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Unconditional federal transfers and state government spending: The flypaper effect in Nigeria and South Africa

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Abstract: The flypaper effect is undoubtedly among the most interesting concepts in subnational government spending behavior. This study is the first attempt to provide empirical evidence on the existence of the flypaper effect in the two largest economies in Sub-Saharan Africa: Nigeria and South Africa. Using the two-step system generalized method of moment's estimator, our results show that the flypaper effect exists for both state and provincial governments in Nigeria and South Africa. Provincial governments in South Africa are found to be more responsive to positive changes in unconditional federal transfers than state governments in Nigeria. We therefore recommend sensitization on the receipt and disbursement of unconditional federal transfers. This will help reduce the illusion or information asymmetry about the use of unconditional federal transfers.

Keywords: unconditional federal transfers, flypaper effect, state spending, two-step system, generalized method of moments, Nigeria, South Africa

1. Introduction

Since the early 1970s, the fiscal federalism literature has predicted that the impact of a lump-sum transfer on subnational government expenditure is the same as the impact of an identical increase in taxpayers' income (Sour, 2013). However, this prediction is not supported by recent empirical evidence, as recent evidence shows that an increase in intergovernmental transfers has a greater impact on subnational expenditure than an equivalent increase in taxpayers' income (Bradford & Oates, 1971). The above phenomenon, whereby intergovernmental transfers tend to induce more local expenditure than equivalent increases in subnational income, is known in the public finance literature as the flypaper effect (Turnbull, 1998). The concept of the flypaper effect also corresponds to the long-held view that "money sticks where it hits," meaning that money transferred to the public sector often stays in the public sector, while money transferred to the private sector tends to stay in the private sector (Fisher, 1982; Inman, 2008).

The flypaper effect also describes a situation where an increase in central government grants improves a subnational government's local spending more than the increase induced by an equivalent increase in local revenues (Tanjunga et al., 2021). Empirical evidence on the existence of the flypaper effect in different countries is abundant in the existing literature (Knight, 2002; Singhal, 2008; Brollo et al., 2013; Sour, 2013; Allers & Vermeulen, 2016; Baskaran, 2016; Cruz & Silva, 2020; Iorember et al., 2022a). The flypaper effect is undoubtedly one of the most interesting concepts related to subnational spending. Although many scholars have tested its presence in advanced and emerging economies, the literature on developing countries remains very scarce, and the evidence is largely mixed. To the best of our knowledge, no empirical study tested the flypaper effect in Sub-Saharan Africa (SSA). We, therefore, set out to contribute to the existing debate by examining the evidence for the two largest economies in SSA as to whether the transfer of revenue from the center to state (or

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provincial) governments induces a stronger response in public spending than the effect of comparable increases in private income.

Our study, therefore, seeks to answer the following research questions: Does the flypaper effect exist for state and provincial governments in Nigeria and South Africa? If so, do state governments in Nigeria respond to increases in unconditional federal transfers in the same way as provincial governments in South Africa? The objectives of the study are, therefore, as follows: First, to examine the existence or otherwise of the flypaper effect in Nigeria and South Africa. The second objective is to examine whether the state authorities in Nigeria and the provincial governments in South Africa react similarly to an increase in unconditional federal transfers.

Our empirical results indicate a positive and stronger response of public spending to unconditional federal transfers than to private income, suggesting the presence of the flypaper effect in both countries. That is, the results reveal the flypaper effect's existence since the unconditional federal transfer coefficient is greater than the private personal income coefficient. The finding, thus, answers the first research question since the flypaper effect is found to exist for the state and provincial governments in Nigeria and South Africa. This finding suggests that the variables (unconditional federal transfer and private personal income have) an increasing effect on government spending in both Nigeria and South Africa. This finding agrees with the studies of Pallesen (2006) and Trujillo (2006), who also confirm the existence of the flypaper effect.

On the second research question, the results reveal that the provincial governments in South Africa are more responsive to positive changes in unconditional federal transfers than the state authorities in Nigeria in terms of providing a higher volume of public goods and services. This suggests that the provincial indigenes in South Africa are more informed about unconditional federal transfers such that the illusion level or information asymmetry associated with non-matching transfers in South Africa is less than what obtains at the state level in Nigeria. This may not be unconnected with the disclosure issues surrounding the amount of unconditional transfers received by the state governments. More so, the robustness tests indicated that the outcomes are sensitive to model specifications and choice of estimation technique, consistent with the finding of Becker (1996), who also observed that the flypaper effect is sensitive to model specification.

Our main contributions to the public finance literature on the flypaper effect are thus threefold: The study is the first attempt to provide empirical evidence on the existence or otherwise of the flypaper effect in Nigeria and South Africa, thereby attesting to its original polarity. Second, the study differs from previous attempts in other countries in terms of the choice of estimation technique and the empirical coverage. Unlike in the past, we undertake a comprehensive analysis of the flypaper effect in the two countries using a superior estimation technique, the two-stage System Generalised Method of Moments (SGMM), which is robust to heteroscedasticity and autocorrelation while addressing the endogeneity problems inherent in estimating the flypaper effect. To the best of our knowledge, we have not come across any study that has examined the flypaper effect at the state or provincial level in Nigeria and South Africa on a country-by-country basis while simultaneously providing a comparative analysis of the two leading economies in SSA. Our intention here is to improve the precision of the parameter estimates beyond what has been achieved in the past in order to compare the results with those of other estimators used in previous studies.

The paper is divided into five sections. Following the introduction, section two provides a theoretical background on the flypaper effect and the structure of unconditional federal transfers in Nigeria and South Africa. Section three discusses the methodology. The empirical results are presented and analyzed in section four, while section five provides the concluding remarks and policy options.

2. Literature and Theoretical Review

2.1 The Flypaper Effect in Theory

Bradford and Oates (1971) provided the theoretical basis for the flypaper effect when they postulated that transfers from the federal government to local governments or directly from individuals would have the same effect on allocating the public budget between public and private goods. The empirical studies that later tested the above hypothesis, however, discovered that the response of public spending to intergovernmental transfers was more than the response to increases in private personal income. This implied that the transfer of revenue resources to local authorities yielded more effect on public goods than was earlier predicted in theory, such that the programs implemented with the aid of intergovernmental transfers tended to persist even when the transfers were no longer coming. The continuing discovery of the same result was what caused the public finance literature to consider it as an anomaly and a purely empirical phenomenon, which was first referred to as the flypaper effect by Arthur Okun, who compared it with a paper enclosing some sticky glue being used in some communities to kill insects or rodents (Sour, 2013).

