**Exploring the Twin Deficits Hypothesis and the Saving-Investment Nexus in Gambia (1980-2023)**

**Abstract**

In a closed economy with a low degree of capital mobility, all domestic savings are used to finance domestic investment (S = I), meaning that domestic savings and investment should be perfectly correlated. However, in an open economy characterized by high capital mobility, domestic savings are expected to finance investments offering the highest returns, regardless of their geographic location. The twin deficits hypothesis refers to the positive and significant long-run relationship between the current account deficit (X-M) and the budget deficit (G-T). This hypothesis can also be linked to the degree of capital mobility and the Feldstein-Horioka (FH) Puzzle. In cases where domestic savings and investments are not closely related (due to free capital mobility), the budget deficit and the current account deficit may move together. The Gambian economy is in conformity with the FH hypothesis in both the short run and the long run. This paper provides evidence on the validity of the twin deficits and the Feldstein-Horioka puzzle for The Gambia using time series data for the period 1980 to 2023 using the Johanssen testing approach to long-run analysis, Vector Error Correction approach for short-run analysis and Granger Causality. The objective of the paper is to explain the twin deficit hypothesis and the Feldstein-Horioka puzzle in the Gambia. Using the aforementioned VAR tools, the existence of a significant causal relationship between budget deficit and current account balance in both the short run and long run was discovered. The Granger causality result revealed a unidirectional relationship that runs from Gross Capital formation to current Account Balance. Specifically, the unidirectional relationship runs from GCF to CAB at a 5% significance level. Moreover, the order of integration of each variable was determined using the Augmented Dickey-Fuller test. FD was not stationary at level but was stationary at the first difference at 5% level. The rest of the variables under study have zero order of integration, which means they are stationary at levels. The study recommended that the Government of the Gambia devote attention to capital formation to achieve a budget balance or surplus in the country instead of a budget deficit.

**Key words: Feldstein-Horioka Puzzle, Twin Deficits, Saving-Investment,**

**1. INTRODUCTION**

The relationship between saving and investment gained significant attention following the seminal work of Feldstein and Horioka (1980). Their study, using cross-sectional data from 16 OECD countries covering the period 1960-1974, revealed a high correlation, close to 1, between domestic savings and investment rates, a phenomenon that became known as the Feldstein-Horioka Puzzle. This puzzle emerged from their finding that, despite the increasing integration of global financial markets, domestic savings and investment ratios were still highly correlated.

In a closed economy with a low degree of capital mobility, all domestic savings are used to finance domestic investment (S = I), meaning that domestic savings and investment should be perfectly correlated. However, in an open economy characterized by high capital mobility, domestic savings are expected to finance investments offering the highest returns, regardless of their geographic location.

“The twin deficits hypothesis refers to the positive and significant long-run relationship between the current account deficit (X-M) and the budget deficit (G-T). This hypothesis can also be linked to the degree of capital mobility and the Feldstein-Horioka (FH) Puzzle. In cases where domestic savings and investments are not closely related (due to free capital mobility), the budget deficit and the current account deficit may move together” (Al-Sawaie, 2024). Conversely, if Ricardian Equivalence does not hold, an increase in public borrowing (resulting from a budget deficit) is likely to reduce national savings (both domestic and foreign). For a given level of investment, this decline in national savings leads to a larger current account deficit. Thus, under conditions of perfect capital mobility, twin deficits are expected to coexist in a non-Ricardian world. However, if the FH Puzzle holds, twin deficits are unlikely to coexist, as domestic savings and investments remain highly correlated.

“For a country to enjoy a favorable position in external balance, it needs to ensure fiscal sustainability, which seems to be a necessary condition in this regard. Although the twin deficit hypothesis postulates a linear relationship, there could, however, be a non-linear relationship between the two deficits. Such non-linearity may stem from structural features such as regime shifts in exchange rates, country size, trade openness, and international capital mobility that have not yet been considered by previous studies” (Hussain et al., 2024).

“A stream of empirical research has been published throughout the world to study the many facets of the twin-deficit relationship. Some studies confirm the validity of the conventional view of the hypothesis, while others (even the studies in the twenty-first century) reject the hypothesis” (El-Khishin & El-Saeed, 2021).

