

A Dynamic Analysis of the Twin Deficits Hypothesis in Sierra Leone (1990 to 2023)

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ABSTRACT

Sierra Leone, like many other developing countries, faces constant budget deficit (government expenditure exceeding government revenue) as well as current account deficit (imports outweighing exports) thereby creating a twin-deficit problem or twin deficits hypothesis. The objective of the study is to investigate and analyse the overlap between budget deficit and current account deficit in Sierra Leone for the period between 1990 and 2023 while considering the potential policy effects for achieving sustainable economic growth.

The study employs time series secondary data obtained from the World Bank Database and the Ministry of Finance. Various macroeconomic variables including Real Exchange Rate and Real Gross Domestic Product were specified in the model adopted in this study. Before applying the Autoregressive Distribution Lag (ARDL) approach to investigate and assess the long-run and short-run relationships between the variables; and Granger Causality test technique to examine whether causal relationship exists between the variables under investigation, the study first tested the variables for stationarity via unit roots tests. To ascertain the robustness of the estimated equations using the required econometric procedure, diagnostic tests were variously carried out.

Empirically, the study finds a long run relationship between budget deficit and current account deficit in Sierra Leone for the period under study. The study, therefore, concludes that there exists a bidirectional causality between budget deficit and current account deficit in the country. The study, therefore, proffers policy recommendations consistent with the findings, including strengthening domestic revenue mobilisation, improving public expenditure management, and diversifying the export base to reduce reliance on foreign aid and external borrowing.

Keywords: Fiscal deficit, Current Account Deficit, Gross Domestic Product, Macroeconomic Variables, Economic Growth.

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INTRODUCTION

Twin deficits refer to the simultaneous occurrence of a fiscal deficit and a current account deficit within a country's economy. A fiscal deficit, also referred to as

budget deficit, arises when government spending exceeds government revenue, while a current account deficit occurs when a country imports more goods and services than it exports. This phenomenon is often observed in

developing countries like Sierra Leone, where the twin deficits hypothesis is a significant area of economic research and policy development. The twin deficits hypothesis explains that a simultaneous rise in both fiscal and current account deficits can negatively impact an economy. It suggests that increased government spending, financed through borrowing, can lead to a higher demand for goods and services, ultimately increasing imports and widening the current account deficit. The hypothesis remains a prominent area of study and policy focus, aimed at understanding the intricate relationship between these deficits and their implications for economic growth. Researchers and policymakers strive to develop strategies for correcting fiscal and current account disparities, with the goal of stimulating economic growth and promoting sustainable development.

The twin deficits hypothesis has been a subject of extensive debate, particularly in developed economies. However, its relevance in developing countries like Sierra Leone present a peculiar and crucial ambient. The potential negative impact of twin deficits on national economic health has spurred extensive research and policy recommendations from a blend of national and international institutions. These institutions aim to minimise the adverse consequences of twin deficits, recognising their potential to hinder a country's financial well-being and even ripple across the global economy. The United States provides a notable example of recurring twin deficits. In both the early 1980s and 2002, the country experienced simultaneous increases in both fiscal and current account deficits. These periods were marked by a growing reliance on foreign borrowing. In the early 1980s, the United States' fiscal deficit rose from 2.5% of GDP in 1981 to roughly 5% of GDP in 1986 (Bartolini and Lahiri (2006)). This was primarily driven by substantial tax cuts without commensurate spending reductions. Concurrently, the current account moved from a near-balanced position to a deficit of 3.3% of GDP, reflecting a growing reliance on foreign capital.

Despite extensive research on the relationship between fiscal deficit and current account deficit, the empirical literature presents a conflicting range of results. While some studies support the conventional view of the twin deficits hypothesis, many studies show that the relationship is mix, conditional, and depends on variety of factors, including country-specific characteristics, global economic conditions, and exchange rate policies. This makes it a challenging area to understand, and hence, further research continues to refine the thoughts of researchers on the debate.

Jackson and Jabbie (2020), for example, examined the assertion of twin deficit hypothesis as an indication of

government (policy) failure in Sierra Leone through the utilisation of relevant variables for the period 1980-2018. Their research considers it very important, with its application to the economy of Sierra Leone, which seems to have battled with structural problems, particularly policy failures, as manifested through over-burdened current account and fiscal deficit, which is presently overshadowing efforts of changed regimes to make headway with planned developmental goals.

This hypothesis has received limited in-depth research in Sierra Leone. The country's history of political instability, dependence on natural resource extraction, and vulnerability to external shocks and crises present a stage for investigating and analysing the twin deficits, offering significant lessons for other fragile and resource-dependent economies. The country also has a history of heavy reliance on foreign aid including loans to finance budget deficits, potentially leading to increased imports and a widening current account deficit. Additionally, the country faces challenges in generating sufficient tax revenue, resulting in persistent fiscal deficits that are often financed through borrowing, further contributing to external debt problem and a widening current account deficit.

Sierra Leone's economic landscape has been heavily influenced by a series of crises and shocks, further complicating the analysis of twin deficits. These economic crises and shocks include: civil war, coup d'état, Ebola virus, landslide and flood, and covid 19, among others. Following these crises and shocks, the country embarks on major structural reforms aimed at reducing the fiscal and current account deficits, in order to create a stable macroeconomic environment conducive for growth and sustainable development. Despite these reforms, the fiscal deficit and current account deficit remain a significant problem for policymakers in Sierra Leone, as the reforms have not achieved their intended objectives.

Hence, this study empirically investigates analyses the relevance of twin deficits hypothesis and their potential effects on the Sierra Leonean economy. Although preliminary analysis suggests that the traditional twin deficits relationship may be present in Sierra Leone and it is significantly influenced by factors such as reliance on borrowing and increase in imports.

PROBLEM STATEMENT

Like many other developing countries, Sierra Leone continues to encounter a problem of rising twin deficits without commensurate rise in its economic growth rates. As the country continues to experience persistent fluctuation in its gross domestic product (GDP) growth rates and other critical macroeconomic variables, the problem of twin deficits continues to linger. For the

period under investigation, substantial efforts to achieve economic growth and development have been a priority but the country still suffers from persistent fiscal and current account deficits.