The bureaucratic behavior of local authorities is tailored towards maximizing the government budget, which needs to reflect taxpayers' preferences on public spending, without which the citizens will not vote for the government (Niskanen, 1968). The government budget is maximized at the point of equilibrium where the budget is equal to (or greater than) the minimum cost of supplying the required level of public goods (Iorember et al., 2018). In the attempt to maximize the local budget, the local authorities are assumed to behave like a monopolist by supplying public goods only in exchange for the total budget and not at idiosyncratic rates. This gives the local government a form of market power to enable it to make an "all or nothing" decision (Sour, 2013).

Based on the above assumptions, Sour (2013) postulated that the preferences of bureaucratic governments and those of individuals in the community are quasi-linear, thereby allowing for a mathematical derivation of the flypaper effect as follows: Let "E" represent the level of government expenditure and "Y" the private income of individuals in the community, with "ɡ" as the portion of public good provided through intergovern mental transfers. The model postulates that (a) the change in public expenditure arising from a change in intergovernmental transfers is positive. That is $\partial E/\partial g>0$, (b) the change in public expenditure arising from a change in the private income of individuals in the community is positive. That is $\partial E/\partial Y>0$. Thus, the flypaper effect is said to exist whenever the impact of intergovernmental transfers on public expenditure is higher than the impact of private income of individuals in the community: If $\partial E/\partial g>\partial E/\partial$, then there is the flypa per effect.

A number of studies have also attempted to know whether the response of public spending to unconditional federal transfers is symmetric or not. In other words, does public spending respond to positive and negative changes in unconditional federal transfers in the same manner? The two categories of asymmetry of the flypaper effect identified in the extant literature are the fiscal replacement and the fiscal restraint paradigms (Alymkulova et al., 2023; Gbaka et al., 2022; Zhou et al., 2022; Bature et al., 2022; Sour, 2013). The fiscal replacement category occurs when there is a reduction in federal transfers, but the local authorities prefer to keep public spending at the same level by generating more taxes or growing the local public debt. The fiscal restraint asymmetry occurs when the local authorities choose to reduce public spending by a bigger margin than would have been the case for a symmetric response.

Sour (2013) further indicates that subnational governments are exposed to a greater burden of tax collection under the fiscal replacement category in comparison to the lesser burden imposed by the symmetric case, while the tax burden placed by the fiscal restraint category is the least. The extant literature is also observed to be deficient in information on the reasons for the existence of the different types of asymmetry, except for the exposition about the fiscal replacement paradigm that some political factors are responsible for

the difficulty faced by political leaders at the local level to cut down or possibly eliminate public programs that have already taken root when faced with dwindling federal transfers (Gramlich, 1987).

Many subnational governments were found to exhibit asymmetric fiscal replacement behaviors in response to unconditional federal transfers (Gramlich, 1987; Melo, 2002; Levaggi & Zanola, 2003; Pallesen, 2006; Trujillo, 2006). It is, however, essential to note that the role of asymmetries in determining the response of public spending to unconditional federal transfers is outside the scope of this study, which aims at determining the existence or otherwise of the flypaper effect in Nigeria and South Africa, and to ascertain further whether the state/provincial authorities in the two countries respond in the same way to increase in unconditional federal transfers.

In another development, Becker (1996) observed that the flypaper effect is sensitive to model specification, noting that a potential endogeneity problem may result from the unobservable characteristics of the cross-sections such that the coefficient estimate of the transfer variable may be biased. Hines and Thaler (1995) also expressed doubts about the existence of the flypaper effect, citing procedural and measurement errors as reasons for the misleading results. The evidence emerging from the cross-country empirical literature is also mixed, but with a larger majority of the results supporting the existence of the fly-paper effect.

2.2 The Structure of Unconditional Federal Transfers in Nigeria and South Africa

Unconditional federal fiscal transfers refer to revenue allocations from the central to the lower tiers of government for general-purpose spending. Typical examples of such allocations in Nigeria include those from statutory revenue and Value Added Tax (VAT) Pool Accounts, as well as revenue drawn from Excess Crude and Stabilization Accounts for allocation among the three tiers of government in times of budgetary shortfalls. Unlike conditional fiscal transfers, the subnational governments have full discretion over the use of unconditional federal transfers.

On the other hand, conditional federal fiscal transfers are revenue transfers from the center to the lower levels of government meant for specific purposes usually outlined by the central government. Good examples of such transfers include federal grants to state-owned universities to procure laboratory equipment or emergency relief funds granted by the central to the state governments to address the plight of those in internally displaced people (IDP) camps located in different states. The subnational governments would typically find it difficult to divert such funds to other uses as they do not have complete discretion over its usage.

2.2.1. Unconditional Federal Transfers in Nigeria

The federal system in Nigeria assigns responsibilities among the three tiers of government in line with the 1999 constitution. The federal government is responsible for the functions listed under the exclusive legislative list. However, it is jointly responsible with the state governments for overlapping functions listed under the concurrent legislative list.

The federal government collects, on behalf of the federation, oil and non-oil revenue (including main taxes) and remits into the federation account for distribution among the three tiers of government. The sharing of revenue from the federation account is based on a vertical formula that allocates 87.0 percent of the federally collected revenue to the three tiers of government after deducting the 13 percent allocation to oil-producing states based on an existing derivation principle on mineral revenue. The vertical revenue allocation formula stipulates 52.7, 26.7, and 20.6 percent of the revenue available for distribution in favor of the federal, state, and local governments, respectively.

2.2.2. Unconditional Federal Transfers in South Africa

With the advent of democratic governance in 1994, the unitary system in South Africa was replaced by a more federal-like system having a three-tier structure - the national, provincial, and municipal governments. The country now has a total of nine provinces with eight metropolitan, 44 districts, and 226 local municipalities. The municipalities are grouped into metropolitan and district municipalities, with each district municipality having various local municipalities. Policy initiatives and strategic development goals are handled at the national level, with responsibilities and standards set for the provinces and municipalities to function effectively.

However, the national government still monitors the lower levels of government in order to ensure the effective implementation of concurrent functions. The concurrent functions provided in the constitution for the national and provincial governments include education, housing, health, and welfare, with the policy formulation vested in the national government and the implementation handled by provincial governments. Road construction in provincial areas is, however, the exclusive preserve of provincial governments. In contrast, basic services such as sanitation, streetlights, access/feeder roads, and general town planning are left in the hands of local governments (Hobdari et al., 2018).

The subnational governments in South Africa enjoy two major types of transfers: earmarked transfers and equitable share transfers. About 80 percent of the transfers to provincial governments come in the form of equitable share transfers (which are unconditional transfers). However, this category of transfers only accounts for about 50 percent of the transfers to municipalities, which is inclusive of their share of general levy usually shared between metropolitan and other municipalities. Population is the major index used in arriving at the formula for sharing the two categories of transfers, and these transfers are shared based on a transparent formula that is always updated every five years with the aid of census survey data. National revenue estimates, however, provide the basis for equitable share transfers to the provincial and municipal governments. About 48 percent of the 2015/16 budget appropriations went to the national government, with only about 43 percent and 9 percent going to provincial and municipal governments. This sharing excludes the amount reserved for debt service and contingent liabilities (Hobdari et al., 2018).

