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The Intertemporal Approach to modeling the Current Account: Evidence from Nigeria

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April, 2002

A Thesis submitted to the
Faculty of Graduate Studies and Research
In partial fulfillment of the requirements of the degree of
Doctor of Philosophy

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0-612-78636-6
ABSTRACT

This dissertation has two objectives. The first is to modify the existing Present Value Model of the Current Account (PVMCA) to reflect the major features of the Nigerian economy and to determine if this resulting theoretical framework is valid for the analysis of the Nigerian current account for the period 1960-97. The second objective is to examine the excessiveness and sustainability of the Nigerian current account deficits during this period.

To achieve these objectives, the thesis presents a model of current account determination that is based upon the permanent-income hypothesis of private consumption behavior. We derive a present value relationship among the current account, expected changes in net output and a consumption-based real interest rate. This thesis then extends this framework to incorporate changes in the terms of trade and possible asymmetric access to the international financial markets. It also conducts an empirical estimation of the several variants of the PVMCA. The econometric results show that an intertemporal model of current account determination that includes changes in the interest rate, exchange rate and terms of trade outperforms one that excludes them.

This thesis represents the first attempt to use an intertemporal model of the current account and selected macroeconomic and structural indicators to assess the external position of the Nigerian economy. The empirical results support the hypothesis that current account deficits accompanied by macroeconomic instability and structural weaknesses can generate an external crisis.
ABREGE

La présente thèse a deux objectifs: premièrement, modifier le modèle existant de la valeur actualisée du compte courant (MVACC) de manière à refléter les principales caractéristiques de l'économie du Nigeria, ainsi qu'à déterminer si le cadre théorique qui en découle se prête à l'analyse du compte courant Nigérian durant la période 1960-97; deuxièmement, voir si les déficits enregistrés par ce pays pendant la même période étaient trop élevés et viables.

Pour atteindre ces deux objectifs, nous avons présenté un modèle de détermination du compte courant fondé sur l'hypothèse du revenu permanent des consommateurs. Nous avons dérivé le rapport des valeurs actualisées entre le compte courant, les variations prévues de la production nette ainsi que le taux d'intérêt réel qui tient compte de la consommation. Nous avons ensuite intégré à ce cadre les variations des termes de l'échange et un éventuel accès asymétrique aux marchés financiers internationaux. Nous avons également procédé à une estimation empirique des diverses variantes du MVACC. Les résultats économétriques démontrent qu'un modèle intemporel de la détermination du compte courant englobant les variations du taux d'intérêt, du taux de change et des termes de l'échange est supérieur au modèle qui ne reflète pas ces changements.

L'utilisation d'un modèle intemporel du compte courant et de certains indicateurs macroéconomiques et structurels pour évaluer la situation extérieure du Nigeria constitue une première. Les résultats empiriques avalisent l'hypothèse voulant que les déficits courants accompagnés d'une instabilité macroéconomique et de lacunes structurelles peuvent provoquer une crise extérieure.
ACKNOWLEDGEMENTS

My deepest appreciation goes to the members of my thesis committee: Professors Jagdish Handa and Franque Grimard. Prof. Handa painstakingly went through every page of the various versions of my thesis. He was never tired of reading it over and over. Even when I thought that the thesis would never come to an end, he encouraged me to continue working hard and believed that I would be able to finish. Words are not enough to express my gratitude. Professor Grimard showed a truly deep interest in my studies and research. He read every chapter of the thesis and contributed to shaping it. Even during his sabbatical, he gave me the opportunity to call him at home. I am not taking any of this assistance and guidance for granted: I really do appreciate the assistance of both Profs. Handa and Grimard. My appreciation goes to Professor Black, the external examiner for this thesis, for his insightful comments and suggestions.

My sincere gratitude also goes to the faculty and staff of the Department of Economics. Among others, I would like to thank Professors John Galbraith, John Iton, N. V. Long, and Curtis Eberwein, as well as Elaine Garnham and Linda Montreuil. My thanks also go to Prof. Jan Jorgensen, one of the two coordinators of the Economic Policy Management. He believes in the abilities and value of students from the developing countries and I really appreciate his support.