Sierra Leone's twin deficits, coupled with the country's history of economic shocks and vulnerabilities, raise concerns about the sustainability of its economic growth trajectory. Given that twin deficits hypothesis suggests a strong link between these deficits and economic growth, the nature and extent of this relationship in Sierra Leone remain unclear.

Despite the fact that the twin deficits hypothesis offers insights into potential economic consequences, there is a lack of research specifically examining its implications for Sierra Leone's policy choices.

The twin deficits hypothesis, while widely debated in developed economies, presents an impenetrable challenge for developing countries like Sierra Leone where economic structures and institutional capacity differ significantly. This research seeks to examine the relevance of the twin deficits hypothesis in Sierra Leone's peculiar situation, considering factors like aid dependence, underdeveloped export sector and recurring economic shocks. The study aims at providing a deep understanding of the principle of twin deficits problem in Sierra Leone, highlighting the specific challenges and opportunities for policymakers.

This study focuses on Sierra Leone's twin deficits and economic growth from 1990 to 2023, particularly during significant events like the post-war recovery, the Ebola virus outbreak, landslide and flood disaster, and the Covid-19 pandemic.

LITERATURE REVIEW

Theoretical Literature

This section reviews five major theoretical models that contribute to understanding the interplay between fiscal balance and current account balance.

Keynesian Absorption Theory (Twin Deficit Hypothesis)

The Keynesian absorption theory, also known as the twin deficit hypothesis, posits a direct relationship between budget deficits and current account deficits. This theory suggests that an increase in government spending exceeding tax revenue leads to a budget deficit. With output remaining constant, this deficit increases domestic absorption (spending), particularly domestic income. This increased income, in turn, stimulates imports, thereby widening the trade deficit and resulting in a current account deficit. The theory emphasises a one-way causation, with budget deficits driving current account deficits in the long run.

Mundell-Fleming Model (MFM)

The Mundell-Fleming Model (MFM) builds upon the Keynesian framework by incorporating an open economy perspective. It highlights how exchange rate systems influence the impact of budget deficits on the current account balance. An increase in government spending within the MFM leads to higher interest rates, attracting capital inflows and appreciating the exchange rate. This appreciation makes imports cheaper and exports more expensive, potentially leading to a worsening trade balance and ultimately, a current account deficit.

Twin Divergence Hypothesis (TDH)

In contrast to the twin deficit hypothesis, the twin divergence hypothesis argues for a negative relationship between budget deficits and trade deficits. This view, proposed by Baxter (1995), emphasises the impact of output fluctuations and investment crowding out effects on both fiscal and current account balances. An investment crowding out effect, where government spending displaces private investment, can lead to a decrease in domestic investment, potentially offsetting the expansionary effects of government spending and impacting trade balances.

Ricardian Equivalence Hypothesis (REH)

The Ricardian Equivalence Hypothesis (REH) suggests that the method of financing government deficits does not impact economic performance. This hypothesis, rooted in the Permanent-Income-Life Cycle Hypothesis, proposes that individuals are rational and forward-looking, anticipating future tax liabilities to offset government debt. As a result, they do not change their current consumption patterns. The REH argues that if a government finances a deficit through tax cuts or bond sales, individuals recognise the resulting future tax liabilities and adjust their savings accordingly. To mitigate the impact of future tax increases, they would increase current savings rather than spending on consumption, effectively offsetting the impact of the deficit. This suggests that government deficits do not affect the private sector's lifetime budget constraint or the real wealth of consumers, implying no relationship between current account deficits and budget deficits.

Current Account Targeting (CAT)

As opposed to the twin deficit hypothesis, which posits budget deficits as the driving force behind current account deficits, the current account targeting theory suggests a reverse causality, where current account deficits initiate budget deficits. This theory, popularised by Summers (1988), highlights the potential impact of large capital inflows on government revenue. Countries heavily reliant on foreign direct investment (FDI) to stimulate economic growth may experience CAT. The influx of capital, often

used to finance infrastructure projects, can lead to increased government spending, creating budget deficits.

Empirical Literature

The following empirical works have been carried out on the twin deficits hypothesis.

Saeed and Khan (2012) used annual data from 1972-2008 to investigate the dynamics of budget deficits and current account deficits in Pakistan. Using Johansen maximum likelihood procedure for long run cointegration and granger causality. They find a long run relationship between the two deficits. This causality runs from budget deficit to current account deficit thus conclude that Pakistan is a twin deficits hypothesis economy.

Vamvoukas (1999) examines the Greek economy from 1948 - 1993 exploring the relationship between budget deficits and real output. Using Error Correction Modeling, Granger bivariate and trivariate causality, and Hendry's general-to-specific technique and finds evidence for a one-way causality running from budget deficits to current account deficits, consistent with the traditional Keynesian proposition.

Lau, et. al. (2006) examine the twin deficit hypothesis (TDH) link for four (4) countries which are India, Malaysia, Thailand and Philippines. While still making use of the Toda-Yamamoto granger causality test, the authors find support for bi-directional causality in India & Malaysia-just like their study for Malaysia two years prior. The study also finds strong support for TDH for Thailand while for Indonesia, reverse causality was confirmed. The study confirms that exchange rate and interest rates are important channels for causality.

Sadullah and Deniz (2008) use quarterly data from 1996 Q1 to 2006 Q4 to study six emerging countries: Czech, Brazil, Mexico, Colombia, South Africa and Turkey. Using panel co-integration and fully modified OLS method, the authors in similarity with Akbostanci and Tunc (2001) find supports for the twin deficit hypothesis for the said countries. Their study points out on the important role of intermediary variables i.e. interest rates and exchange rates.

Brian (2012) employs the use of VAR model to empirically examine the causal relationship between budget deficit and current account deficit for Argentina. Using quarterly data from 1976 Q1 to 2010 Q3, the study couldn't find causality in any direction. Their study concludes that Argentina is a Ricardian nation.

Kosimbei (2002) used annual data from 1964 to 2000 to analyse the relationship between fiscal and current account deficit. The author carried out Granger causality tests

which revealed that there was no causality between fiscal and current account deficits. The study concluded that the Ricardian equivalence is valid in the Kenyan case with short-run dynamics being the same as long run equilibrium relationships.