“Achieving sustainable economic growth in Africa has remained a major challenge despite several reforms which have been adopted in Africa. A careful examination of Sub-Saharan Africa (SSA), indicates that the level of domestic savings is lower as compared to domestic investment. This has resulted in a financing gap which is usually supplemented by foreign capital flows such as foreign credit, foreign direct investment and foreign aid. This becomes important given that growth has been regarded as one of the pillars of solving many of the problems bedevilling these countries” (van Wyk & Kapingura, 2021).

“The Gambia like other economies in Africa has been categorized as Less Developed Country (LDC). This placement of the Gambia as LDC presupposes that her economy is grouped among the somewhat impoverished susceptible to the whims and caprices of underdevelopment such as low Gross National Income (GNI), weak integration of the private sector into the domestic and external economies, with the attendant weak private investment as most economic activities are regulated and controlled by government and the public sector. Investment especially domestic private investment is a major determinant of growth in any economy as it plays a very fundamental role in promoting, projecting and sustaining the performance of the economy” (Owuzo et al., 2024).

This study aims to empirically test the validity of the Feldstein-Horioka Puzzle in The Gambia, while also exploring the presence of twin deficits and the degree of capital mobility using annual time-series data.

This study seeks to investigate how variables such as the budget balance (T-G) and the current account (NX) interact to influence economic growth. Specifically, it will provide evidence of the validity of the twin deficits hypothesis and the Feldstein-Horioka Puzzle in a small, open economy like The Gambia.

Research Objectives are as follows:

* Test the Twin Deficits Hypothesis: Examine whether there is a positive and significant relationship between the budget balance (T-G) and the current account (NX).
* Analyze the short-run and long-run relationships among these variables.
* Investigate the validity of the Feldstein-Horioka Puzzle in The Gambia's context.

**Research Hypothesis:**

* Hypothesis 1: There exists a significant positive relationship between the budget deficit and the current account deficit (twin deficits).
* Hypothesis 2: The Feldstein-Horioka Puzzle holds, indicating limited capital mobility.

The rest part of the paper is organized as follows. Section 2 reviews the existing literature on the Feldstein-Horioka puzzle. The theoretical and analytical framework is presented in section 3. Section 4 gives data description and econometric methodology. Section 5 discusses the estimation results while section 6 is devoted to a conclusion.

**2. LITERATURE REVIEW**

**2.1 Theoretical literature**

With perfect capital mobility worldwide, domestic saving is not necessarily related to domestic investment. However, there is strong empirical evidence that domestic investment and national savings are correlated. Much of the evidence is based on cross-section regressions of 16 OECD countries for the 1960–74 periods. This empirical finding is known as the Feldstein-Horioka (1980) puzzle. “According to this puzzle, the relationship between national savings and domestic investment can be used as a measure of international capital mobility. Under perfect mobility, the investment is not controlled by domestic saving but only by the accessibility of funds in the international fully integrated capital market. Saving in each country should react to the worldwide opportunities for investment while investment in that country should be financed by the international pool of funds. The important factor of concern for investors should be the rate of return. In a closed economy, domestic savings must finance investment but in the case of an open economy, some of the investments may be financed by foreign savings. Therefore, saving and investment could move independently of each other. Alternatively, the high I-S correlation suggests that capital might not be fully mobile across borders” (Levy 2004).

## Uni-directional: Budget deficit causes Current account deficit

Mukhtar et al. (2007) noted that “the twin deficits hypothesis pointed out that budget deficit and current account balances are closely related so reductions in the former are both necessary and sufficient conditions to obtain improved performance in the later. Hence it is believed that causality between the government balance and the current account balance is very important to investigate. This paper went on to stress that the twin deficits render four alternative hypotheses as observed earlier. They noted that the budget deficit causing the current account deficit is consistent with conventional views that higher budget deficits are the main cause of higher current account deficits, however, they buttress that all four hypotheses are equally plausible on theoretical grounds”.