I would like to seize this opportunity to thank all the Canadians for their financial support channeled through the Canadian International Development Agency (CIDA). Without this support for my studies, a doctorate degree at McGill University would have stayed a dream.
At the home front, I would like to thank my loving and caring parents, Mr. James Olawuwo Adedeji and Mrs. Moteleola Adedeji. My uncle Mr. Olajire Adedeji and his wife Mrs. Areoye Adedeji were also always there for me. My mother-in-law, Ms.Chima Wogu, has shown me that love has no boundaries. She has been more than a mother-in-law to me, she too is my mum. My sister Mrs. Funmilayo and her husband Mr. Bayo Aderinto also deserve my appreciation. My brothers, Bamiji, Tayo, Kayode and Seun Adedeji have always been helpful, loving and supportive -- and made me realize that there was no alternative to finishing my thesis. Omoruyi Obaseki has been a good friend. He also provided me with a conducive atmosphere during my visit to Montreal to complete my thesis.

I came across a number of people that I can regard as my academic fans: they always believed in me. In this regard, I would like to thank Prof. Ademola Ariyo, Prof Modupe Onadeko, Prof. Ajayi, Dr. Tayo Fadiran and Mr. Kunmi Fadiran.

I thank the Almighty God, the Alpha and Omega, who took me from ground zero to a level that surpasses my imagination. His promise stands “Even though your beginning may seem humble, so prosperous will your future be”.

The maxim is still true: ‘behind every successful man is a great woman’. Completing my thesis involved depriving my family of precious time; it even involved taking my laptop to our honeymoon. Without reservations, I dedicate this dissertation to my loving, caring and affectionate wife, Theodora Adedeji.
Dedicated to my wife, Theodora
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CHAPTER 1

INTRODUCTION

The Nigerian economy since independence in 1960 has been characterized by recurrent current account deficits and continual increase in external debt. The ratio of the external debt to GDP was 10% in 1970, reached 110% in 1986 and stood at approximately 71% in 1997. The recurring current account deficits coupled with the evolution of external debt generate interest in examining the excessiveness and sustainability of the Nigerian external imbalances. This examination requires a formal model that gives the optimal current account balance, which can then be compared with the actual one. In an attempt to assess the excessiveness of the Nigerian current account balance, this thesis focuses on the present value model of the current account, which gives an optimal current account balance.

The present value model of the current account (PVMCA) is an intertemporal approach that treats the current account as a buffer for smoothing consumption in the face of shocks affecting, output, investment and government expenditures. This approach to current account determination has its origin in Campbell and Shiller's (1987) seminal work on the relationship between current saving and the expected change in labor income. In current account modeling, the current account serves as saving, and the expected change in the net output (GDP minus investment minus government expenditure) acts as the expected change in labor income.
The standard PVMCA assumes that the home country and the rest of the world produce goods that are physically identical (so that there is no direct role for the terms of trade); assumes a constant real interest rate (so that there is no role for consumption tilting effects); and assumes no transport costs, deeming that all goods are tradable across countries (so that it excludes nontradable goods and a role for movements in the real exchange rate). These assumptions have limited the empirical success of the standard PVMCA.

Two findings of the standard PVMCA generated our interest in extending it. First, many studies have found the actual current account to be more volatile than the optimal. Second, the statistical restrictions implied by these models have been rejected for a considerable number of countries. Given the available mixed results, Otto (1992), Milbourne and Otto (1992), Sheffrin and Woo (1990), among others opined that, for a small open economy, the current account might be more affected by temporary changes in the resource prices. Thus, it is imperative to relax the assumption of a single good and allow for a distinction between tradable and nontradable goods.

The thesis integrates changes in the interest rate, exchange rates and terms of trade. Changes in the terms of trade are considered important for the Nigerian economy. A change in the terms of trade impacts on the current account through a number of channels. The first channel is the income effect. An unanticipated deterioration in the terms of trade, with a constant consumption level, reduces current income below its permanent level; this tends to produce deterioration in the current account balance. The increase in the current prices of importables relative to
the future prices induces agents to tilt consumption towards the future, thereby reducing current consumption. Moreover, deterioration in the terms of trade affects the current account through changes in the exchange rate. The deterioration in the terms of trade induces domestic economic agents to increase their relative demand for non-tradables, leading to an increase in the relative price of nontradables (exchange rate appreciation), with consequent negative impact on the current account balance. To reflect on possible relationships between changes in the terms of trade and exchange rates and the overall impact on the current account, an interest rate that captures expected changes in both terms of trade and exchange rates is used by this thesis. We refer to this as consumption-based interest rate. This model is then extended to accommodate possible restrictions on access to the international financial markets. Moreover, we take into account the oil price shocks of 1973 and the introduction of the Structural Adjustment Program (SAP) in 1986.

