047351	0.123278	0.000000	0.269626
Observations	39	39	39	39	39

Std.Dev. = Standard Deviation

The mean value represents the average value for each variable. The mean value peaked at $3506.2 million (RGDP), $7,997 million (remittance), and 1, 316, 994 tertiary school enrolment) and population growth averaged 2.52% over the period under study. The results also showed a positive mean for all variables except the net migration rate (NMR), with a mean value of -0.391.This implies an excess of emigration over immigration during the study period.

Furthermore, the Jarque-Berra test is a test statistic for whether sample data have a normal distribution with respect to skewness and kurtosis. The series is normally distributed if $p > 0.05$, and vice versa, at a 5% probability level. Therefore, we reject the null hypothesis for RGDP, REM, and NMR and conclude that the series are not normally distributed. However, the series for TER and PNG are typically distributed. This implies that, unlike TER and PNG, which are normally distributed, RGDP, REM, and NMR are skewed with possible extreme highs or lows, which may be attributed to shocks to Nigeria's political, economic, or social landscape.

Unit Root Tests

The stationarity property of the variables was examined using the classical unit roots tests; Augmented Dickey Fuller (ADF), Phillip Peron (PP) and Kwaitkowski-Phillips-Schmidt-Shin (KPSS) considering the intercept and intercept & trend test equations. The unit-root test results are presented in Table 2.The null hypothesis for the ADF and PP test is that the series has a unit root (i.e., non-stationary), whereas that of KPSS has no unit roots (i.e., stationary).

Table 2

Variables	ADF		PP		KPSS	
	Constant	Constant &Trend	Constant	Constant &Trend	Constant	Constant &Trend
LRGDP	-2.460	-1.663	-2.370	-1.441	1.604***	0.447***
LRGDP	-3.734**	-4.286***	-5.123***	-5.574***	0.398***	0.055
LREM	-0.755	-1.911	-0.756	-2.015	1.880***	0.194**
LREM	-3.446*	-3.406*	-6.318***	-6.232***	0.106	0.101
LTER	-1.808	-1.439	-1.774	-1.128	1.883***	0.421***
LTER	-3.834**	-4.194***	-4.679***	-4.942**	0.274***	0.049
NMR	-4.436***	-4.192***	-2.489	-2.888	0.431***	0.220***
NMR	-9.875***	-11.896***	-5.186***	-5.178***	0.070	0.070
PNG	-2.753	-2.014	-2.123	-2.783	0.556***	0.297***
PNG	-6.768***	-6.717***	-4.453***	-4.139**	0.248***	0.164**

Unit Root Test Results Using ADF, PP and KPSS Unit Root Tests

*Significance:*** = 1% level; ** = 5% level; * = 10% level*

In this study, the Augmented Dickey-Fuller (ADF) test was performed to check the order of integration of the variables as a requirement for time-series analysis. However, given the low power in a small sample of the ADF test (Choi and Chung, 1995), Phillips-Perron (PP) and Kwaitkowski-Phillips-Schmidt-Shin (KPSS) unit root tests were also applied to check the robustness of the estimation results.

These tests were conducted using two regression cases: i) with constant only and ii) with constant and trend. The results in Table 2 show that the ADF test failed to reject the null hypothesis of a unit root at the level of real GDP, remittances, tertiary school enrollment, and population growth. However, we do not fail to reject the null hypothesis of net migration rate at levels. At the first difference, all variables were stationary. The KPSS test also rejected the

null hypothesis of a stationary process at the level for all the variables, showing no rejection of the stationary hypothesis for all variables at first difference except for real gross domestic product, and tertiary school enrollment in the intercept-only case and intercept and intercept with trend cases for population growth. Although there are mixed results with the order of integration of the net migration rate and real gross domestic product using the ADF and KPSS tests, the Phillips–Perron test revealed that all variables are stationary at first difference, that is, I(1).The probability level was highly significant at the 1% probability level.

However, ADF, PP, and KPSS unit root tests are insensitive to fractional unit roots, necessitating a more robust unit root test for modeling, forecasting, and policymaking, which takes into cognizance precisely considers the unit root order of the time series.

Unit Root Test with Structural Break

The precision of the standard unit root test may be limited if there are structural breaks, because even though a series may be stationary, it does not revert around the same mean across all times. This has significant implications for statistical inferences and the credibility of estimates. Leybourne and Newbold (2003) posited that in the presence of structural breaks results may support the non-stationary hypothesis and the ill-defined non-rejection zone and may even lead to the flawed conclusion of the presence of a stochastic trend hence the need to carry out a unit root test taking into consideration the structural breaks in the series.