Hakro (2009) stressed that the twin deficits proposition in developing countries context is questioned by a number of economists such as Lany (1984), Bernheim (1988), Vamvoukas (1997) and Islam (1998). Lany (1984) studies empirically the relationship and argues that fiscal deficits have a stronger effect on external surpluses in developing countries than in the developed world. Using data from Greece, Vamvoukas (1977) tested causality relationships and suggested a uni-directional relationship going from fiscal to current account deficits, justifying the conventional view.

The above study reviewed studies such as Summers (1986); Dewald and Ulan (1990); Enders and Lee (1990); Kim (1995) and Miller and Russek (1989), which suggested that “a $1 increase in fiscal deficit leads to a corresponding trade deficit increase of anywhere between 25 cents to $1. Hence supporting the conventional view that the two deficits are closely linked and thus external deficits are caused by fiscal deficits”.

Chang and Hsu (2009) pointed out “the Mundell-Fleming approach which argues that an increase in budget deficit induces upward pressure on interest rates that, in turn, will trigger capital inflows and an appreciation of exchange rates, ultimately leading to an increase in current account deficit, their second theoretical argument was a linkage between the twin deficits to the Keynesian absorption theory which suggested that an increase in budget deficit would induce domestic absorption and hence import expansion thereby causing an increase or a worsening of the current account deficit. Hence from the above explanation both the Mundell-Fleming model and Keynesian Absorption theory support a uni-directional relationship that the budget deficit causes the current account deficit”.

## Uni-directional: Current account deficit causes Budget deficit

Mukhtar et al. (2007) buttressed that “the falling of net exports, caused by factors other than budget deficits, may impose increasing pressure on the government to expand its various spending programs. According to this study, it is believed that during the 1980’s the large current account deficits in the United States had harmed domestic manufacturing industries leading to unemployment and loss in foreign market shares. These deleterious economic and financial conditions of the current account deficits according to the study were viewed with much concern in the United States by the business community, labor leaders and government officials. The above situation led to an increase in government spending and a decline in revenues”.

Chang and Hsu (2009) concluded that “uni-directional causality may run from the current account deficit to the budget deficit. In explaining this relationship the study noted that a deterioration in the current account leads to a slower pace of growth and hence an increase in budget deficit. When a country experiences a financial or solvency crisis resulting from chronic, excessive current account deficit it may face a situation in which large injections of public funds are required to rehabilitate its troubled financial sector, to improve its corporate governance and to mitigate against recession. This causation is termed “current account targeting” by Summers (1988). He argued that external adjustment may be sought via fiscal policy. This causal pattern may be more relevant for developing countries that have accumulated large foreign debts. While Anoruo and Ramchander (1998) discovered that trade deficit causes fiscal deficit in most Asian countries. They argued that governments in developing countries might engage in fiscal stimulus to lessen the deleterious economic and financial consequences of large trade imbalances”.

## Bi-directional: Both deficits cause each other

Hakro (2009) study on “Twin Deficit Causality link-Evidence from Pakistan states that trade (current account) and budget deficits relationships have important implications for a number of reasons; the first point noted by this study was persistent large deficits cause indebtedness by borrowing internally and externally and secondly deficits imposes a burden on future generations. Thus, rising trade deficits are indeed escalating budget deficits and hence the current account balance cannot be remedied unless policies addressing government deficits are put in place”. This study pointed out that Islam (1998) utilizing data from Brazil estimated the relationship between current account balance and budget deficits, using the Granger causality test, the results show a bi-directional relationship between the two deficits, hence contradicting the conventional twin deficit hypothesis.

Chang and Hsu (2009) pointed out that “the causality between the two variables (budget deficit and current account deficit) runs in both directions i.e. both variables cause each other; hence the two variables are interdependent”. The study buttresses that Feldstein and Horioka (1980) find that savings and investment are highly correlated, causing budget deficit and current account deficit to move together.

## Causally independent: No relationship between Budget deficit and Current account deficit

Chang and Hsu (2009) explained that “the relation between budget deficit and current account deficit is based on the presumption that the twin deficits are not related. The study used the Ricardian equivalence hypothesis which reject entirely the income-expenditures approach and relies instead on the inter-temporal approach, since the government’s means of finance do not alter private agents’ inter-temporal approach budget constraints, the real interest rate, the quantity of investment or the current account balance”. The study claims that budget deficits do not cause any interest and exchange rate changes (Garcia and Ramajo, 2004), which thus have no effect on current account imbalance, therefore under the Ricardian equivalence hypothesis, budget and current account deficits are causally independent.