Merza, et al. (2012) used Ganger causality test, Johansen cointegration test, Vector Auto Regression (VAR) and Impulse response functions to study the twin deficit hypothesis for Kuwait. Results for the data spanning from 1993 Q1 to 2010 Q4 indicate that though budget deficits and current account deficits are cointegrated in the long run, budget deficits respond negatively to shocks in current account deficits.

Sobrino (2013), using quarterly data from 1980 to 2012, rejects the twin deficits hypothesis for Peru. His evidence strongly points to reverse causality, that is, current account deficit causes the fiscal account deficit.

METHODOLOGY

Based on the open economy macroeconomics, an increase in the budget deficit will give rise to an increase in the interest rate that in turn causes the capital inflows and an appreciation of the real exchange rate. As a result of loss in international competitiveness, the domestic economy records current account deficit. From this theoretical view, five variables could be included in the model to test the twin deficit hypothesis. They are measures of fiscal deficits and current account deficits, both of which are expressed as percentage of GDP, real interest rates, real exchange rates and real GDP. The twin deficit model will be represented as model adopted by Ahmad and Aworinde (2015).

Model Specification and Description of Variables

The basic model to find out the relationship among the Current Account Balance (CAB), Budget Deficit (BD), Real Interest Rate (RIR), Real Exchange Rate (REXR) and Real Gross Domestic Product (RGDP) can be represented as;

$$CAB = f(BD, RIR, REXR, RGDP)$$

In econometric form;

$$CAB_t = \beta_0 + \beta_1 BD_t + \beta_2 RIR_t + \beta_3 REXR_t + \beta_4 RGDP + \varepsilon_t$$

where CAB is the dependent variable, representing the ratio of the Current Account Balance to GDP, BD is the key explanatory variable of interest, representing the ratio of the budget deficit to GDP, RIR is an explanatory variable, representing the real interest rate, adjusted for inflation, REXR is an explanatory variable, representing the real exchange rate of the Leone currency against other currency, adjusted for inflation. RGDP is an explanatory variable, representing the real gross domestic product of Sierra Leone, adjusted for inflation. β_0 is the intercept

term. $\beta_1, \beta_2, \beta_3,$ and β_4 are coefficients for the explanatory variables, representing the estimated impact of a unit change in each variable on the current account deficit. ϵ_t is the error term.

Estimation Procedure

The Augmented Dickey Fuller (ADF) test is employed to check stationarity of variables or otherwise make them stationary by taking the first difference of the variables. We proceed to ascertain whether there is long-run association among CAB, BD, RIR, REXR, and RGDP using the Johansen cointegration test. The Error Correction Model (ECM) is estimated to check stability of the long-run association among the variable. Lastly, Granger causality test is performed to determine the direction of causality between the variables.

Autoregressive Distributed Lag (ARDL) Approach

Autoregressive distributed lag (ARDL) approach was developed by Pesaran, et al. (1997) for testing co-integrating relationship. It has peculiar advantages over other symmetric co-integration tests. First, the ARDL approach can be applied to variables of different order of integration. Second, the ARDL approach could be used on small or finite sample size. Third, the short and long-run parameters are estimated concurrently. Fourth, the approach can be used to accommodate the structural breaks identified in the variables used. In respect of these advantages, and coupled with the fact that the variables employed in this study are of different orders of integration and relatively, a small sample size is used, the ARDL approach is the most suitable technique for this study.

Estimating an ARDL model involves four steps. The first step is to examine the presence of co-integration using the bounds test procedure (Pesaran et al. (1997)). The second step is to estimate the coefficient of the long run relationships identified in the first step. The third step is to estimate the short run coefficients while the final stage is to test for the stability of the model, by using the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squared recursive residuals (CUSUMSQ). An ARDL representation of the model can be represented as:

The ARDL model testing procedure starts with conducting the bound test, which states the null hypothesis of zero co-integration, that is:

$$H_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$$

Against the alternative hypothesis of the existence of co-integration, that is;

$$H_1 \neq \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0$$

The statistic underlying the procedure is the F-statistic which is used to test the significance of lagged levels of

the variables, in order to establish the existence of co-integration. The critical values are divided into upper and lower critical bounds. The upper critical values assume that all the series are I (1) while the lower critical values assume that all the series are I (0). However, due to the limited number of sample observations, the critical values in this paper are extracted. If the computed F-statistic falls outside the critical bound, a conclusive inference can be made without considering the order of integration of the underlying regressors. For instance, if the F-statistic is higher than the upper critical bound, then the null hypothesis of no cointegration is rejected. Alternatively, if the F-statistic is lower than the lower critical bound, then the null hypothesis of no cointegration cannot be rejected. If, however, the calculated F-statistic lies within the lower and upper bounds, then the test is said to be inconclusive. In this context, the unit root tests should be conducted to ascertain the order of integration of the variables. If all the variables are found to be I (1), then the decision is taken on the basis of the upper critical value. On the other hand, if all the variables are I (0), then the decision is based on the lower critical bound value. Once cointegrating relationship is ascertained, the error correction estimates of the ARDL model are obtained. The diagnostic test statistics of the selected ARDL model can be examined from the short run estimates at this stage of the estimation procedure. Similarly, the test for parameter stability of the model can be performed.

The ECM is the error correction term which measures the speed of adjustment, and it is the coefficient of the error correction term, which is expected to be negative and statistically significant to further confirm the existence of a cointegrating relationship.

Unit Root Test

The Augmented Dickey-Fuller (ADF) test is employed to test the stationarity of the variables since many time series data tend to have unit root. The ADF procedure tests the null hypothesis that a series Y_t has unit root or is non-stationary by calculating t-statistic for the coefficient of the lagged dependent variable $\beta = 0$ in the following regression equation:

$$Y_t = \alpha + \beta Y_{t-1} + \gamma_t + \delta_k Y_{t-k} + \epsilon_{it}$$

If the value of the ADF test statistic is less than the critical value (conventional 5 percent level of significance) then we accept the null hypothesis and conclude that the series is non-stationary, and vice versa. If a series is found to have unit root, then the series is differenced d number of times for it to be stationary. Hence if the first difference of the series Y_t becomes stationary, then we conclude that the series Y_t is integrated of order one or $Y_t \sim I(1)$.