Table 3

Unit Root Test with Structural Break Results Using Innovational Outlier

Variables	ADF (t-statistics)		ADF (t-statistics)	
	At levels	Break-point	At first difference	Break-point
LRGDP	-3.91	1985	-7.82***	1999
LREM	-3.04	1990	-7.05***	2005
LTER	-2.99	1988	-5.93***	2005
NMR	-8.75***	1986	-7.20***	2008
PNG	-7.61***	2001	-5.11***	1990

*Significance:*** = 1% level; ** = 5% level; * = 10% level*

As shown in Table 3, there are different breakpoints at the levels and at the first difference. Significant structural breaks were found in 2005, 1986, and 2008 for remittance and net migration rates, respectively. It is not surprising that the net migration rate shows a break in 1986, as this coincides with the period of the Structural Adjustment Program and the declaration of the National Economic Emergency by Major General Ibrahim Babangida as a result of the economic burden following a plummet in oil

prices, which must have led people to leave the country. In addition, in consonance with the ADF, PP, and KPSS test results, all variables are stationary at the first difference.

Fractional Integration Results

The restrictive imposition of the order of integration as I(0) or I(1) can be limiting because the time series could be I (d), where d is any real number, integer, or fraction, which makes the deductions more meaningful for policy implications. In this case, the series is stationary and invertible when -0.5 <d <0.5;stationary means reverting and possesses long memory when 0 < d < 0.5, while it means reverting non-stationary when 0.5 < d < 1.Therefore, we conducted a fractional unit test on the time series using the Robinson 1994 linear model approach, followed by log-periodogram regression and local Whittle estimation methods.

Table 4

The selected results based on the appropriate deterministic terms are in bold."NC" implies no result convergence.

Logged transformed RGDP, TER, and REM were adopted based on Robinson's (1994) approach. The results in Table 4 depict the estimates of order of integration (d) for the variables with deterministic term, constant only, and constant with trend in the second, third, and fourth columns, respectively. The confidence intervals in parentheses are used to select the appropriate deterministic term for each case based on t-statistics. Hence, evidence of mean reversion, that is, I (d<1), was seen in the "d" estimates for LnRGDP and PNG, while proof of I (d=1; d>1) was seen in the other variables (NMR, LnTER, LnREM).

However, the estimates of d in the constant-only case revealed a slightly different result, with evidence of mean reversion found in NMR in LnRGDP and PNG. In a different twist, the constant with trend case revealed evidence of mean reversion in PNG and LnREM and evidence of I (d>1) in LnRGDP and LnTER, while NMR showed no convergence. Given these wavering results, t-statistics were used to select the appropriate models; the selection is presented in Table 5.

Variable	No deterministic term	Constant only	Constant with trend
LnRGDP	0.9978	0.9999	1.0767
	(0.8469, 1.1487)	(-2.0616, 4.0614)	(0.7868, 1.3666)
NMR	1.0552	0.999	NC
	(0.6424, 1.4680)	(-1.8950, 3.8948)	
LnTER	1.0255	1.2369	1.0955
	(0.8897, 1.1613)	(0.9694, 1.5044)	(0.7549, 1.4361)
PNG	0.9863	0.999	0.9990
	(0.7293,1.2433)	(-1.9852, 3.9850)	(-1.9166, 3.9164)
LnREM	1.0434	1.0758	0.8882
	(0.8525,1.2343)	(0.8471, 1.3045)	(0.5754, 1.2010)

Fractional Integration based on (Robinson 1994) Linear Model

Table 5

Selected Model in Table 4

Variable	d	Constant (c)	Trend (t)
LnRGDP	0.9999	-26676.8***	-
	(-2.0616, 4.0614)	(-7.176E18)	
NMR	0.999	-47513.6***	-
	(-1.8950, 3.8948)	(11.4)	
LnTER	1.0955	-1.3511	0.0434**
	(0.7549, 1.4361)	(-1.31)	(1.80)
PNG	0.9990	-5.1800	0.0075***
	(-1.9166, 3.9164)	(-7.23E11)	(2.24)
LnREM	0.8882	-3.6887	0.1061***
	(0.5754, 1.2010)	(-1.11)	(2.62)

Note: As shown in Table 4, the confidence intervals of d are in parentheses, whereas the t-values of the estimated deterministic terms are in parentheses in the 3rd and 4th columns.