Hakro (2009) noted that “recent empirical studies are completely divided over the causality relationship between budget and current account deficits, hence the study points to the Ricardian equivalence which claims that fiscal and external deficits are uncorrelated”, Evans (1988, 89) concludes that there is no clear relationship between the two deficits, using data from France, Canada, West Germany, Italy, Japan, United Kingdom and the United States.

## Deficits Siblings not Twins

Frankel (2006), study on “the subject “Could the Twin Deficits Jeopardize US Hegemony?” made a very interesting contribution to the twin deficit phenomenon. He argued that the two deficits are siblings and not twins because sometimes they move in different directions, as he puts it, the current account balance could not move in the same direction if there was a big exogenous increase in investment. He buttressed that the United States experienced an investment boom in the 1990s in information, communication technology and other business capital goods. The result was a rising current account deficit even while the budget deficit was completely eliminated”.

## Savings, Investment and the Twin Deficits

Frankel (2006) stressed that in the United States, private savings have been on the decline which also results in a fall in national savings, thereby crowing out net exports, as has been the increase in the budget deficit. The study noted that President Bush's “tax cuts (the abolition of the estate tax, near-abolition of taxes on dividends, capital gains taxes etc.) were implemented on the basis that it was going to stimulate savings but private savings rate did not rise, hence this was an indictment of the Bush administration’s fiscal policy. The study went on to explain that global investors lose interest in the path of ever-rising holding of United States assets, which results in the dollar plunging, the United States interest rates rise and security markets fall hence subsequently following a depreciation of the dollar from 2002 to 2004.

Bartolini and Lahiri (2006) pointed out that one approach to linking fiscal policy changes to current account changes is the uncovering of the relationship between fiscal policy and investment. Using this line of inquiry allows for the determination of the amount of foreign financing required to close the domestic gap between savings and investment. “The study further pointed out that this strategy can be complex since the empirical behavior of investment is usually hard to characterize. Investment responds to many factors, such as domestic and foreign interest rates and productivity which are often unstable and unpredictable” (McCarthy 2001).

The study pursued a more direct line of inquiry, by replacing consumption with the current account balance as the variable to be explained in their regression equation. The substitution enabled the researchers to estimate a direct relationship between fiscal balances and the current account in their sample of countries. Their estimates revealed that each dollar rise in the fiscal deficit is associated on average with a 30-cent decline in the current account. In conjunction with their earlier finding—that each dollar rise in the fiscal deficit leads to a fall in national savings of 33 to 37 cents—this result implies that changes in national savings are reflected almost one-for-one in changes in current accounts in their country group.

**2.2 Empirical literature**

The contradiction between empirical evidence and conventional wisdom referred to as the Feldstein-Horioka puzzle- has been the subject of a plethora of articles attempting to explain it. The literature can be classified in two categories. On the one hand, many researchers attribute the puzzle to factors that are unrelated to capital mobility, and they argue that the Feldstein-Horioka methodology is inappropriate for measuring capital mobility. For example, current account solvency constraints (Coakley et al., 1998), the growth rate of income (Obstfeld, 1985), government policies targeting sustainable current account (Summers, 1985), nontraded goods and immobile factors (Engel and Kletzer (1987), productivity shocks (Obstfeld, 1985) country-size effects (Tsung-Wu Ho, 2003) can generate comovements between savings and investment, even if capital is mobile. (Tesar 1991, Coakley et al, 1998 and Obstfeld and Rogoff 2000, provide an excellent literature review). On the other hand, another line of research supports the validity of Feldstein and Horioka’s methodology in measuring capital mobility, and they explain the puzzle on methodological and econometric grounds. Within this framework, a number of researchers focus on the role of policy regime changes. (Gundlach and Sinn 1992, Jansen 1996, Jansen and Schulze 1996, Sarno and Taylor 1998, BajoRubio 1998, Ozmen and Parmaksiz, 2003, 2005, and Coakley et al. 2004). Their findings suggest that policy regime changes introduce structural breaks which significantly bias the empirical results towards rejecting the hypothesis of capital mobility. Such evidence calls for a “country by country” approach –as opposed to cross-section analysis- in order to ensure that the particular characteristics of the economy under examination are incorporated explicitly into the empirical analysis (Corbin 2001, Coakley et al. 2004, Taylor 2002, Jansen 1996, Mark 2003, Giannone and Lenza 2004, provide an analysis of the effects of country heterogeneity on the estimation methodology).