Cointegration Test

The literature suggests three widely used procedures to determine the existence of long-run association (cointegration) or otherwise between stationary time series variables, namely, the Engle-Granger two-step method, the Johansen test, and the Phillips-Ouliaris cointegration test. This paper will adopt the Johansen test as it is more suitable for a two-variable model. The Trace test and the Maximum eigenvalue test will be adopted to determine the number of cointegrating vectors. The Trace (λ_{trace}) test examines the null hypothesis that the number of cointegrating vectors equals or is less than (r) and computed as:

$$\lambda_{trace(r)} = -T$$

Then again, the Maximum eigenvalue (λ_{max}) test examines the null hypothesis that there is (r) number of cointegrating vectors in contrast to the alternative hypothesis that there are ($r+1$) cointegrating vectors. The λ_{max} test is thus calculated as follows:

$$\lambda_{max} = (r, r+1) = -T \ln(1 - \lambda_i)$$

Error Correction Model (ECM)

We can proceed to run regressions in first difference provided the series of interest are $I(1)$. Although we may well lose the long-run relationship inherent in the data, there is need to use variables in their levels as well in the regressions. The Error Correction Model is designed to fit in variables both in their levels and first differences and thus captures both the short run equilibrium and long-run equilibrium adjustments between variables.

Granger Causality Test

If the current or lagged terms of a series say X_t determines another Y_t then there is granger causal relationship between the variables where Y_t is granger by X_t (Granger, 1969).

Stability Test

To check for the robustness of the results, CUSUM and CUSUMSQ tests proposed by Brown et al. (1975) are carried out. The tests are applied to the residuals of the estimated model. The CUSUM test is based on the cumulative sum of recursive residuals based on the first set of N observations. It is updated recursively and is plotted against the break points. If the plot of CUSUM statistic stays within a 5% significance level (portrayed by two straight lines whose

equations are given in Brown et al. (1975), then, the estimated coefficients are stable. Similar procedure is used to carry out the CUSUMSQ tests which are based on the squared recursive residuals

Diagnostic Tests (Best Linear Unbiased Estimation)

Normality Test

The normality of the data is tested using Jarque-Bera to

check whether the data are normally distributed. The null hypothesis will be rejected if the p-value is less than the 5% significance level.

Heteroscedasticity Test

Breusch Pagan Test was introduced by Trevor Breusch and Adrian Pagan in 1979. It is used to test for heteroscedasticity in a linear regression model and is assumed that the error term is normally distributed. The study conducts heteroscedasticity test to determine whether the variance of the errors from regression is dependent on the values of the independent variables. It is a chi-square test.

Serial Correlation LM Test

The serial correlation in the discrete time case is the correlation of a signal with delayed copy of itself as a function of delay. It is the similarity between observations of a random variable as a function of the time lag between them. This analysis is also a tool for finding repeating patterns, such as the presence of periodic signal obscured by noise, or identifying the missing fundamental frequency in a signal implied by its harmonic frequencies.

Functional Form Mis-specification Test

Models that are mis-specified can have biased coefficients and error terms and also tend to have biased parameter estimations. Application of functional mis-specification is necessary especially when a model has the appropriate explanatory variables (in this case; Budget Deficits, Real Interest Rate, Real Exchange Rate and Real Gross Domestic Product), but fails to account for the relationship between the explanatory and response variables.

Data Sources

Data on Current Account Balance (CAB), Budget Deficit (BD), Real Interest Rate (RIR), Real Exchange Rate (REXR) and Real Gross Domestic Product (RGDP) are obtained from the IMF's World Economic Outlook Database and the World Bank's World Development Indicators online.

PRESENTATION AND ANALYSIS OF EMPIRICAL RESULTS

This section presents the empirical findings and discussion of results. It provides descriptive statistics, unit root test (at level and first difference), Phillips-Perron (at level and first difference) and the bounds test of cointegration results. The section also provides the long run and short run results, stability and diagnostic analysis.

Descriptive Statistics

The results of the descriptive statistics are presented in Table 1. Based on the results, we observe a high standard deviation for Budget Deficit, which implies that Budget

Deficit is more volatile compared to other variables. The results also show that Current Account Balance, Budget Deficit, Real Interest Rate and Real Gross Domestic Product have negative skewness with values of -2.893099, -1.573621, -1.148737 and -0.24005, respectively, which indicate that the variables are moderately skewed to the left. However, Real Exchange Rate is normally distributed with positive skewness value (0.214293) with implications that the variable is skewed to the right. The value of the kurtosis for the variables Current Account Deficit, Budget Deficit, Real Interest Rate and Real Gross Domestic Product are all above 3, which indicate that the distributions are platykurtic, i.e., the distributions have a thinner tail shape than a normal distribution. For variable Real Exchange Rate is leptokurtic with a long-right tail (positive skewness), since it has kurtosis value less than 3. The values of the Jarque-Bera statistic test for the goodness of fit of whether the sample has skewness and kurtosis matching a normal distribution and P-values are less than the 5% significance level for the variables Current Account Deficit, Budget Deficit, Real Interest Rate, Real Exchange Rate and Real Gross Domestic Product, which indicate that we cannot reject the null hypothesis, and thus, conclude that they are normally distributed.

Table1. Descriptive Statistics

	CAB	BD	RIR	REXR	RGDP
Mean	-12.7898	-23.0389	5.4547	116.1838	2.9136
Median	-9.4260	-8.6352	6.8183	117.1481	4.1926
Maximum	1.9662	-1.5550	27.1459	142.8208	26.4173
Minimum	-65.0289	-112.7530	-31.6974	91.3533	-20.5987
Std. Dev.	11.9037	30.2485	12.9374	15.8117	9.2292
Skewness	-2.8930	-1.5736	-1.1487	0.2142	-0.2400
Kurtosis	13.1969	4.2665	4.7032	1.8907	4.7346
Jarque-Bera	177.5493	14.8660	10.5652	1.8265	4.18449
Probability	0.0000	0.0005	0.0050	0.4011	0.1234
Sum	-396.4859	-714.2080	169.0966	3601.698	90.32250
Sum Sq. Dev.	4250.983	27449.18	5021.299	7500.380	2555.398
Observations	34	34	34	34	34