3. Data and Methods

3.1. Data

The study utilizes annual panel data on Nigeria and South Africa over the period 2013–2020. The choice of the two countries and the time frame are informed by their size, contribution to Africa, and data availability. Nigeria and South Africa are the two largest economies in Sub-Saharan Africa, and both countries have subnational governments that receive transfers from the federal or central government. Following the literature, we use the per-capita revenue (own revenue or population) of the state or provincial governments as a proxy for private personal income since historical data on private income is not available at the state or provincial level in Nigeria and South Africa. The first dataset is a sample of 22 out of the 36 state governments in Nigeria (including the federal capital territory, which shares a similar status with the state governments), while the second dataset consists of a population of 9 provinces in South Africa. This reflects a sample of 176 observations for Nigeria and a population of 72 observations for South Africa. The selection of the states in Nigeria and the study period were based on the availability of relevant data. The selected states cut across all geopolitical zones in the country, implying that the sample is representative of the entire population of the state governments.

The data on unconditional federal transfers (UFT), total revenue (TR), own revenue (OWN), and total expenditure (TE) of the state governments in Nigeria are from various editions of the Central Bank of Nigeria's (CBN's) Annual Economic Report and the CBN's Statistical Bulletin. However, the data on GDP deflators are from the online database of

the International Monetary Fund's (IMF's) World Economic Outlook, while the estimated state population (POP) is from the National Bureau of Statistics (NBS). The data on public school enrollment come from the online databases of the Federal Ministry of Education (FMF), the Universal Basic Education Commission (UBEC), and the National Bureau of Statistics (NBS), with minor interpolations to cover data gaps.

On the other hand, the data on equitable (unconditional or non-matching) transfers (UFT), own revenue (OWN), and total expenditure (TE) of the provincial governments in South Africa are from the online databases of the National and Provincial Treasuries. The data on Gross Domestic Product (GDP) deflators are from the International Monetary Fund's (IMF's) World Economic Outlook, while the estimated provincial population (POP) is from the online databases of Statistics South Africa and the Provincial Treasury. The data on public school enrollment is, however, from the online database of the National Treasury.

3.2 Econometric Model

To explore the existence of the flypaper effect, we express the following dynamic panel regression model with endogenous regressors to capture the response of the state or provincial spending to unconditional federal transfers and private personal income. The model controls for unobserved group-specific effects.

$$lnTE_{i,t} = \alpha_0 + \alpha_1 lnTE_{i,t-1} + \alpha_2 lnUTE_{i,t-1} + \alpha_3 lnPPI_{i,t-1} + \omega_i + \delta_t + \alpha_4 lnX_{i,t-1} + \varepsilon_{i,t}, \quad (1)$$

where i represents the number of cross-sections [i = 1,…., 22] states in the case of Nigeria and 1,….,9 provinces in the case of South Africa]; t denotes the number of time series (or years). $lnTE_{it}$ is the natural logarithm of public expenditure for state or province i in year t. $lnUFT_{it}$ stands for the natural logarithm of unconditional federal transfers for state/province i in year t. $lnPPI_{it}$ represents private personal income proxied by per capita own revenue for state or province i in year t; lnX_{it} is a vector of control variables reflecting public school enrollment *(lnPSE)* and year dummies included in the model to circumvent the problem of omitted variable bias or model under-fitting. α_0 is the intercept term. $\alpha_1 - \alpha_4$ are the elasticities of state or provincial expenditure to a one percent change in the one-period lag of the dependent variable, unconditional or non-matching federal transfers, and private personal income respectively. ω_i and δ_t denote unobserved state/provincial-fixed effects and year-fixed effects in that order. $\varepsilon_{i,t,}$ however, represents time and state-specific error term.

The lagged log of public spending ($lnTE_{i,t-1}$) and non-matching federal transfers ($lnUFT_{i,t-1}$) are the endogenous variables in the model, the log of public school enrollment ($lnPSE$) is treated as weakly exogenous; while the log of private personal income ($lnPPI_{i,t-1}$) and the year dummies are strictly exogenous. The instrumental variables used in the model are the one-period lag of the state/provincial spending ($lnTE_{i,t-1}$) for the GMM in strument, with the log of public school enrollment ($lnPSE$), the log of private personal income ($lnPPI$), the log of total revenue ($lnTR$) of the state and provincial governments and the log of the state or provincial population ($lnPOP$) as other instruments.

It is important to note that the impact of the regressors on the dependent variable in both the short and long-run cannot be measured via the use of a static model, which is why we employ a dynamic panel regression model to be estimated by the two-step SGMM estimator in order to reflect the persistent feature of the state/provincial spending while at the same time resolving the endogeneity problem, omitted variable bias, state/province-specific heterogeneity and measurement errors. We then apply the Hansen J. test of over-identifying restrictions to assess the overall instrument validity and the Arellano-Bond AR(2) specification test to verify that the error terms are serially uncorrelated (Ozili & Iorember, 2023; Musa et al., 2021; Iorember et al., 2022b; Usman et al., 2021).

For us to ascertain the presence of the flypaper effect, we have to compare the response of public expenditure of the state/provincial governments to a one percent increase in unconditional or non-matching federal transfers (α_2) and the response of the state/provincial spending to a one percent increase in private personal income (α_4). If $\alpha_2 > \alpha_3$ then there is evidence that the flypaper effect exists at the state or provincial level in the country being investigated. The flypaper effect is, thus, the estimated difference between α_2 and α_3.

3.3.Techniques of Estimation and Justification

To estimate the model, our study employs the two-step System Generalized Method of Moments (SGMM) estimation technique proposed by Arellano and Bover (1995) and Blundell and Bond (1998) to investigate the flypaper effect in Nigeria and South Africa. The study, thus, departs from the past in the choice of estimation technique for many obvious reasons. The SGMM is, by convention, a robust estimation technique that does not only control for the endogeneity problem in the model but also controls for omitted variable bias and unobserved panel heterogeneity, including measurement errors in the data (Iorember et al., 2022c). The SGMM is also appropriate for dynamic panel models with a large number of observations but a small time frame, as is the case with our study where the regressors are not strictly exogenous but correlated with the error term, reflecting the inherent presence of the endogeneity problem in the model. The two-stage SGMM is appropriate in such situations where the model exhibits a random walk. Monte Carlo evidence also suggests possible gains in precision in addition to a reduction in small sample bias when the dependent variable is persistent and the time frame is short (Adeleye et al., 2017). Embedded in the two-step System GMM estimation technique are two diagnostic tests for instrument validity. These are the Hansen (1982) J. test and the Sargan (1985) test of over-identifying restrictions under a null hypothesis that upholds the overall validity of the instruments used in the model. The Hansen J. test is, however, most often used to test for the validity of the instruments. Thus, a failure to reject the null of either of the tests lends credence to the overall validity of the instruments (Adeleye et al., 2017).