The Feldstein Horioka puzzle has been tested in both developed and developing countries and there is evidence that there exists a relationship between domestic investment and savings.

Fountas and Tsoukis (2000) examined empirically the interactions among the current account, budget balances and the real interest rate as it can provide more information about the effective degree of financial openness than simple saving-investment correlations. They found that in the short run, there is some evidence in favor of the twin deficits and current account targeting hypotheses.

Fidrmuc (2003) examined the evidence of twin deficits and the F–H puzzle for such economies and found a positive long-run relationship between the twin deficits in several countries. Investment in some EU countries is financed to a relatively high degree via the international financial markets involving that the F–H puzzle is less significant in the EU countries.

**Basic Derivation of the Twin Deficits Relationship**

From our macroeconomics studies, total national income (Y) also referred to as GDP must equal total expenditures on final goods and services (E) since income is utilized and created from the production and expenditures on goods and services within an economy; hence

$$Y≡E………(1)$$

We should also recall that GDP or Y constitute four components; consumption expenditures (C), private domestic Investment (I), government purchase of goods and services (G) and net exports (NX);

$$E ≡ C + I + G + NX………. (2)$$

At the household level total income accrued is generated from production (Y) and transfer payments (F) from the government to the household, hence total income and transfer payments from the government are available to the household for consumption expenditures, private savings and payment of taxes (R) to government;

$$Y + F ≡ C + S + R.......... (3)$$

$$Y ≡ C + S + R – F………. (4)$$

We can term F as negative tax since it is paid to the household by the government, whiles R is taxes received by the government from the household, therefore (R – F) can be termed as net tax revenue (T), then our equation will now yield;

$$Y ≡ C + S + T………. (5)$$

$$Since Y ≡ E………. ..(6)$$

Subtracting C from both sides of equations 2 and 5, yields equation 8;

$$C + S + T ≡ C + I + G + NX………. (7)$$

$$S + T ≡ I + G + NX………. ..(8)$$

Moving to the twin deficits; government budget deficit and current account (trade) deficit, which are global phenomena resulting in economic challenges in various countries across the world. Starting with the government budget deficit;

$$T – G ≡ (I + NX) – S……… (9)$$

The government runs into a deficit due to higher government expenditures than revenues generated by the government (G ˃ T), one way the government can finance its deficit is through mobilizing private savings. The consequences of the government budget deficit are that it will result in a slowdown in domestic private savings due to the crowing out the effect of the private sector and foreign investment will also decline which will increase the government’s pressure on foreign borrowing. A continuous government budget deficit will have negative consequences on future generations since they will have to service the deficit bill, and they will also pay higher taxes as a result of interest incurred on the debt Gordon (2006).

Turning to the current account deficit, a trade deficit is a situation where in an open economy a country imports more than it is able to export hence this dilemma is referred to as negative net exports (-NX). When a nation experiences the aforementioned situation we say that it has a current account deficit. According to Gordon (2006) current account records the nation’s current international transactions, including exports and imports of goods and services, income from foreign investments, and transfers to and from other countries. There are three significant components of the Current Account:

1. Trade in goods and services

2. Net investment income

3. Transfer payments

A nation is faced with three possible scenarios on the international flow of capital and goods which determine its trade (current account) situation with the rest of the world as illustrated in Table 1 below:

**Table 1: International Flow of Goods and Capital Summary**

Trade Deficit Balance Trade Trade Surplus

1 Exports < Imports Exports = Imports Exports ˃ Imports

2 Net Exports < 0 Net Exports = 0 Net Exports ˃ 0

3 Y< C + I + G Y = C + I + G Y ˃ C + I + G

4 Saving < Investment Saving = Investment Saving ˃ Investment

5 Net Capital Outflow < 0 Net Capital Outflow = 0 Net Capital Outflow ˃ 0

Source: Mankiw N.G; Principles of Economics; 6th Edition; page 680

As explicitly illustrated in Table 1 above, when a nation’s imports exceed its exports this will result in foreign borrowing to finance the surplus of imports given the negative net exports. Assuming that net exports are negative, national income might be negative if it cannot finance consumption, investments, and government purchases i.e. (Y< C + I + G). This situation will ultimately result in borrowing to finance consumption expenditures, private domestic investment and government purchases. A nation faced with this dilemma is left with no options but to turn to National Savings (NS) i.e. the sum of Private Savings (Sp) by both households and business firms and government savings (Sg) to finance investments. Mankiw (2008) highlighted that in a trade deficit situation, a country is investing more than it is saving. Hence it must then finance some of the domestic investment by selling assets abroad, which will then result in net capital outflow being negative i.e. (Net capital outflow <0).

In the economy, total savings (NS) is utilized to finance investment (I). Total savings is composed of private savings (Sp), public or government savings (Sg) and foreign savings (Sf). Private savings is the difference between disposable income (income minus taxes) and consumption:

$$Sp = Y – T – C………. (10)$$

Government or public savings (the negative of the fiscal budget deficit) is the difference between tax revenue and government revenue:

$$Sg = T – G………. (11)$$

Foreign savings is the amount of extra import the national economy can buy above the value of exports sold abroad:

$$Sf = M – X.......... (12)$$

Since savings must equal investment, equation 13 demonstrates another relationship between the twin deficits but also reveals another relationship i.e. between private savings and private domestic investment:

$$(I – Sp) = Sg + Sf = (T – G) + (M – X) ………. (13)$$

Rearranging equation 13 yields equation 14:

$$(T – G) = (X – M) + (I – S)………. (14)$$

Which, results thus:

Government Budget = Current Account + (Investment – Savings)

**3. Methodology for Twin Deficits and F-H Puzzle**

National income Identity is

$$Yi = Ci + Ii + Gi + NX ……………………………………………………………(15)$$

This identity implies that the trade balance must equal the difference between national savings (defined as output less total consumption) and investment (gross capital formation). It provides a link between the external balance and saving-investment decisions.

Feldstein and Horioka (1980) proposed an assessment of the degree of capital mobility by measuring the correlation between investments and savings.

Fidrmuc (2003) presented a regression model that encompasses both the twin deficit hypothesis and the Feldstein-Horioka puzzle. The model makes no difference between net exports and the current account balance. Rearranging the macro identity, one obtains the relation:

$Xi – Mi = Yi – (Ci + Gi) – Ii = Si -Ii …………………………………………….(16)$

$$NX = Yi – (Ci + Gi) – Ii = Si -Ii …………………………………………(17)$$

 $NX= \left(Yi – T- Ci\right)+ \left(T - Gi\right)– Ii ………………………………………….…...(18)$

$$NX\_{i}= α+ β \left(T\_{i }- G\_{i}\right)+ γI\_{t}+ ……………………………………………….…(19)$$

Where

$$NX = Si -Ii = NX = CA balance $$

$$C = Private Consumption$$

$$G = Government Purchases$$

$$I = investment$$

$$T = Tax Revenue$$

This identity motivates the testing of a long-run relationship between the current account, the budget deficit and total investment. Therefore, gross capital formation denoted by Investment as a share of GDP is included in the relationship between the current account (X-M = CA) and the fiscal balance (T-G = BD).

$$(CA)\\_i= α+ β ((BD)\\_i )+ γI\\_t+ u\\_i …………………………………………(20)$$

Here, the expected sign of the coefficient for fiscal balance is positive and that of investment is negative. It implies that the current account balance is worsened by the budget deficit and high investment. If an economy is perfectly integrated into the world market, then the coefficients of both variables should equal unity. In this case, the budgetary as well as investment expenditures are financed by the world financial market. However, it is shown in the study by Feldstein and Horioka (1980) that a large portion of domestic investment is still financed from domestic sources (savings).

The above result, generally referred to as the Feldstein–Horioka puzzle, has been widely confirmed by subsequent intensive research.