Unit Root Test Results

The results of the unit root tests are presented in Table 2. The unit root tests whether the time series variables (Current Account Deficit, Budget Deficit, Real Interest Rate, Real Exchange Rate and Real Gross Domestic Product) are non-stationary and possess a unit root. The null hypothesis is generally defined as the presence of a unit root and the alternative hypothesis is either stationarity, trend stationarity or explosive root depending on the test used. The test used in this analysis is the Augmented Dickey Fuller Test (ADF-test). The ADF-test statistic tests the null hypothesis that a unit root is present in a time series sample. The ADF-test

statistic used in the test is a negative number. The more the negative, the stronger the rejection of the hypothesis that there is a unit root at some level of confidence. The literature suggests that most macroeconomic variables time series data are non-stationary at their level form and the use of nonstationary data produces spurious empirical results (Nelson and Plosser, 1982). Therefore, to ensure the data series are stationary, Augmented Dickey Fuller (ADF) test is used by Dickey and Fuller (1981) and is non-parametric in nature while the Phillip Perron (PP) test serves as a robust check. The study utilises both the ADF and PP test to ascertain the stationarity of the variables.

Table 2. Augmented Dickey-Fuller and Phillips-Peron Unit Root Results

Variables	Augmented Dickey-Fuller			Phillips-Peron		
	Level	First Difference	Order	Level	First Difference	Order
CAB	-3.67017	3.679322**	I (1)	-2.9639**		I (0)
BD	-2.96397	-2.967767**	I (1)	-2.9639	-2.9677**	I (1)
RIR	-2.96397**		I (0)	-2.96397		I (0)
REXR	-2.963972	-2.967767	I (1)	-2.9639	-2.9677**	I (1)
RGDP	-2.96397**		I (0)	-2.9639**		I (0)

**Rejection of the null hypothesis of unit roots at 5% significance level and lag length based on Schwartz Information Criterion

It is evident from the table that the results of regressors are found to be a mixture of orders of integration i.e. I (0) and I(1). The ADF test results show that variables such as RIR and RGDP are integrated of order I (0), whilst CAB, BD, REXR are integrated of order I (1). However, the PP results show that CAB, RIR, RGDP are integrated of order I (0) and BD are integrated of order I (1).

Selection of Optimal Lag Length

To enable us estimate and decide the most optimal lag length for the model and for the variables, it is imperative that we establish an estimate of a vector autoregression

whose lag length differs from the true lag length and are inconsistent as are the impulse response functions and variance decomposition derived from the estimated VAR. The literature prescribes five different criteria for optimal lag length selection namely, Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), and Hannan-Quinn information criterion (HQ). The result shows that the optimal lag length is one (1) based on the selection criteria. Thus, the study uses one (1) lag for each variable based on the AIC criteria (see Table 3).

Table 3. *Optimal Lag Selection Length*

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-56.96575	NA	0.003001	5.542340	5.740712	5.589071
1	41.87694	152.7569*	1.66e-06*	-1.988813*	-0.996956*	-1.755161*
2	56.87452	17.72441	2.16e-06	-1.897684	-0.112341	-1.477111

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

ARDL F-Bounds Test Cointegration Result

Based on the unit roots test results presented in Table 2, we perform cointegration test using the Auto Regressive Distributed Lag (ARDL) model. The objective for the cointegration test is to ascertain the existence of a long run relationship between the endogenous and exogenous variables. The decision rule is that the null hypothesis is rejected if the F-statistic exceeds the upper bound (limit)

at the 1%, 5% and 10% significance levels; otherwise, we confirm there is no cointegration. From the results presented in Table 4, the F-statistic (5.128938) is found to be greater than the upper bound (1), at the 1% and 5% levels of significance. Therefore, the study concludes that there is cointegration, indicating there exists a long run relationship among the variables.

Table 4. *F-Bounds Test Results*

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	5.128938	10%	2.45	3.52
K	4	5%	2.86	4.01
		2.5%	3.25	4.49
		1%	3.74	5.06

ARDL Long Run Results

Given that the bounds test revealed the existence of co-integration when current account balance was used as an endogenous variable, the equation of the current account balance as a function of budget deficit, real interest rate, real exchange rate, and real gross domestic product are hence estimated for the long run coefficients.

twin deficit hypothesis in the long run. Results from the long run ARDL using AIC revealed a positive (0.294697) relationship between current account deficit and budget deficit and implies that a 1% increase in the budget deficit in the previous period is associated with a 0.29% increase in the current account balance in the long run. The result suggests that an increase in the budget deficit will increase the current account deficit in the long run, a finding consistent with the conventional Keynesian proposition. It

From Table 5 budget deficit is the key variable for the

is statistically significant and provides evidence against the twin deficits hypothesis in the long run. This finding is in conformity with the studies by Piersanti (2000), Leachman and Francis (2002), and Cavallo (2005) who concluded that the twin deficits are closely linked and causality runs from budget deficit to current account deficit. It shows that a fiscal expansion, *ceteris paribus*, might lead to a trade surplus. The relationship between current account balance and real interest rate was found to be unfavorable over the period under study. It revealed that a 1% increase in the real interest rate in the previous period brings about a 0.002% decrease in the current account balance in the long run. This is statistically significant and suggests that higher real interest rates lead to trade deficits in the long run.

Real exchange rate is found to impact current account balance positively throughout the study period. The coefficient (0.343659) is statistically significant implying that a 1% increase in the real exchange rate in the previous

period leads to a 0.34% increase in the current account balance in the long run. In such case, a more valuable currency leads to trade surpluses in the long run.

Current account balance and real gross domestic product are positively related both in the short and long run during the study period. The findings indicate that a 1% increase in real gross domestic product from the previous period causes a 0.06% increase in the current account balance in the long run. This result is statistically significant and may indicate that stronger economic activity leads to trade surpluses in the long run.

These results provide evidence against the twin deficits hypothesis in the long run in Sierra Leone. In essence, a higher budget deficit does not create trade deficits, but creates trade surpluses in the long run. Additionally, the level of the current account balance in Sierra Leone is significantly influenced by the budget deficit, real interest rate, real exchange rate and real gross domestic product.