4. Results and Discussions

4.1 Descriptive statistics

Table 1 provides the summary statistics of the data used in the study and the direction of their relationships with the dependent variable (state/provincial expenditure). A cursory look at Table 1 indicates that states/provinces receiving larger unconditional federal transfers appear to record larger amounts of public spending.

We further observe that states from the South-South (SS) geopolitical zone (AkwaIbom, Delta, and Bayelsa states) are the largest beneficiaries of unconditional federal transfers in Nigeria, and public spending in these states is also among the highest (see Figure 1 below). This is not surprising since these states receive additional allocation of revenue resources from the Federation Account via the 13 percent derivation principle.

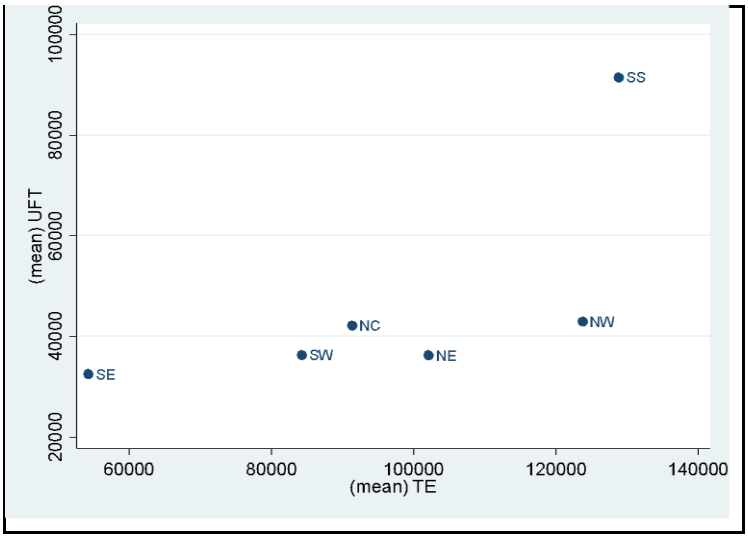
The states in the South-East geopolitical zones receive the lowest amounts of unconditional federal transfers and are also among the least suppliers of public goods at the state level in view of their relatively low public spending. Some states in the North-Central (NC), South West (SW), North-East (NE), and North-West (NW) geopolitical zones also receive low amounts of unconditional or non-matching federal transfers but manage to increase public spending albeit slightly (Figures 1 and 2).

Table 1. Descriptive Statistics

	Mean	SD	Min.	Max.
Nigeria				
Total State Expenditure	103,417.80	53,520.40	33,081.30	316,338.2
Unconditional Federal Transfers	53,032.60	41,504.80	18,370.00	221,800.0
Private Personal Income	2,517.70	2,049.10	375.2	20,075.00
Public School Enrollment	0.688	0.621	0.101	3.276
Total Revenue of State Governments	86,296.30	51,377.80	35,442.40	313,640
Total State Population	5.4	2.3	2.1	14.5
South Africa				
Total State Expenditure	59,993.20	33,149.60	13,165.90	142,367.2
Unconditional Federal Transfers	47,833.60	27,061.40	9,021.50	113,370.0
Private Personal Income	295.3	81.5	133.5	439.5
Public School Enrollment	1.403	0.787	0.283	2.880
Total revenue of State Governments	60,526.50	33,384.60	12,540.60	142,393.7
Total State Population	0.254	3.84	1.163	15.488

Note. SD – Standard deviation, Min – minimum, Max – maximum. Source: authors' computation.

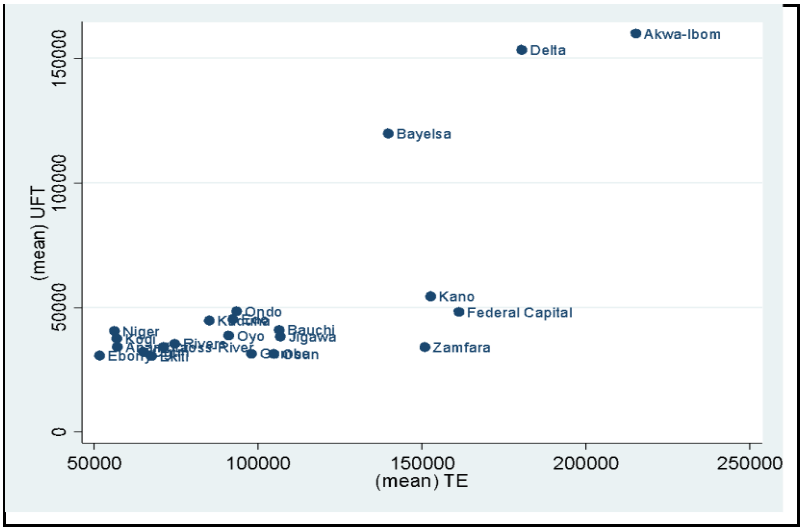
Figure 1. Scatter Plot on the Distribution of Unconditional Federal Transfers and Public Spending among Geopolitical Zones in Nigeria.



Note. TE – Total Expenditure, UFT – Unconditional Federal Transfer, SE – South-East, SW – South-West, NC – North-Central, NE – North-East, NW – North-West, SS – South-South.

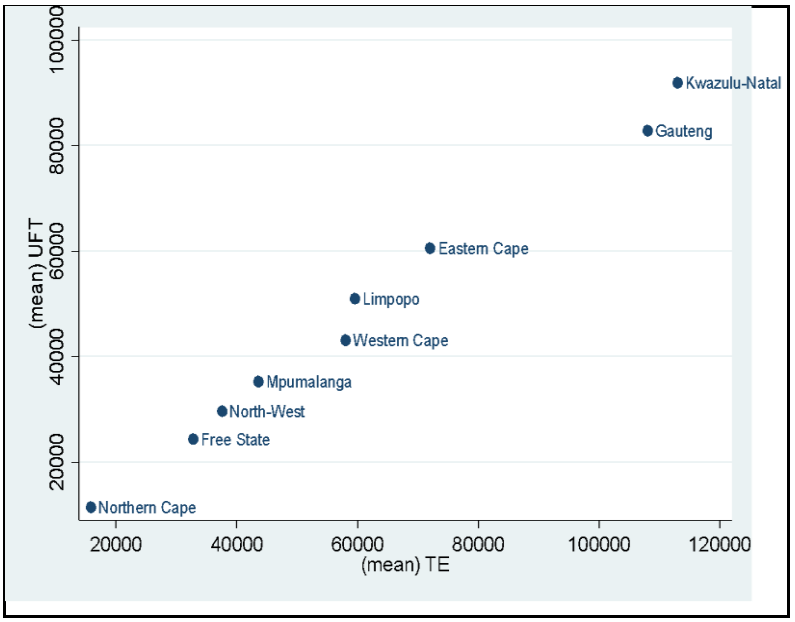
Turning to South Africa, Figure 3 shows that the distribution of unconditional federal transfers among the South African provinces shows that Kwazulu-Natal receives the highest amount of equitable share transfers, followed by Gauteng province. Eastern Cape, Limpopo, and Western Cape provinces receive moderate amounts of unconditional federal transfers. However, Mpumalanga, Free State, and North West provinces are among the lowest recipients of non-matching transfers in South Africa, with the Northern Cape receiving the least (Figure 3).