The model proposed by Fidrmuc’s (2003) to address the relationship CA deficit, Budget deficit and FH puzzle we employ:

$$(CA)\\_i= α+ β (BD)\\_i )+ γ((I/Y))\\_t+ u\\_i ……………………………………(21)$$

$γ=1 $mean FH puzzle hold and $γ\# 1$ means perfect capital mobility (No FH puzzle)

$β$≻0 means TD Hypothesis and otherwise, it does not hold.

# 4. RESULTS AND DISCUSSION

In this section, we discuss the methodology of research and the data used in the analysis with reference to The Gambia. We employed the unit root tests, Johansen co-integration technique and the Error Correction Model to attain our objectives. The main purpose of co-integration analysis is to verify the nature of the long-run relationship between a set of time series variables.

However, it is essential to check each time series for stationarity before starting the co-integration tests.

**4.1 Descriptive Analysis of Data**

The Data was retrieved from the World Bank (databank) and it covers the period from 1980 to 2023. It provides a credible database to serve researchers, academics, and investors who need reliable economic data for accurate information. The country under study is The Gambia and the indicators have the following distribution:

**Table 2: Data Distribution and Statistics**

|  |  |  |  |
| --- | --- | --- | --- |
| **Statistics/** Indicators | **FD** |  **CAB** | **GCF** |
| Data range | 1980-2023 | 1980-2023 | 1980-2023 |
| Observation | 43 | 43 | 43 |

Since some of the indicators have missing values, the literature suggests the use of a weighted average as a replacement for the missing values in order to avoid spuriousness in the data. The Equation used for the weighted Average:

 $\overline{Ind}\_{t}= \frac{1}{T}\sum\_{T=1}^{N}Ind\_{t} \left(22\right) $

Where $Ind\_{t}$ Is the method used to generate the weighted average of all the indicators (Sannoh & Fanneh, 2022)

**4.2 Unit Root Tests**

**Table 3: Augmented Dickey-Fuller Test.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Country** | **Variables** | **Test-Statistics** | **Test (1st Diff)** | **Lag**  |  **integration** |
| Gambia | FD | -2.2891 | -3.0178 | 4 | I (1) |
|  | CAB | -3.58 | - | 4 | I (0) |
|  | GCF | -0.2878 | -3.9369 | 4 | I (1) |

$$Critical values for test statistics: 1pct 5pct 1 tau2 -3.58 -2.93 -2.60$$

In order to examine whether or not the variables under study are stationary at levels or at first difference, Augmented Dickey-Fuller test was employed. Thus, the order of integration of each variable was determined. FD was not stationary at level but was stationary at the first difference at 5% level. The rest of the variables under study have zero order of integration, which means they are stationary at levels.

**4.3 Co-Integration Analysis**

## **Table 4: The Cointegration Test Results (Johansen-Procedure)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Country** | **Null H.** | **𝜆 max** | **5% level** | **𝜆 trace** | **5% Level** |
| Gambia | r <= 2 | 5.04 | 9.24 | 5.04 | 9.24 |
|  | r <= 1 | 7.14 | 15.67 | 12.17 | 19.96 |
|  | r <= 0 | 32.80 | 22.00 | 44.97 | 34.91 |

We ran Johansson integration Test on the variables using both Trace and Maximum Eigen test to determine the economic meaningful relationship between the variables. The null hypothesis states that there are at least zero, one and two integrating vectors in the equation. From both the Trace and max Eigen test, we reject the null hypothesis that there exists at least zero integrating vector at a 5% significance level. What this means is, that there is at least one economically meaningful relationship between the selected variables in the equation. Thus, from the same set of tests, we fail to reject that there exists at most one Integrating vector in our equation.

**4.4 Granger Causality Test**

## **Table 5: Result of Granger Causality Test (Direction)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Country** | **P-value****CAB → FD** | **P-value****GCF → FD** | **P-value****GCF → CAB** |
| Gambia | 0.7911 | 0.582 | 0.0002554 \*\*\* |

## **Table 6: Result of Granger Causality Test (reverse direction)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Country** | **P-value****FD→ CAB** | **P-value****FD → GCF** | **P-value****CAB → GCF** |
| Gambia | 0.998 | 0.4501 | 0.6016 |

$$Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1$$

The Granger Causality test was computed on the variables in both directions. We are able to infer that none of the variables significantly influences the other in both directions except for Gross Capital Formation and Current Account Balance. The result of the Granger test reveals that there is a unidirectional relationship that runs from GCF to CAB at a 5% significance level.