Table 5. ARDL Long Run Result

Endogenous Variable is lnCAB				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.774616	0.554796	5.001146	0.0000
lnBD(-1)	0.294697	0.039057	7.545390	0.0000
lnRIR(-1)	-0.002213	0.000717	-3.086710	0.0021
lnREXR(-1)	0.343659	0.014295	24.04043	0.0000
lnRGDP(-1)	0.059576	0.021520	2.768414	0.0058
R-squared	0.892384	Mean dependent var		-12.86007
Adjusted R-squared	0.780832	S.D. dependent var		12.10073
S.E. of regression	1.779364	Akaike info criterion		8.084219
Sum squared resid	4081.443	Schwarz criterion		8.317752
Log likelihood	-116.2633	Hannan-Quinn criter.		8.158928
F-statistic	18.97561	Durbin-Watson stat		1.952136
Prob(F-statistic)	0.000000			

ARDL Short Run Results

The short run results are presented in Table 6.

D (lnCAB (-1)) is the first difference of the natural logarithm of the Current Account Balance (CAB) lagged by one period. This measures the change in the current account balance from the previous period. Findings reveal that current account balance in the present is influenced by current account balance in the earlier periods. With a positive coefficient of 0.129753, if the current account balance increases by 1% in the previous period, the current change in the current account balance will increase by 0.13% keeping other variables constant, hence, statistically significant at the 5% level.

D (lnBD (-1)) is the first difference of the natural logarithm of the Budget Deficit (BD) lagged by one period. This measures the change in the budget deficit from the previous period. It is shown that budget deficit (key variable for the twin deficits hypothesis) in the short run had a short-term negative effect of -0.051525 on current account balance. It implies that, a 1% increase in the budget deficit in the previous period (lagged budget deficit) depicts a 0.05% decrease in the current period's change in the current account balance. This is statistically significant and provides strong evidence against the twin deficits hypothesis in the short run. In such case, a fiscal expansion does not improve, but worsen the trade balance.

D(lnRIR (-1)) is the first difference of the natural logarithm of the Real Interest Rate lagged by one period. It measures the change in interest rate from the previous period. A positive coefficient of 0.127431 implies that a 1% increase in the real interest rate from the previous period creates a 0.13% increase in the change in the current account balance this period. This is statistically significant and might indicate that higher interest rates attract capital inflows, which improves the trade balance.

D(lnREXR (-1)) is the first difference of the natural logarithm of the Real Exchange Rate (REXR) lagged by one period. It measures the change in the exchange rate from the previous period. The real exchange rate had a positive (0.116649) short run correlation with current account balance. The result reveals that, a 1% increase in

the exchange rate in the previous period leads to a 0.12% increase in the change of current account balance in the current period. In such case, a more valuable currency may lead to a trade surplus.

Finally, D(lnRGDP (-1)) is the first difference of the natural logarithm of Real Gross Domestic Product (RGDP) lagged by one period. It measures the change in real gross domestic product from the previous period. The real gross domestic product had a positive (0.120499) correlation with current account balance. It implies that, a 1% increase in the real gross domestic product in the previous period results in a 0.12% increase in the current change in the current account balance. This is statistically significant and may indicate that greater economic activity in Sierra Leone leads to trade surpluses.

Table 6. ARDL Short Run Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.890181	0.560340	5.157907	0.0000
D(lnCAB(-1))	0.129753	0.025555	5.077443	0.0000
D(lnBD(-1))	-0.051525	0.021865	-2.356510	0.0188
D(lnRIR(-1))	0.127431	0.037003	3.443853	0.0006
D(lnREXR(-1))	0.116649	0.028351	4.114397	0.0000
D(lnRGDP(-1))	0.120499	0.037459	3.216798	0.0014
ECM(-1)	-0.604337	0.221010	-2.734441	0.0121
R-squared	0.869372	Mean dependent var		-0.301717
Adjusted R-squared	0.764333	S.D. dependent var		12.45188
S.E. of regression	1.795263	Akaike info criterion		7.903394
Sum squared resid	2835.729	Schwarz criterion		8.233431
Log likelihood	-107.5992	Hannan-Quinn criter.		8.006758
F-statistic	13.76573	Durbin-Watson stat		1.998723
Prob(F-statistic)	0.000000			

Granger Causality Results

The granger causality test was conducted to examine whether causal relationship exists between the variables under investigation. The result based on the significant probability values less than or equal to 0.10 reveals that there exists bi-directional causal relationship between Current Account Balance, Budget Deficit, Real Interest

Rate, Real Exchange Rate and Real Gross Domestic Product. Similar results of these causal relationships were obtained by Chang and Hsu (2009) and Tang and Lau (2009). However, there was no causal relationship between Current Account Balance and Budget Deficit, Real Interest Rate, Real Exchange Rate and Real Gross Domestic Product. The overall results fail to reject the hypothesis of the study.

Table 7. Granger Causality Results

Pair wise Granger Causality Tests			
Lags: 1			
Null Hypothesis:	Obs	F-Statistic	Prob.
lnBD does not Granger Cause lnCAB	34	10.6145	0.0099
lnCAB does not Granger Cause lnBD		7.80511	0.0203
lnRIR does not Granger Cause lnCAB	34	0.07713	0.7833

lnCAB does not Granger Cause lnRIR		0.09262	0.7632
lnREXR does not Granger Cause lnCAB	34	8.02640	0.0221
lnCAB does not Granger Cause lnREXR		4.87407	0.0481
lnRGDP does not Granger Cause lnCAB	34	9.01713	0.0069
lnCAB does not Granger Cause LnRGDP		11.0020	0.0045
lnRIR does not Granger Cause lnBD	34	0.97286	0.3327
lnBD does not Granger Cause lnRIR		10.3639	0.0033
lnREXR does not Granger Cause lnBD	34	0.51751	0.4781
lnBD does not Granger Cause lnREXR		1.12534	0.2982
lnRGDP does not Granger Cause lnBD	34	0.09537	0.7598
lnBD does not Granger Cause LnRGDP		3.07707	0.0907
lnREXR does not Granger Cause lnRIR	34	1.68015	0.2059
lnRIR does not Granger Cause lnREXR		0.16305	0.6895
lnRGDP does not Granger Cause lnRIR	34	0.22623	0.6382
lnRIR does not Granger Cause LnRGDP		0.90771	0.3492
lnRGDP does not Granger Cause lnREXR	34	1.14694	0.2937
lnREXR does not Granger Cause LnRGDP		0.01057	0.9189

Stability Test

The stability of the regression coefficients is evaluated using the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) test for structural stability. The

model is stable, since both the CUSUM and CUSUMSQ test statistics lie within the 5% critical bound as shown in figures 1 and 2.