Figure 2.



Note. TE – Total Expenditure, UFT – Unconditional Federal Transfer

Figure 3. Scatter plot on the Distribution of Unconditional Transfers and Expenditure of State Governments in South Africa.



Note. TE – Total Expenditure, UFT – Unconditional Federal Transfer

4.1.1. Correlation Matrix

The potential relationships between the public spending of the state governments in Nigeria and the other variables are given in Table 2 (panel A). Those of South Africa are presented in panel B of the same table. The correlation matrices point to the nature of the relationships to expect in the empirical analysis. It also corroborates the economic intuition behind the *a priori* expectations. All the variables exhibit positive relationships with public spending by the state and provincial governments in Nigeria and South Africa. Furthermore, all the variables exhibit positive relationships with one other except for the connection between public school enrollment and private personal income in both countries. The relationship between private personal income and state population is mixed, as it reveals a negative relationship for Nigeria but a positive one for South Africa.

Table 2. Correlation Matrix of the Variables

Panel A: Nigeria						
Data	TE	UFT	PPI	PSE	TR	POP
TE	1					
UFT	0.6657	1				
	(0.013)					
PPI	0.3002	0.2486	1			
	(0.044)	(0.031)				
PSE	0.1995	0.0385	-0.144	1		
	(0.051)	(0.077)	(0.069)			
TR	0.7165	0.9757	0.3472	0.1266	1	
	(0.000)	(0.000)	(0.073)	(0.052)		
POP	0.1425	-0.0102	-0.2124	0.8552	0.0808	1
	(0.032)	(0.098)	(0.064)	(0.000)	(0.091)	
Panel B: South Africa						
TE	1					
UFT	0.994	1				
	(0.000)					
PPI	0.1765	0.1044	1			
	(0.034)	(0.060)				
PSE	0.9111	0.9263	-0.1427	1		
	(0.000)	(0.000)	(0.013)			
TR	0.9989	0.9927	0.1709	0.9152	1	
	(0.000)	(0.000)	(0.065)	(0.000)		
POP	0.9405	0.9146	0.2131	0.8701	0.9467	1
	(0.000)	(0.000)	(0.029)	(0.000)	(0.000)	

Note. () shows the *p*-values (p). $p < 0.01$, $p < 0.05$, $p < 0.1$ denote significance level at 1%, 5% and 10%, respectively. TE – Total expenditure, UFT - unconditional federal transfers, PPI – private personal income, PSE - Public School Enrollment, TR - Total revenue of State Government, POP – population.

The observed strong positive correlation between unconditional federal transfers and public spending vis-a-vis the correlation with private personal income, particularly in South Africa, appears to signal the presence of a flypaper effect in the spending behaviors of the state/provincial governments. The relationship between public spending and public revenue of the state/provincial governments is strong in both countries, but it is relatively much stronger in South Africa. This is likely because of the reliance by South Africa on conventional means of raising revenue (taxes) in comparison to Nigeria's over-reliance on volatile oil revenues that promote procyclical spending. The strong relationship between public school enrollment and public spending, as well as unconditional federal transfers in South Africa, seems to support the claim in the flypaper effect literature on the validity of public school enrollment as an instrumental variable in the expenditure function. The observed weak relationship in the case of Nigeria could be attributed to the relatively low percentage given to this principle in the revenue allocation formula.

4.2 Analysis of the Flypaper Effect

Our main interest in this study is to evaluate the behavior of the state/provincial spending to changes in unconditional or non-matching federal transfers and private personal income in Nigeria and South Africa towards verifying the existence or otherwise of the flypaper effect in the two largest economies in Sub-Saharan Africa (SSA). In line with

the extant literature, the flypaper effect is interpreted in this study as the difference in elasticities of state or provincial government spending to a one percent change in unconditional federal transfers and private personal income, holding all other factors constant. Table 3 presents the pooled estimates of the model using the system GMM approach. Evidently, the results show that a one percent increase in the model variables (unconditional federal transfer, private personal income, public school enrolment) leads to a positive and significant impact on public spending by 0.60%, 0.23%, and 33%, respectively. These results suggest that the variables have an increasing effect on government spending in both Nigeria and South Africa. More so, the results reveal the existence of the flypaper effect since the coefficient of the unconditional federal transfer is greater than the coefficient of the private personal income. This finding agrees with the studies of Pallesen (2006) and Trujillo (2006), who also confirm the existence of the flypaper effect. To further deepen the understanding of the effects, we estimated the model on a country basis, and the results are presented in Table 4.

Table 3. Two-Steps System GMM Estimates [Dependent Variable: State/Provincial Total Expenditure (log)], Pooled Estimates

	Coefficient	**Std. Error**	***p*-value**
Log of Total Expenditure_1	0.3219***	0.0193	0.0000
Log of Unconditional Fed. Transfer	0.6631***	0.0351	0.0000
Log of Private Personal Income	0.2319***	0.0265	0.0000
Log of Public School Enrolment	0.327***	0.0329	0.0001
Constant	2.5194***	0.2972	0.0000
Diagnostic Tests			
AR(1)	-2.823		0.066
AR(2)	-1.897		0.071
Hansen test	0.452		0.386
No. of Countries	2		

Note. ***, **, and * indicate rejection of the null hypotheses at the 1%, 5%, and 10% significant levels, respectively.

The dynamic panel regression model results and the long-run coefficients for Nigeria are reported in the second and third columns of Table 4, respectively. The results of the dynamic panel regression model and the long-run coefficients for South Africa are reported in the fourth and fifth columns, respectively. From the empirical results, we find that the one-period lag of state spending is a strong determinant of current spending by the state governments in Nigeria. This finding seems to attest to our earlier claim that state spending in Nigeria tends to persist over time. We are, however, surprised about the observed non-persistence of public spending by provincial governments in South Africa. This perhaps opens another area for future research, as investigating the persistence of public spending in Nigeria and South Africa is clearly outside the scope of this study.