In terms of theoretical contribution, this is the first attempt at incorporating the terms of trade in a present value model of the current account, as well as accommodating possible asymmetry in access to the international financial market. Within the context of the Nigerian economy, this thesis is the first attempt at estimating a PVMCA that includes changes in interest rate, exchange rate and at the same time accommodates the oil price shocks of 1973 and the SAP of 1986.

We find that the intertemporal approach constitutes an appropriate approach for examining the current account. This position is based on the following results:

- The optimal and actual current account balances are found to be stationary variables.
• The statistical restrictions implied by the PVMCA are not rejected when changes in the interest rate, exchange rate and terms of trade are considered.

• The optimal current accounts derived from the PVMCA are able to capture the evolution of the actual current account balance.

• Nonetheless, the actual current account is more volatile than the optimal, indicating that speculative factors are a major driving force behind capital flows.

• We find that the introduction of the Structural adjustment program did not alter the relationship between the change in net output and the current account, though the post-oil-price-shock periods were marked by a relatively greater response of the current account to expected changes in the net output.

After empirical implementation of the PVMCA, we conduct an empirical analysis of the model of current account determination, based on traditional approaches (the elasticity, absorption and monetary approaches). To reflect the distinct features of the Nigerian economy, we account for the oil price shock of 1973 and the introduction of Structural Adjustment Program in 1986. Despite the fact that this approach has been used to investigate the determinants of current account in Nigeria, the thesis has a number of new contributions. First, the thesis covers a longer data span of any studies on current account determination in Nigeria. Second, the time series of the relevant variables are examined for stationarity, before applying the OLS to the relevant equation. The results from estimating this
basic model of current account determination point to changes in world real interest rates, exchange rates, terms of trade and fiscal balances as important determinants of the current account.

Moreover, we assess the sustainability of the current account balance by examining the macroeconomic variables that reflect the structure of the Nigerian economy, the policy stance of the government and political economy factors. With an estimated PVMCA, the thesis moves ahead to assess the excessiveness of the Nigerian current account balances during the period 1960-97. The issue of excessiveness is addressed by comparing the actual current account balances with the optimal current account balances.

This thesis appears to be the first in-depth country analysis for any sub-Saharan African country using the concepts of excessiveness and sustainability. Our findings on this were:

- The use of various macroeconomic indicators to assess the sustainability of the Nigerian current account deficits reveals a key insight. An assessment of the sustainability of external imbalances must be based on a wide range of relevant macroeconomic indicators. Current account deficits associated with exchange rate appreciation and fiscal deficits appear not to be sustainable. When associated with low savings, a high concentration of exports in a particular commodity, lower economic growth, growing external debt, high debt servicing, inadequate foreign exchange reserves and political instability, current account deficits can degenerate into an external crisis.
• In the period before 1986, especially 1981–83, the current account balances were persistently excessive. The strict trade and exchange-policy measures curbed this trend during 1984–85. However, the unsustainability of such policy measures was reflected in dramatic widening of the gap between optimal and actual current account balance in 1986.

• For most of these years, the optimal current account deficits in the absence of unrestricted access to the international financial market were greater than those with unrestricted access. This suggests that, in the face of unexpected shocks, the economic agents in Nigeria might not be able to use the international financial markets to the extent they wanted.

The thesis is organized as follows:

Chapter 2 describes the evolution of the Nigerian economy during the period 1960-97, focusing on the relevant macroeconomic variables. It discusses relevant concepts, such as solvency, excessiveness and sustainability encountered in the subsequent chapters.

Chapter 3 reviews the theoretical and empirical literature on the current account. This review emphasizes the PVMCA, its insights for examining the current account and the existing empirical findings. In this chapter, we examine the applicability of the intertemporal model of the current account to the Nigerian economy, and review the existing empirical literature on current account determination in Nigeria.