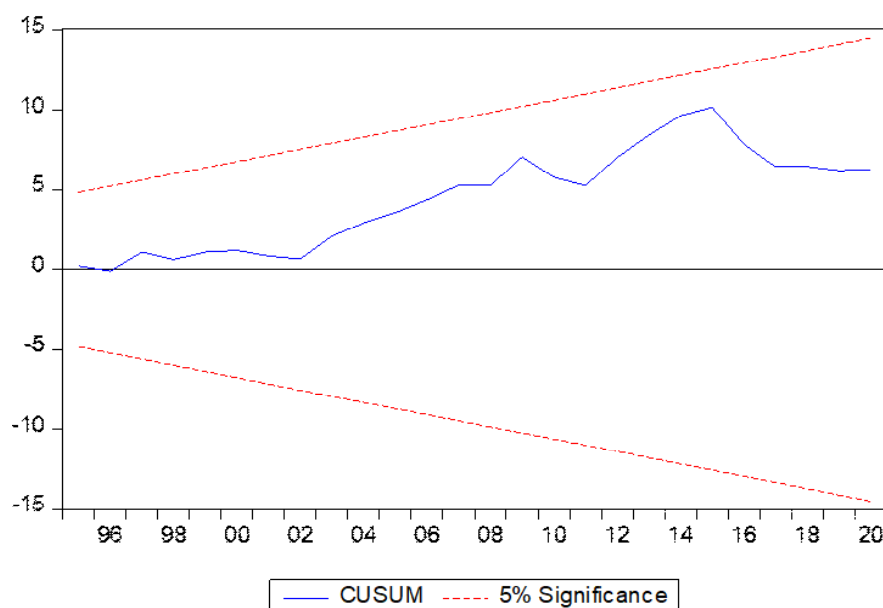


Figure 1. Plot of CUSUM Test

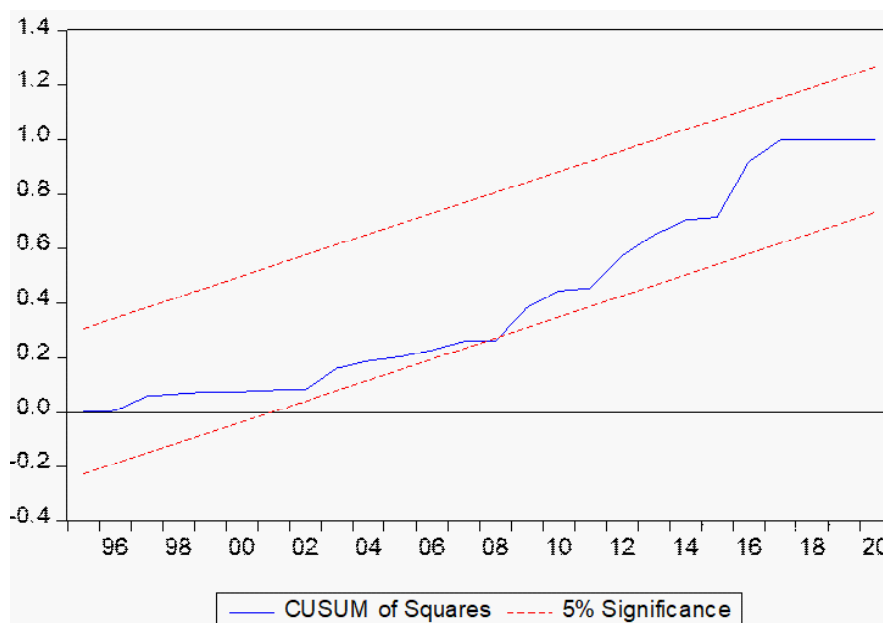


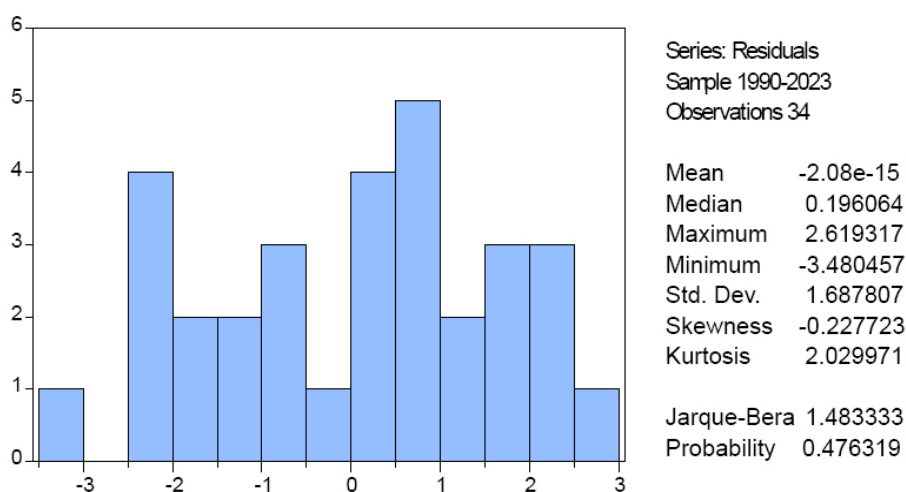
Figure 2. Plot of CUSUMSQ Test

Diagnostic Tests

Normality Test

The study conducted normality test to determine whether the variables used in the model were normally distributed through their residuals.

The hypothesis tested was;



We used Jargue-Bera test for normality and established that all variables were normally distributed since the p-value of 0.4763 is greater than the 5% level of significance. The rule of thumb is that if the p-value is greater than the 5% level of significance reject the null hypothesis and accept that the series are normally distributed.

Autocorrelation Test

Since autocorrelation is associated with biasness of the estimates which can lead to spurious regression, we conducted Breusch-Godfrey Serial Correlation LM test, and confirmed that the prob. Chi-square (1) value of 0.8327 was indeed greater than the significant level of 0.05 and thus there was no autocorrelation amongst the series.