All things being equal, the results indicate that a one percent increase in unconditional federal transfers leads to a 0.268 percent increase in state spending in Nigeria in comparison to a 1.080 percent increase in provincial expenditure in South Africa. Both estimates are significant at the one percent level. Interestingly, we find that a one percent increase in private personal income (proxied by per capita own revenue) leads to a 0.110 percent and 0.129 percent increase in state and provincial spending in Nigeria and South Africa at the ten percent level of significance. The greater coefficients associated with unconditional federal transfers than with private personal incomes in

both countries suggest the existence of a flypaper effect for non-matching transfers in the two largest economies of Sub-Saharan Africa.

Table 4. Two-Steps System GMM Estimates [Dependent Variable: State/Provincial Total Expenditure (log)], Country Specific Estimates

	Nigeria		South Africa	
Variables	**Dynamic Panel**	**LR Coef.**	**Dynamic Panel**	**LR Coef.**
Constant	-37.79*		0.34	
	(21.53)		(0.377)	
Log total expenditure_1	0.428**	0.748	-0.108	
	(0.175)	(0.535)	(0.127)	
Log Uncond. Fed. Transfers	0.268**	0.468***	1.080***	0.975**
	(0.102)	(0.085)	(0.107)	(0.064)
Log Private Personal Income	0.110*	0.192*	0.129*	0.117**
	(0.0541)	(0.101)	(0.062)	(0.049)
Log Public School Enrolment	0.0539**	0.094**	-0.021	
	(0.0246)	(0.04)	(0.056)	
Number of Observations	154		63	
Time Dummies	Yes		Yes	
Number of Groups	22		9	
Number of Instruments	18		9	
F-Statistic	37.65		92.37	
AR(1)	0.04		0.204	
AR(2)	0.103		0.215	
Hansen test	0.248		0.361	

Note. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ denote significance levels at 1%, 5%, and 10%, respectively. Values in () are the standard errors.

The flypaper effect estimated for Nigeria at 0.158 (i.e. the difference between the coefficients of log unconditional federal transfers and log private personal income for Nigeria – 0.268 – 0.110) is far lower than the 0.951 estimated for South Africa (i.e, the difference between the coefficients of log unconditional federal transfers and log private personal income for South Africa - 1.080 – 0.128). We find the elasticity of expenses by provincial governments to a one percent change in unconditional or non-matching federal transfers in South Africa to be elastic, while that of the state governments in Nigeria is inelastic. The greater elasticity of expenditure to changes in unconditional federal transfers in South Africa suggests that the provincial governments respond more to changes in unconditional federal transfers than do state governments in Nigeria.

This further suggests that the provincial indigenes in South Africa are more informed about unconditional federal transfers such that the illusion level or information asymmetry associated with non-matching transfers in South Africa is less than what obtains at the state level in Nigeria. This may not be unconnected with the disclosure issues surrounding the amount of unconditional transfers received by the state governments.

The Hansen tests of over-identification restriction reveal that the instrument sets are not over-identified, while the results of the specification tests [AR(2)] indicate that the models are free from second-order serial correlation. This implies that valid inferences can be drawn from the empirical results.

The LR coefficients reported in Table 4 reveal that unconditional federal transfers have significantly more prominent effects on state spending in Nigeria but significantly smaller effects on provincial spending in South Africa in the long run, all things being equal. The LR flypaper effect estimated for South Africa (0.858) i.e (0.975 – 0.117) is substantially larger than that for Nigeria (0.276) obtained from 0.468 – 0.192. This implies that the provincial authorities in South Africa are more responsive to changes in unconditional federal transfers than the state authorities in Nigeria regarding the supply of public goods when faced with more revenue resources. The above finding is not surprising given the

corruption perception index of the two countries and the fact that the level of corruption appears to be more at the subnational levels.

On average, a one percent increase in unconditional federal transfers is, in the LR, associated with 0.468 and 0.975 percent increase in state/provincial spending in Nigeria and South Africa at the one percent level of significance, ceteris paribus. Thus, unconditional federal transfers and public spending at the state/provincial level exhibit an inelastic LR relationship in both Nigeria and South Africa. While the LR impact is larger for Nigeria, it is found to be smaller for South Africa.

4.3 Robustness Checks

We conduct robustness checks on the results; first, using alternative measures of the state or provincial spending and second, by expressing all the variables in per capita terms to see if compensating for the differences in the size of the states or provinces will affect the results in any significant way. We also estimate the model using alternative estimators such as the pooled OLS, fixed-effects, and random effects estimators in order to verify if the results are sensitive to the choice of estimator, consistent with the studies by Usman et al. (2022).

Table 5 below clearly indicates that the flypaper effect is sensitive to model specification as the results in Table 4 differ widely from the results in Table 5 when control measures are considered, such as expressing all the variables in per capita terms and when a different measure of the dependent variable (expressed as % of GDP) is adopted. This finding is consistent with the finding of Becker (1996), who also observed that the flypaper effect is sensitive to model specification. Though state spending is still established to be persistent in Nigeria and the existence of a flypaper effect is also established in both the short- and long-run, the elasticity of state spending to a one percent increase in unconditional federal transfers is found to have increased to 0.330, but that of private personal income remains the same. We, however, could not establish the presence of a flypaper effect for South Africa in both the short and long run using these alternative specifications.

Table 5. Robustness Checks [Using Alternative Measures of State/Provincial Govt. Expenditure]

	Nigeria				**South Africa**			
	[per capita (log)]		**[In % of GDP]**		**[per capita (log)]**		**[In % of GDP]**	
Variables	**Dynamic Panel**	**LR Coeff.**	**Dynamic Panel**	**LR Coeff.**	**Dynamic Panel**	**LR Coeff.**	**Dynamic Panel**	**LR Coeff.**
Constant	1.415***		-0.0247		1.1480		0.9380	
	(0.475)		(0.049)		(3.263)		(1.790)	
Log total expenditure_1	0.408***	0.689*	0.505*	1.0210	-0.0805		1.022**	-45.6000
	(0.124)	(0.354)	(0.246)	(1.003)	(0.362)		(0.191)	(378.9)
Log Uncond. Fed. Transfers	0.330***	0.557*	0.0020		1.015*	0.940*	-0.2100	
	(0.111)	(0.093)	(0.003)		(0.448)	(0.541)	(0.303)	
Log Private Personal Income	0.110**	0.185**	-0.0010		0.1210		0.2290	
	(0.045)	(0.082)	(0.003)		(0.152)		(0.208)	
Log Public School Enrolment	-0.0222				-0.0509		0.2000	
	(0.029)				(0.056)		(0.282)	
Number of Observations	154		154		63		63	
Time Dummies	Yes		Yes		No		No	
Number of Instruments	18		18		9		9	
F-Statistic	11.14		9.48		12.8		87.46	
AR(1)	0.035		0.116		0.269		0.138	
AR(2)	0.069		0.202		0.822		0.435	
Hansen test	0.424		0.193		0.179		0.114	

Note. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ denote significance levels at 1%, 5%, and 10%, respectively. Values in () are the standard errors.