Inconsonance with the t-statistics criteria, the constant with trend case was significant at 1% for all variables except LnTER, which was significant at 5%.However, the constant-only case was appropriate for LnRGDP and NMR. Therefore, considering the estimates for d, evidence of I (d<1) was found for all variables except LnTER, which showed evidence of I (d>1).

Table 6

Fractional Integration Results based on Log-periodogram Regression and Local Whittle Estimation Methods

Variable	Local Whittle Estimates			Log-Periodogram Regression Estimates		
	$M^{0.5}$	$M^{0.6}$	$M^{0.7}$	$M^{0.5}$	$M^{0.6}$	$M^{0.7}$
LnRGDP	0.8998	1.0136	0.9276	0.9295	1.0462	1.0120
NMR	0.4280	0.7384	0.8323	0.4390	0.7312	0.8162
LnTER	1.0384	0.9959	0.9987	1.2677	1.1141	1.0736
PNG	0.9421	0.9128	0.8954	0.9871	0.9155	0.9072
LnREM	1.1623	1.0770	1.0753	1.2601	1.1265	1.1966

Note: The three periodograms used were $M^{0.5}$, $M^{0.6}$, and $M^{0.7}$, which correspond to samples 6, 9, and 12, respectively, where M is the sample size of the time series.

Furthermore, using both the local Whittle semi-parametric and log-periodogram (GPH) techniques, an analysis of the fractional unit root (i.e., fractional integration) of the time series was carried out. The results presented in Table 6 were compiled for three periodogram points: m = t 0.5, m =t 0.6, and m = t 0.7.The results showed that fractional integration estimates, ds, were computed fairly well around 1 in all cases across the three periodogram points for the five time series. Thus, because equality of unit roots, as recommended by Engle and Granger

(1987), is part of the co-integration procedure, we conducted the homogeneity of the fractional-order test. The test results are listed in Table 7.

Homogeneity Test

The homogeneity test used was based on Robinson and Yajima (2002) with a null hypothesis of the same degree of integration, and the test results, as shown in Table 7, showed no significant differences in the paired fractional orders given that the test statistics are all less than 1.96 two-tail t-tests. Hence, we fail to reject the null hypothesis and conclude that the degree of integration is equal.

Table 7

Homogeneity Test of Paired Fractional d-values

Variable	**LnRGDP**		
	$M^{0.5}$	**$M^{0.6}$**	**$M^{0.7}$**
NMR	1.1718	0.6039	0.2583
LnTER	0.1338	0.1380	0.2126
PNG	0.0592	0.1659	0.1819
LnREM	0.7345	0.6065	0.6337

Critical value at 5% (1.96)

Given these findings, we adopted a general fractional co-integration approach using the Hausman test to establish the fractional co-integration relationships.

Fractional Co-integration Test

Table 8

Testing for Fractional Co-integration based on Hausman test

Variable	**LnRGDP**		
	$M^{0.5}$	**$M^{0.6}$**	**$M^{0.7}$**
NMR	0.8757	0.0096	305.58
LnTER	0.0106	0.0315	0.0085
PNG	886.35***	5.887***	4.7100***
LnREM	1.2937	0.1702	0.1590

Critical value at 5% (1.96)

The Huasman test of no cointegration in the fractional unit root framework, as given by Marinucci and Robinson (2001), was carried out. In Table 8, we present the results of the Hausman test of no co-integration against the hypothesis of fractional co-integration, which failed to reject the null hypothesis of no co-integration between the dependent variable LnRGDP and the independent variables NMR, LnTER, and LnREM. However, the results rejected the null hypothesis of no co-integration between LnRGDP and PNG. Thus, since none of the primary variables in this research show evidence of fractional co-integration, there was no need for further estimation of a co-integration model to establish long-run relationships.

Test of Research Hypothesis

Test of Hypothesis 1 (H01)

As shown in Table 8, the t-values were not significant at the 5% significance level. Therefore, we fail to reject the null hypothesis and conclude that the net migration rate, which is a proxy for human capital flight, has no long-term effect on economic growth.

As shown in Table 8, the t-values were not significant at the 5% significance level. Therefore, we do not reject the null hypothesis and conclude that remittances have no long-run effect on economic growth.

Discussion

The primary purpose of this study is to establish the degree of influence of human capital flight on economic growth in Nigeria using a fractional integration and co-integration approach. The descriptive statistics adopted for the study show evidence of substantial variation in the variable trends within the analysis period. This is indicated by the differences between the maximum and minimum values of all variables.