Table 8a. Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.032343	Prob. F(1,21)	0.8590
Obs*R-squared	0.044595	Prob. Chi-Square(1)	0.8327

Heteroscedasticity Test

Breusch Pagan Test was introduced by Trevor Breusch and Adrian Pagan in 1979. It is used to test for heteroskedasticity in a linear regression model and assumes that the error

term is normally distributed. The study conducted heteroskedasticity test to determine whether the variance of the errors from regression is dependent on the values of the independent variables. It is a chi-square test.

We used the probability chi-square (4) and established that the variables are not heteroskedastic since the prob. Chi-square value of 0.9548 is greater than the 5% significance level. The rule of thumb is that if the prob. Chi-square

value is greater than the 5% level of significance, we reject the null hypothesis and thus conclude that the variance is not constant.

Table 8b. *Heteroskedasticity Test: Breusch-Pagan-Godfrey*

F-statistic	0.209768	Prob. F(6,22)	0.9699
Obs*R-squared	1.569294	Prob. Chi-Square(6)	0.9548
Scaled explained SS	6.298142	Prob. Chi-Square(6)	0.3906

Ramsey Regression Equation Specification Error Test (RESET) Test

James B Ramsey developed this test and the test is, in general, a specification test for the linear regression model. It tests whether non-linear combinations of the fitted values help explain the response variable. The intuition behind the

test is that if non-linear combinations of the explanatory variables have any power in explaining the response variable, the model is mis specified in the sense that the data generating process might be better approximated by a polynomial or another non-linear functional form.

Table 8c. *Ramsey RESET Test*

Equation: UNTITLED			
Specification: D(lnCAB) C D(lnCAB(-1)) D(lnBD(-1)) D(lnRIR(-1)) D(lnREXR(-1))			
D(lnRGDP(-1)) ECM(-1)			
Omitted Variables: Squares of fitted values			
	Value	df	Probability
t-statistic	1.416779	21	0.1712
F-statistic	2.007261	(1, 21)	0.1712
Likelihood ratio	2.647336	1	0.1037

SUMMARY OF MAIN FINDINGS

This paper has endeavoured to investigate and analyse the relationship between budget deficit and current account deficit in Sierra Leone for the period covering 1990 to 2023 taking into consideration the potential policy effects for achieving sustainable economic growth. The country continues to register high levels of budget deficit and current account deficit notwithstanding receipt of numerous foreign aids and the availability of substantial natural resources.

The research reveals a statistically significant long-run relationship between fiscal deficit and current account deficit in Sierra Leone, suggesting a degree of validity to the twin deficit hypothesis. With evidence supporting a long-run relationship, factors such as political instability, foreign aid, persistent borrowing, underdeveloped export sector, and structural and institutional weaknesses have exacerbated increased government spending, resulting to disproportionately increase in demand for imported goods.

The ARDL long run relationship reveals that Budget Deficit, Real Exchange Rate and Real Gross Domestic Product have a positive and significant relationship with Current Account Deficit. This implies that, increase in, for example, Budget Deficit, Real Exchange Rate and Real Gross Domestic Product would necessitate an increase

in Current Account Deficit. The Real Interest Rate on the other hand is negative, implying an inverse relationship with Current Account Deficit.

The short run results are consistent with results from the long-run except for Budget Deficit and Real Interest Rate.

With evidence supporting a long-run relationship between the two deficits, this relationship is significantly influenced by factors such as political instability, foreign aid, borrowing, undeveloped export sector, and structural and institutional weaknesses.

The granger causality tests indicate a bidirectional causality between the two deficits, implying that government's spending cut or tax increase policies may also lead to a reduction in the current account deficit, dampening economic growth.

POLICY RECOMMEDATIONS

Premised on the research findings, authors have provided the following policy recommendations to enhance the effective and efficient utilisation of policies for the purpose of strengthening domestic revenue mobilisation, improving public expenditure management, and diversifying the export base to reduce reliance on external borrowing.

These recommendations aim to address both deficits in a coordinated way, recognising the feedback loops between them. Authors, therefore, recommend the following

policy measures in order to achieve economic growth and sustainable development:

- Government needs to prioritize a responsible fiscal management to reduce external borrowing.
- The implementation of a medium-term fiscal framework with clear targets for reducing the fiscal deficit. This should involve a mix of revenue enhancement and expenditure control measures. The framework should be transparent and credible to signal commitment to fiscal sustainability, which can boost investor confidence.
- The development of a comprehensive export diversification strategy to reduce reliance on a few primary commodities. This should involve promoting value-added exports, supporting SMEs, and investing in infrastructure. It helps improve the trade balance and reduces vulnerability to commodity price shocks, and addresses the current account deficit
- Reform the tax system to broaden the tax base, reduce tax loopholes, and improve tax compliance. This should involve measures such as strengthening tax administration, combating tax evasion, and expanding the coverage of value-added tax (VAT). This policy would enable government to increase revenue without relying on distortionary taxes.
- Focus public spending on high-return investments that promote long-term economic growth, such as education, healthcare, and infrastructure. This policy enhances productivity and competitiveness while controlling government spending.
- Strengthen public financial management systems to improve budget execution, reduce waste and corruption, and enhance the efficiency of public spending. This should involve measures such as implementing program-based budgeting, strengthening procurement processes, and enhancing internal control.
- Improve access to financial services for individuals and businesses, particularly in rural areas. This can help to boost domestic demand and reduce reliance on imports.
- Promote diversification of the economy beyond primary commodities. This could include supporting the development of manufacturing, services, and tourism sectors. This policy reduces vulnerability to commodity price volatility and enhances long-term growth prospects.

ABBREVIATIONS

ADF: Augmented Dickey Fuller

ARDL: Auto Regressive Distribution Lag

BD: Budget Deficit

REH: Ricardian Equivalence Hypothesis

CAT: Current Account Targeting

CAD: Current Account Deficit

CAB: Current Account Balance

COVID: Corona Virus Disease

ECM: Error Correction Model

FD: Fiscal Deficit

GDP: Gross Domestic Product

RIR: Real Interest Rate

REXR: Real Exchange Rate

RGDP: Real Gross Domestic Product

TDH: Twin Deficit Hypothesis

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