From the results of the alternative estimators reported in Table 6, the outcome of the Hausman test indicates 0.938 in the case of Nigeria, implying that we cannot reject the Null Hypothesis (H0), which says that the random effects are independent of the explanatory variables. This further implies that the estimator of best fit in the case of Nigeria is the random-effects estimator (panel 3 of table 6). In the case of South Africa, the result of the Hausman test indicates 0.000, implying a rejection of H0, which means that the random effects are correlated with the explanatory variables and, therefore, the model of best fit in the case of South Africa is the fixed-effects model (panel 5 of Table 6).

Table 6. Robustness Checks Using Alternative Estimators [The dependent variable is the State/Provincial Govt. Expenditure]

	Nigeria			**South Africa**		
	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Pooled OLS	FE	RE	Pooled OLS	FE	RE
Constant	8.371***	9.238*	8.982***	0.797***	2.314***	0.919***
	(1.215)	(5.357)	(2.361)	(0.192)	(0.350)	(0.263)
Log Unconditional Fed. Transfers	0.537***	0.387	0.451***	0.884***	0.638***	0.865***
	(0.061)	(0.259)	(0.114)	(0.038)	(0.064)	(0.051)
Log Private Personal Income	0.118***	0.285***	0.233***	0.162***	0.006	0.138***
	(0.042)	(0.069)	(0.055)	(0.023)	(0.035)	(0.030)
Log Public School Enrollment	0.086**	0.210**	0.144**	0.0642*	-0.276	0.078
	(0.036)	(0.103)	(0.063)	(0.036)	(0.181)	(0.050)
Number of observations	176	176	176	72	72	72
R^2	0.462	0.401	0.438	0.997	0.821	0.996
Year FE	No	Yes	Yes	Yes	Yes	Yes
State/Province FE	No	Yes	No	No	Yes	No
Number of Groups	22	22	22	9	9	9
Hausman test			0.938			0.000

Note. FE – Fixed Effects estimation, RE – Random Effects estimation. Standard errors are in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ denote significance levels at 1%, 5%, and 10%, respectively

Based on the results of the models of choice (panels 3 and 5 of Table 6), we find that the results are also sensitive to the choice of the estimator as the estimation results of the random-effects estimator indicate the existence of the flypaper effect at the state level in Nigeria. However, the estimation results of the fixed-effects estimator could not confirm the results of the two-step SGMM estimator that the flypaper effect exists at the provincial level in South Africa.

5. Conclusion and Policy Recommendations

In view of the scarce literature on the flypaper effect at the country level in Sub-Saharan Africa (SSA), this study employs a sample of 22 out of the 36 states in Nigeria and the population of nine provinces in South Africa to investigate the existence or otherwise of the flypaper effect in the two countries. Being the first attempt at providing empirical evidence on the existence or otherwise of the flypaper effect in the two largest economies in SSA, the study contributes to the flypaper effect literature by employing a more robust estimation technique (the two-step system GMM estimator) that improves the precision of the parameter estimates towards providing empirical evidence on the existence of the flypaper effect in these countries. The study further provides empirical evidence that the flypaper effect exists in these countries in both the short and long run and that the flypaper effect for the provincial governments in South Africa is substantially larger than that of the state governments in Nigeria.

We further establish evidence of the persistence of state spending in Nigeria and the lack of it in South Africa. Since the persistence or non-persistence of state spending is not the central focus of this paper, we wish to recommend further research in this area as a more detailed investigation on the persistence of provincial spending in South Africa will throw more light on the persistence of public spending in both countries. As more information unfolds, another area for future research that may attract the interest of scholars is in testing for the existence of the flypaper effect concerning conditional or matching transfers in both countries.

Based on our findings that the provincial authorities in South Africa are more responsive to changes in unconditional federal transfers than the state authorities in Nigeria, Nigeria may need to upscale sensitization on the receipts and disbursements of unconditional federal transfers. This will help reduce the illusion level or information asymmetry about the use of unconditional federal transfers. It will also enhance the benefits that are derivable from using state resources, particularly the procurement of public goods and services. Given that the elasticity of state or provincial spending in both countries is large, we believe that an increase in unconditional federal transfers will immensely benefit the indigenes in terms of the higher supply of public goods and services.

Certain limitations to this study can be taken into account in subsequent research. The current study is limited to a sample of 22 out of the 36 state governments in Nigeria, for which data are available with minor extrapolation to cover a few data gaps, and a sample of 9 provinces in South Africa. The selection of the states in Nigeria and the study period were, thus, based on the availability of relevant data. The selected states, however, cut across all geopolitical zones in the country, implying that the sample is representative of the entire population of the state governments. As more information unfolds in the future, further research may focus on testing the existence of the flypaper effect with regard to conditional or matching transfers in both countries. Also, with improvements in data collection, another area for future research is the flypaper effect on local governments and municipalities in Nigeria and South Africa. This will allow for comparison of the flypaper effects for the state/provincial and the local/municipal governments in the two countries, in addition to investigating the subnational governments. More so, further research will expand the study to cover more countries that operate federal and federating units or subnational government systems.

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References

Allers, M. A., Vermeulen, W. (2016). Capitalization of equalizing grants and the flypaper effect. *Regional Science and Urban Economics*, 58, 115-129. https://doi.org/10.1016/j.regsciurbeco.2016.03.005

Alymkulova, N., Iorember, P. T., & Omotesho, O. (2023). Public Spending and Private Sector Investment in Nigeria: An Investigation of the Crowding-in (or Crowding-out) Effect Amidst Deteriorating Fiscal Balance. In *Post-Independence Development in Africa: Decolonisation and Transformation Prospects* (pp. 263-278). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-031-30541-2_15

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, 58(2), 277-297. https://doi.org/10.2307/2297968

Baskaran, T. (2016). Intergovernmental transfers, local fiscal policy, and the flypaper effect: evidence from a German state. *Finanzarchiv/Public Finance Analysis*, 1-40. https://doi.org/10.1628/001522116X14462054864882

Bature, N. B., Ogba, J. L., & Iormom, I. B. (2022). Explaining the incidence of household healthcare expenditure in Nigeria under a regime of low fiscal provision: Is the exchange rate important? *Journal of Public Affairs*, 22(1), e2365. https://doi.org/10.1002/pa.2365

Becker, E. (1996). The illusion of fiscal illusion: Unsticking the flypaper effect. *Public Choice*, 86(1), 85-102. https://doi.org/10.1007/BF00114876