**The Short Run Analysis**

The short-run dynamics are examined using the Error Correction Model (ECM). $Response CAB.d :$

$$Call:$$

$$lm(formula = CAB.d \~ ect1 + FD.dl1 + CAB.dl1 + GCF.dl1 + GDP.dl1 + $$

$$ FD.dl2 + CAB.dl2 + GCF.dl2 + GDP.dl2 + FD.dl3 + CAB.dl3 + GCF.dl3 + GDP.dl3 - 1, data = data.mat)$$

$$Residuals:$$

$$ Min 1Q Median 3Q Max $$

$$-3.4247 -1.0241 -0.2215 1.2082 3.8845 $$

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Lag Variables** | Estimate  | Std. Error  | t value  | Pr(>|t| |
| ect1 | 0.06063 | 0.01327 | -4.568 | 0.000125 \*\*\* |
| FD.dl1 | 0.32609 | 0.23135 | 1.410 | 0.171513 |
| CAB.dl1 | 0.26462 | 0.22776  | 0.22776 | 0.256726 |
| GCF.dl1 | 0.63974 | 0.25038 | 2.555 | 0.017378 \* |
| GDP.dl1 | 0.63473 | 0.21289 | 2.981 | 0.006485 \*\* |
| FD.dl2 | 0.54197 | 0.27368 | 1.980 | 0.059246 . |
| CAB.dl2 | 0.02113 | 0.18903 | 0.112 | 0.911934 |
| GCF.dl2 | 0.81731 | 0.23931 | 3.415 | 0.002271 \*\* |
| GDP.dl2 | 0.38847 | 0.13802 | 2.815 | 0.009597 \*\* |
| FD.dl3 | 0.40773 | 0.21787 | 1.871 | 0.073524 . |
| CAB.dl3 | 0.16092 | 0.16571 | 0.971 | 0.341206 |
| GCF.dl3 | 0.45936 | 0.20866 | 2.202 | 0.037556 \* |
| GDP.dl3 | 0.25399 | 0.12813 | 1.982 | 0.059003 . |

$Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ $ $Residual standard error: 2.301 on 24 degrees of freedom$

$Multiple R-squared: 0.6696,Adjusted R-squared: 0.4907$ $F-statistic: 3.742 on 13 and 24 DF, p-value: 0.002521$

Vector error correct model result on Current Account balance shows that there exists a short-run dynamics of CAB that is derived from Fiscal deficit, Current account balance and GDP at 5% significance level. However, there is no reverse significant short-run response from FD and GCF as a result of impulse from CAD respectively. This validates the unidirectional relationship between the CAB and GCF from our Granger causality result.

**The Long Run Analysis**

The short-run dynamics were determined by the lag values of the variables in the VECM result. The Ect1 term represents the long-term dynamics between the variables. In essence, the ect1 estimate looks at the speed of adjustment or convergence to the equilibrium after short-run dynamics. In other words, after short-run deviation from equilibrium in the previous year will be adjusted in the current year with a speed of 6.063% at a 0.5% significance level.

**5. CONCLUSION AND RECOMMENDATION**

In our study, we examine the inference that there exists a positive and significant relationship between budget balance (T-G) and current account (NX) in the Gambia. We used VAR tools such as the Johannsen correlation function, Granger causality and VECM function to validate our claims in the study. From our VECM we discovered the existence of a significant causal relationship between budget deficit and current account balance in both the short run and long run. The Granger causality result revealed a unidirectional relationship that runs from Gross Capital formation to current Account Balance. Therefore, the Government of the Gambia has the option to devote its resources to accumulating physical capital to influence the current account balance by stimulating the export or the inflow. In other words, the government can devote attention to capital formation to achieve a budget balance or surplus in the country instead of a budget deficit.

Disclaimer (Artificial intelligence)

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Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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Details of the AI usage are given below:

1.

2.

3.

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