Chapter 4 focuses on various variants of the theoretical framework of the PVMCA. This chapter develops the general theoretical framework for analyzing the current account balance in the intertemporal context.
Empirical investigations of the various versions of the PVMCA are carried out in Chapter 5. The focus of this chapter is to assess the relevance of the PVMCA in the context of the Nigerian economy. Chapter 6 deals with the issue of excessiveness and sustainability of current account deficits. First, we investigate a simple model of current account determination to see how the intertemporal framework changes our understanding of the relevant determinants of the current account. Second, we use macroeconomic and structural indicators and a condition that recognizes that a constant external debt to GDP ratio is a measure of sustainability of external imbalances. We then use the PVMCA framework to assess the excessiveness of the Nigerian current account deficits during the period covered by this thesis. Chapter 7 summarizes and concludes the thesis.
CHAPTER 2
AN OVERVIEW OF THE NIGERIAN ECONOMY AND THE
RELEVANT CONCEPTS

2.1 Introduction

This chapter has two main objectives. The first is to provide stylized facts on the Nigerian economy during the 1960-97 period covered by this dissertation. This is important for two main reasons. First, it permits an understanding of the need to extend the basic intertemporal model of the current account to reflect changes in the exchange rate and the terms of trade. Second, a crucial issue addressed in this thesis is the sustainability of the Nigerian current account deficits. An understanding of the structure of the Nigerian economy is relevant to seeing the appropriateness of the macroeconomic variables chosen to achieve this. The second objective of this chapter is to discuss relevant concepts that are explored in more detail in chapters 4, 5 and 6¹.

Two sections follow this introduction. Section 2.2 provides information on the structure and evolution of the Nigerian economy. Section 2.3 reviews the evolution of the current account balance and other macroeconomic variables. The evolutions

¹ See Appendix I.
of these macroeconomic variables are used to characterize the occurrence of external crisis in Nigeria in 1986\(^2\).

2.2 Overview of the Nigerian Economy (1960-97)

This section provides background information on the Nigerian economy during the period 1960-97. Broadly, we divide the analysis into four major periods. The first period is 1960-73. It covers the period from the year of independence up to the first oil prices shock in 1973. The second period, 1974-80, covers the period after the first oil price shock and before the emergence of serious economic recessions. The third period, 1981 to 1986, includes various austerity measures implemented by the Nigerian government prior to the adoption of the Structural Adjustment Program. The period thereafter, 1987-97, marked the post-Structural Adjustment Program era.

2.2.1 The Agricultural Sector

Before the dominance of the oil sector in the 1970s, the agricultural sector was the mainstay of the Nigerian economy. As of 1960, agriculture’s share of total value added was 64% (Appendix II) and constituted the major source of foreign exchange earnings. The development of the oil sector marked a deterioration in the importance of the agricultural sector: its share of total output declined to 34% by

\(^2\) Chapter 6 conducts a more extensive examination of the external position of the Nigerian economy.
1997. Agriculture, combined with other non-oil exports, contributed about 2% of the foreign exchange earnings in the 1990s.

The decline in the performance of the agricultural sector can be analyzed from two perspectives. First, the decline can be perceived as a natural phenomenon, part of the developmental process. As an economy moves from one stage of development to another, the agricultural sector is expected to become less important as other sectors and GDP grow at faster rates.

Second, the decline may be the consequence of a macroeconomic policy that discriminates against the agricultural sector. There is evidence that points strongly to this hypothesis. A number of factors have been identified as responsible for the poor agricultural performance: the failure of the commodity boards\textsuperscript{3} to ensure consistency between set prices, domestic costs and international prices; the widening gap between the retail food prices and stagnant producer prices that engendered further transfer of resources from the agricultural sector to other sectors, especially the service sector; the use of a fixed exchange rate before 1986 that culminated in real exchange rate appreciation.

The following review of the emergence of the oil sector provides additional support to the hypothesis that the decline in the importance of the Nigerian agricultural sector may indeed have been a consequence of a macroeconomic policy that discriminated against the agricultural sector.

\textsuperscript{3} This is the board responsible for fixing the prices of agricultural export products. The idea behind this is to prevent farmers from being vulnerable to changes in agricultural export products in the international markets.
2.2.2 External Shocks and Policy Responses (1973-81)

The development of the oil industry in the early 1970s transformed Nigeria from an agrarian economy to an oil-based economy. Oil's share of total output was 12% in 1970, increased to 33% by 1974 and further increased to 39% by 1997 (Appendix II). The share of oil in total federally collected revenues increased from 26% in 1970 to 60% by 1973, reached a peak of 82% by 1974 and stood at 72% by 1997. In terms of foreign exchange earnings, the oil share of total exports was 58% in 1970, 83% by 1973, 93% by 1974 and further increased to 98% by 1997.