Bradford, D. F. and Oates, W. E. (1971). Towards a predictive theory of intergovernmental grants. *American Economic Review*, 61(2): 440-44

Brollo, F., Nannicini, T. Perotti, R., and Tabellini, G. (2013). The political resource curse. *American Economic Review* 103, 1759-1796. https://doi.org/10.1257/aer.103.5.1759

Cruz, T. and Silva, T. (2020). Minimum spending in education and the flypaper effect. *Economics of Education Review* 77, 102012. https://doi.org/10.1016/j.econedurev.2020.102012

Darby, J., Muscatelli, A., Roy, G. (2005). Fiscal Consolidation and decentralization: a tale of two tiers. *Fiscal Studies* 26 (2), 169-195. https://doi.org/10.1111/j.1475-5890.2005.00009.x

De Mello, L. (2000). Fiscal decentralization and intergovernmental fiscal relations: a cross-country analysis. *World Development* 28 (2), 365-380. https://doi.org/10.1016/S0305-750X(99)00123-0

Dollery, B. E., and Worthington, A. C. (1996). The empirical analysis of fiscal illusion. *Journal of Economic Surveys* 10, 261-297. https://doi.org/10.1111/j.1467-6419.1996.tb00014.x

Gbaka, S., Iorember, P. T., Abachi, P. T., & Obute, C. O. (2021). Simulating the macroeconomic impact of expansion in total government expenditure on the economy of Nigeria. *International Social Science Journal*, 71(241-242), 283-300. https://doi.org/10.1111/issj.12289

Gramlich, E.M., Galper, H. (1973). State and local fiscal behavior and federal grant policy. *Brookings Papers on Economic Activity*, 1, 15-58. https://doi.org/10.2307/2534084

Hines, J. R., and Thaler, R. H. (1995). Anomalies: The flypaper effect. *Journal of Economic Perspectives* 9, 217-226. https://doi.org/10.1257/jep.9.4.217

Hobdari, N., Nguyen, V., Dell'Erba, S. and Ruggiero, E. (2018). Lessons for effective fiscal decentralization in Sub-Saharan Africa. Departmental Paper Series, African Department, International Monetary Fund (IMF), No. 18/10, ISBN 9781484358269 (paper). https://doi.org/10.5089/9781484358269.087

IMF (2009). Macro policy lessons for a sound design of fiscal decentralization. IMF, Washington D. C.

Inman, R. P. (2008). The flypaper effect. Working Paper 14579. National Bureau of Economic Research. https://doi.org/10.3386/w14579

Iorember, P. T., & Jelilov, G. (2018). Computable general equilibrium analysis of increase in government agricultural expenditure on household welfare in Nigeria. *African Development Review*, 30(4), 362-371. https://doi.org/10.1111/1467-8268.12344

Iorember, P. T., Gbaka, S., Jelilov, G., Alymkulova, N., & Usman, O. (2022c). Impact of international trade, energy consumption and income on environmental degradation in Africa's OPEC member countries. *African Development Review*, 34(2), 175-187. https://doi.org/10.1111/1467-8268.12629

Iorember, P. T., Iormom, B., Jato, T. P., & Abbas, J. (2022b). Understanding the bearable link between ecology and health outcomes: the criticality of human capital development and energy use. *Heliyon*, 8(12). https://doi.org/10.1016/j.heliyon.2022.e12611

Iorember, P. T., Jelilov, G., Alymkulova, N., & Yua, P. M. (2022a). Reconsidering the nexus between monetary policy and economic growth in Nigeria: The role of interest rate, money supply, and financial inclusion. *International Social Science Journal*, 2(244), 339-351. https://doi.org/10.1111/issj.12324

Knight, B. (2002). Endogenous Federal Grants and crowd-out of state government spending: Theory and evidence from the federal highway aid program. *American Economic Review* 92, 71-92. https://doi.org/10.1257/000282802760015612

Martinez-Vazquez, J. and Sepulveda, C. (2018). A theoretical rationale for the fiscal gap model of equalization transfers. international center for public policy. Working Paper 18-23, November. https://doi.org/10.2139/ssrn.3460234

Musa, M. S., Jelilov, G., Iorember, P. T., & Usman, O. (2021). Effects of tourism, financial development, and renewable energy on environmental performance in EU-28: does institutional quality matter? *Environmental Science and Pollution Research*, 28(38), 53328-53339. https://doi.org/10.1007/s11356-021-14450-z

Niskanen, W. (1968). The Peculiar Economics of Bureaucracy. *The American Economic Review*, 58(2): 293-305.

Oates, W., 2006. *On theory and practice of fiscal decentralization*. IFIR Working Paper Series 2006-05. Institute for Federalism and Intergovernmental Relations, Lexington.

Ozili, P. K., & Iorember, P. T. (2023). Financial stability and sustainable development. *International Journal of Finance & Economics*, https://doi.org/10.1002/ijfe.2803

Singhal, M. (2008). Special interest groups and the allocation of public funds. *Journal of Public Economics* 92, 548-564. https://doi.org/10.1016/j.jpubeco.2007.05.005

Sour, L. (2013). The flypaper effect in Mexican local governments. *Estudios Económicos*, 165-186. https://www.jstor.org/stable/23609654

Tanjunga, A. H.; Salamb, S.; Rusdi, J. F.; Ermawati, Y.; Novianty, I.; Hendaris, R. B. and Apriliawati, Y. (2021). *Flypaper Effect Assessment Methods in the Expansion of Regional Autonomy*. MethodsX 8, 101387. https://doi.org/10.1016/j.mex.2021.101387

Turnbull, G. K. (1998). The overspending and flypaper effects of fiscal illusion: Theory and empirical evidence. *Journal of Urban Economics*, 44(1), 1-26. https://doi.org/10.1006/juec.1997.2056

Usman, O., Iorember, P. T., Jelilov, G., Isik, A., Ike, G. N., & Sarkodie, S. A. (2021). Towards mitigating ecological degradation in G-7 countries: accounting for economic effect dynamics, renewable energy consumption, and innovation. *Heliyon*, 7(12). https://doi.org/10.1016/j.heliyon.2021.e08592

Usman, O., Iorember, P. T., Ozturk, I., & Bekun, F. V. (2022). Examining the interaction effect of control of corruption and income level on environmental quality in Africa. *Sustainability* 14, 11391. https://doi.org/10.3390/su141811391

Zhou, L., Iormom, B. I., Azhar, M. S., & Peng, M. Y. P. (2022). Domestic inflation, exchange rate, and aggregate import demand nexus in Nigeria: New evidence from cointegrating regression. International *Journal of Finance & Economics*, 27(4), 4154-4165. https://doi.org/10.1002/ijfe.2364