First, standard approaches for univariate analysis- ADF, PP, and KSS methods–were employed to test for unit roots. Although the results were conflicting for some variables, it was concluded that all variables were stationary at the first difference, I (d=1). Considering structural breaks, the results show that regardless of a known break point in 1986, 2005, and 2008, all series are only stationary at the first difference; that is, they are I(1).These results suggest that the effects of one-time shocks on series are permanent. Thus, based on both sets of test results, we would conclude that one-time shocks to human capital flights, as captured by the net migration rate and remittances, would have permanent effects. As such, a steady policy stance would not be critical in ameliorating the menace, as a one-off policy shock would have long-lasting effects.

Second, owing to the restrictive nature of the standard unit root test (d =0 or d =1), we tested for fractional unit roots with fractional integration techniques for the univariate cases, using parametric and semi-parametric techniques.

The empirical results suggest that there is statistically significant evidence for rejecting the presence of long memory for both the net migration rate and remittance. All series presented had estimates of approximately 1 (RGDP, NMR, PNG: d = 0. 999; REM: d = 0.888; TER: d = 1.096). Thus, we also conclude that the series are non-stationary though mean-reverting. This implies that a one-off policy will leave a permanent effect on the series. Thus, steady policy intervention is not necessary to yield a permanent impact.

To estimate a fractional co-integration relationship to ascertain the direction of the effect of human capital flight on economic growth, we conducted a homogeneity test. This is consistent with the condition of homogeneity in integration orders proposed by Engle and Granger (1987) and later by Johansen (1996).The results indicate that the order of integration of the series was homogeneous.

Finally, the Hausman test for no co-integration of Marinucci and Robinson (2001) was carried out to estimate a co-integration model. However, no evidence supporting fractional co-integration was obtained, except for population growth, which is not a primary variable in this study. As a result, the proposed (FCVAR) method, as formulated initially by Johansen (2008)and further expanded by Johansen and Nielsen (2010, 2012), could not be applied. Therefore, our results prove the fractional cointegration hypothesis between economic growth and human capital flight. This implies that human capital flight has no long-term effect on economic growth. This is not far-fetched from the observations of the individual series.

This is a contradictory submission to the study of Adeosun and Popogbe (2021), who reported a devastating short- and long-run effect of brain drain in domestic promotion as well as a positive relationship between brain drain and human capital formation, remittances, and the diaspora effect.

However, in concordance with the findings of this study, Adewuni et al. (2019) also reported no long-run relationship between brain drain and economic growth in Africa, using a co-integration approach. This finding can be attributed to whether an economy has a surplus of redundant skilled labor such that an exodus of human capital only provides an opportunity

for those left at home to be gainfully employed while reducing the unemployment rate. Thus, as evidenced by Nigeria's high unemployment rate (21%; NBS, 2021), the country may export surplus labor. As a result, human capital flights do not significantly impact economic growth (Docquirer & Beine, 2001). Another explanation is that remittances are sent home. Various scholars have found that only a small portion of these monies is spent by relatives on investment goods, with a big chunk spent on consumables and little or no investment in trade and foreign direct investment (Mckenzie& Gibbon, 2010). The implication is that it may not have a sufficiently strong ripple effect to affect economic growth.

The policy implication of these findings is that the relationship between human capital flights and economic growth depends on the peculiar characteristics of a sending country. A flight may not influence economic growth if the country exports human capital from a surplus. Additionally, remittances must be plowed into productive usage to influence economic growth.

Conclusion and Recommendation

This study investigated the effect of human capital flights on economic growth in Nigeria using time-series data from 1981 to 2019.The variables used in this study include real gross domestic product, net migration rate, tertiary school enrolment, population growth rate, and remittances. The fractional integration and co-integration estimation was adopted and has generally shown that despite an upward trend in human capital flights, remittances, and economic growth, there is no fractional co-integrating relationship between these variables.

Thus, the study concludes that human capital flight has no long-term relationship with economic growth. In addition, remittances do not have a long-run relationship with economic growth. Based on these findings, it is recommended that, even though this study has shown that human capital flight does not have a long-run relationship with economic growth, the government should prioritize investing in education and skills development, which is crucial for innovation and competitiveness. In addition, the government must diversify economic growth drivers, including supporting domestic industries, encouraging innovation, and attracting foreign direct investment. Finally, even if remittances are not long-term drivers of economic growth, they can help recipient households improve their well-being. Policymakers should consider ways to use remittances for development, such as improving financial literacy, encouraging investment in productive assets, and providing a favorable environment for small enterprises.

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