The dominance of the oil sector in the 1970s and 1980s reflected significant increases in oil prices during the 1973-74 and 1979-80 periods. Commensurate with increases in the oil prices, both government and private consumption expenditures increased tremendously. Expanded government resources were transferred to the private sector through wage increases in the public sector\(^4\). The increased salary of the public sector workers resulted in the private sector worker's demands for salary increases. The increase in aggregate demand arising from the upward movement in the public sector salaries combined with increases in the cost of production associated with increases in the private sector salaries led to an increase in the general level of prices. With a fixed exchange rate regime and in the face of increases in domestic prices, the real exchange rate appreciated. This, in turn,

\(^4\) The "Udojie" award of 1975 increased salaries by over 100% in the government sector.
further increased the aggregate demand in the economy and had a consequent negative impact on the current account balance.

2.2.3 The Adverse Oil Prices Shocks and the Policy Response (1982-86)

Given the Nigerian economy’s excessive dependence on petroleum export earnings, the fall in world oil prices in 1982 had a negative impact. The Nigerian economy is heavily dependent on imports of manufactured and intermediate goods, and import demand could not adjust quickly enough to declining foreign exchange receipts. To facilitate importation of these goods, the government set real exchange rates at unsustainable appreciated levels and engaged in some short and medium term borrowing, creating an increase in debt service obligations.

This policy response resulted in current account and balance of payments deficits, reduced foreign exchange reserves and an increase in external debt obligation. In response, the government put trade and exchange controls in place.

This policy of exchange controls and restrictions aimed at reducing the outflow of foreign exchange was inadequate in dealing with the current account deficit problems. The nature of exchange control administration created uncertainties among private investors that reduced incentives for private investment and encouraged corruption, rent-seeking activities, and smuggling. In addition to the impediments to trade, the nature of the exchange control mechanism introduced distortions into the economy that greatly affected its overall performance. In order to correct the level of absorption in the economy, the government introduced a number of austerity measures.
2.2.4 Austerity Measures and the Structural Adjustment Program

To deal with the economic problems the country was encountering, the government introduced the Economic Stabilization Act in 1982. The National Economic Emergency Act followed in 1985. Both acts focused on reducing the levels of aggregate absorption in the economy. However, these acts failed to address macroeconomic and structural problems facing the economy: the appreciated real exchange rate, the unsustainable size of the government, the over-dependence on the oil sector, and a host of other structural problems.

The government, therefore, introduced the Structural Adjustment Program (SAP) in 1986. The SAP emphasized six major policy measures: restructuring and diversifying of the productive base of the economy to reduce dependence on the oil sector and on imports; deregulation of the exchange rate; trade liberalization; deregulation of the financial sector; rationalization and privatization of public sector enterprises; and adoption of appropriate pricing policies (by eliminating subsidies), especially for petroleum products and in public enterprises. Given the policy measures introduced in 1986, it is a reasonable conclusion that 1986 was a crisis year.

Our overview of the Nigerian economy has revealed its sensitivity to external shocks, especially terms of trade shocks. The absence of a market-determined exchange rate before 1986 resulted in real exchange rate appreciation with resultant deterioration in the current account balance. It is therefore of utmost importance that any model of current account designed for Nigeria takes these variables into consideration.
In the following section, in line with the economic literature on the sustainability of the current account deficits⁵, we have chosen 1986 as the crisis year, when the Nigerian Naira massively depreciated from N1: US$1 in 1985 to N4: US$1 in 1986. This choice is further supported by the fact that, in 1986, Nigeria was unable to service its existing debt obligations and, recognizing the need for a policy reversal in order to reduce external imbalances, introduced economic reforms.

2.3.1 The Current Account Balance

In assessing the external position of a country, attention is usually paid to the current account balance. The change in the net foreign assets position of a country depends on the current account balance. As noted by McGettigan (1999), it is difficult to separate current account sustainability from external sustainability in a broader sense; consequently the terms “current account sustainability” and “external sustainability” are often used interchangeably. Hence, an external crisis may have its foundation in current account imbalances. In support of this proposition, Nyatepe-Coo (1993)⁶ found that current account deficits assumed greater importance as the proximate source of debt build-up in Nigeria, accounting for 63% of the accumulated change in the external debt during the period 1981-89.

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⁶This paper identified three major contributory factors to debt build-up: current account deficits, net capital outflows and capital flight.
Nigeria's current account balance has shown remarkable changes over time (Figure 2.1). The annual average of the current account balance as a ratio of GDP was about -5% during the period 1960-73. It ranged from -7.3% in 1966 to 0.5% in 1973.

The period 1974–80 marked a turn in the evolution of the current account balance. There were current account surpluses in 1974, 1979 and 1980, reflecting substantial increases in the crude oil prices. The current account balance showed an annual average surplus of almost 2 percent of GDP. For this period, the current account balance ranged from -7 percent in 1978 to 17 percent in 1974.

During 1981–83, the current account balance was consistently negative, standing at an annual average of 8 percent of GDP. The following two years marked current account surpluses to the magnitude of 1 percent, partly reflecting the tightening of the trade controls during the same period. The annual average of the current account deficit over the period 1981–85 was approximately 5 percent of GDP.

During the period 1986–88, the current account maintained a negative trend, with the exception of 1986. However, the following four years, 1989–92, marked current account surpluses, followed by current account deficits up to 1995. From 1996 to 1997, current account balances were positive.

The behavior of the Nigerian current account was sensitive to developments in the world oil market, even after the introduction of the economic reforms in 1986. Among other factors, this sensitivity reflects the non-diversification of the economic base.
2.3.2 The Size Of External Debt

The ability of a country to sustain current account deficits is negatively affected by its stock of international liabilities. An existing large burden of external debt may reduce the willingness of the foreign economy to continue financing the current account deficit of the country concerned, as expectations mount up that the country may default on its existing external obligations. Moreover, a large debt-servicing burden can easily exhaust export revenues and prevent imports of investment goods that are needed for growth. In such a case, the debt burden can create a trap that inhibits any growth policies.

The external debt to GDP ratio showed an increasing trend over most of the period covered (Figure 2.2). It increased from approximately 10% during 1970-73 and 1974-80 to 55% during 1981-86 and 116% over the period 1987-1997. This increase, associated with current account deficits, especially during 1981-83, could explain the emergence of the external crisis in 1986.
2.3.3 The Real Exchange Rate

When a country’s real exchange rate is overvalued beyond a certain threshold level, or above an historical average, and this overvaluation is associated with current account deficits, there is a presumption that such deficits are not sustainable. Real appreciation of the currency could lead to a loss of

---

7 Data availability reduced the analysis of exchange rate movements to the period 1981-97. An increase in the real effective exchange rate in Figure 2.2 represents an appreciation and a decrease represents a depreciation.

8 It is important to distinguish between various types of real exchange rate appreciation. Real appreciation that emanates from a pegged exchange rate regime combined with inflation inertia is detrimental to the external position of the economy. On the other hand, a stabilization policy that results in the inflow of foreign direct investment and other capital inflows can generate exchange rate appreciation. Such real appreciation may also be associated with larger current account deficits, but this may be a good development reflecting increased imports of capital or intermediate goods, rather than any fundamental problem. The former form of appreciation calls for a possible devaluation in the future, while the latter may reflect an appreciation of the equilibrium exchange rate.
competitiveness and increase in the consumption of imported goods, which, in turn, would result in a worsening of the current account balance. In order to remove the imbalance associated with such an appreciation, it is mandatory that the government devalues the currency of the country.

There is evidence of real exchange rate appreciation in Nigeria before the introduction of economic reforms in 1986. For the period 1981-85, the annual average appreciation of the real effective exchange rate was 14% (see Figure 2.3 for the evolution of the real effective exchange rate). The current account deficits over the period 1981-85 were not sustainable as they were associated with real exchange rate appreciation. In order to ensure a sustainable current account position, the government had to devalue the currency towards the end of 1986.

The introduction of economic reforms in 1986 produced a significant depreciation of the real effective exchange rate. During 1986-97, the real effective exchange rate depreciated by 12%. At the same time, the current account surplus was 1% of GDP.

Figure 2.3

Real Effective Exchange Rate (1995=100)
2.3.4 Economic Growth Rate

The higher a country's GDP growth rate, the greater the current account imbalance that it can sustain without increasing its external debt-to-GDP ratio\(^9\). Also, high (actual and expected) GDP growth may reflect sustained capital accumulation rates driven by expectations of high profitability. Current account deficits that are associated with higher economic performance can be considered to be sustainable.

The annual average growth rate of GDP was 5% during the period 1960-73, pointing to the sustainability of current account deficits experienced over the same period. However, the growth rate declined to 4% during 1974-80 and the economy witnessed an annual average negative growth rate of 2% over the period 1981-85.

Thus, prior to the structural adjustment reforms introduced in 1986, the economy experienced a substantial decline in the rate of growth. This declining trend in growth points to a reduction in the capacity of the country to sustain persistent current account deficits and consequently, the need to introduce economic reforms to remove external imbalances. Figure 2.4 shows the real growth rate of the Nigerian economy during the period 1960-97.

\(^9\) Section 6.7 in Chapter 6 demonstrates this postulation and uses the Nigerian data to validate it.
2.3.5 Fiscal Deficits

A given current account deficit may emanate from either a public savings-investment balance or a private savings-investment balance or a combination of the two. The linkage between fiscal positions and current account can be established through an equilibrium condition in the goods market that defines the current account balance as:

\[ CA_t = S_t - I_t = \left(S_g - I_g\right) - \left(S_{pv} - I_{pv}\right) \]  

(2.1)

where: \( CA_t \) is the current account balance; \( S_t \) is the aggregate savings, \( I_t \) is the total investment in the economy; \( S_g \) is the government savings; \( I_g \) is the government investment; \( S_{pv} \) is the private investment; and \( I_{pv} \) is the private investment.

If private sector external liabilities are not guaranteed by the government (if they are, private debts become public debt) and the private economic agents base their savings decisions on accurate forecast of relevant economic variables, such as...
expected permanent income (If not, an overly optimistic expected income can result in a current consumption level that is not sustainable), a current account deficit arising from a private saving-investment balance is considered to be more sustainable than the one arising from a public savings-investment balance.

This assumption reflects the fact that fiscal deficits may induce excessive monetary growth, generating the possibility of speculative attacks, especially under a fixed exchange rate regime. If foreign investors suspect that the government will be unwilling or unable to service its external obligation at some stage in the future, this could lead to the cessation of private capital inflows and the withdrawal of the pre-existing short-term foreign investments, culminating in an external crisis.

Government fiscal balances were in deficit in most of the years considered by this study. Over the period 1961-73, the government deficit was 2.4% of GDP (Figure 2.5). The stage of development of the Nigerian economy, and the market expectations that the civil war was a temporary phenomenon and that the economy had the potential for higher growth, prevented an external crisis resulting from current account deficits associated with fiscal deficits.

During the period 1974-81, the dramatic increase in the government revenues from oil exports was reflected in a reduction in fiscal deficits to 0.85 of GDP. Any deficits during such periods are more sustainable since they come from the saving-investment balance of the private sector. Thereafter, the fiscal deficit as a ratio of

---

10 Current account deficits arising from fiscal deficits can lead to external crisis. This would be the case if the government deficits arose from low revenue tax base and unproductive investment and unsustainable consumption levels.
GDP was 7.5% during the 1982-86 period and 6.2% over the period 1987-97. As indicated earlier, current account deficits arising from government savings-investment balances could generate anticipation of higher future tax liabilities. This expectation could lead to a reduction in capital inflows and hinder the ability of the government to sustain such deficits, possibly resulting in an external crisis.

Based on this indicator, the sustainability of current account deficits is sensitive to the behavior of the fiscal balance. Fiscal deficits (emanating from high levels of government consumption expenditure) that lead to current account deficits with resultant debt accumulation hinder the ability of the government to service its debt in the future. Rational foreign investors would tend to withdraw their capital from the country. Also, an environment of current high levels of debt discourages investment as investors anticipate that higher levels of taxes will have to be imposed in the future in order to service the current high levels of debt. Therefore, fiscal indicators constitute relevant variables for predicting the possibility of occurrence of external crisis.
2.3.6 Adequacy of Foreign Exchange Reserves

A lower reserve, in a fixed exchange rate regime, indicates a reduction in the ability of a monetary authority to maintain the administratively fixed exchange rate in the event of a shock that calls for exchange rate depreciation. Economic agents, realizing the weak position of the monetary authority in defending the existing exchange rate, are prone to attack the currency, resulting in eventual currency devaluation [Krugman (1979)].

The conventional approach is to express international reserves in months of imports. However, when capital is highly mobile, this may not necessarily be the most suitable measure of reserve adequacy. An outflow of existing capital puts pressure on the exchange rate and further increases the needs to expand the foreign exchange reserves. Moreover, if reserves are low relative to short term debt servicing (irrespective of the fact that they may be sufficient to cover imports), the country may still experience an external crisis. Also, in periods of uncertainty, there are tendencies to convert liquid liabilities into foreign exchange. This puts pressure
on foreign exchange reserves and increases the need to augment reserves. To capture this scenario, an alternative to the international reserves expressed in months of imports is the ratio of M2 to international reserves. This is to capture the fact that M2, which contains currency and demand plus savings deposits, is one proxy for the potential liabilities that domestic agents may wish to convert into foreign exchange in times of uncertainty.

Foreign exchange reserves in months of imports were 7 months over the period 1960-73; therefore, the financing of current account deficits was not a serious problem, since they were only about 2% of GDP during the same period. The foreign exchange reserves in months of imports increased to 9 months during the period 1974-80. However, they showed a downward turn, decreasing to 2 months of imports in the course of 1981-86 and remained constant at about an average of 2 months in the following period (1987-97). Figure 2.6 shows the evolution of international reserves in months of imports below.
This indicator points to the unsustainability of current account deficits over the period 1981-86 and, therefore, explains the introduction of economic reforms in 1986 that were associated with a depreciation of the exchange rate. Using the ratio of M2 to international reserves as shown in Figure 2.7 does not change this conclusion.

This chapter has reviewed the evolution of the Nigerian economy during the period 1960-97 and used the evolution of a number of macroeconomic indicators such as the current balance position, the size of external debt, the real exchange
rate, the economic growth rate, fiscal deficits and adequacy of foreign exchange reserves to examine the external position of the Nigerian economy. These variables point to the unsustainability of the Nigerian current account deficits in the period preceding the external crisis of 1986.
Appendix I

Intertemporal Solvency

Solvency deals with the ability of a country to generate sufficient net export surpluses (inclusive of services) in the future in order to repay the existing foreign liabilities. Milesi-Ferretti and Razin (1996) identified the inherent weaknesses of using this criterion to assess the external position of an economy. First, since current account balances reflect interactions among the savings and investment decisions of government, the domestic private sector and foreign investors, and since predicting the savings and investment behaviors of these three agents is quite problematic, there exists uncertainty in forecasting the ability of a country to generate sufficient future trade surpluses to repay the current debt obligations. Second, solvency does not distinguish between the ability and the willingness to pay and lend. From a theoretical perspective, though a country may be able to pay its current debt, it may not be politically feasible to divert a large amount of national output to debt servicing. Also, the lenders may not be willing to continue lending to an indebted country given the possibility of default.

Sustainability

The notion of sustainability goes somewhat beyond solvency. It poses the question: can current-account imbalances be sustained under the current policy (with government intertemporal budget constraints satisfied) without requiring a substantial change, or will they lead to a "crisis"? If the answer is in the affirmative, the imbalance is sustainable. Therefore, the concept of sustainability imposes
constraints on the current account imbalances in addition to those imposed by pure intertemporal solvency. We should note the inherent weaknesses of using macroeconomic indicators to assess the external position of a country. First, it is non-structural and, as a result, cannot be used to quantitatively assess the relative forecasting power of these indicators. Second, the indicators for assessing external imbalances could possibly lose their value to predict external crises once market participants and governments begin to incorporate them into their decision-making processes. In this chapter and 6, macroeconomic and structural indicators are used to complement the results observed from the intertemporal model to assess the excessiveness of the Nigerian current account deficits.

**Excessiveness**

The concept of excessive current account deficits expresses the deviation of the actual current account balance from an optimal or benchmark current account. The difference between the actual and optimal balance can be used to examine how close a given path of current account imbalances may be to unsustainability.

Examining the excessiveness of recurring or persistent current account deficits requires a formal model. The intertemporal models of the current account can be used for this purpose. These models in their simplest forms derive their conclusions from consumption-smoothing behavior. They imply that unanticipated temporary declines in output in a small open economy will produce a deterioration in the current account balance.
The assumptions used to derive the optimal current account balance are fundamental in determining the excessive current account balance. Assumptions behind the derivation of the optimal balance include: unrestricted access to the international capital markets and consumption depending on permanent income. These assumptions impact upon the derivation of the optimal current account.

**External Crisis**

Assessing the solvency, sustainability and excessiveness of the external position of a country is a means to an end, not an end in itself. There are several reasons for using these three criteria to determine the external position of a country. One of these is to determine whether the economy under consideration is likely to experience external crisis or not. The notion of external crisis employed in the present analysis could take the form of an exchange rate crisis [Frankel and Rose (1996)], an exchange rate crisis combined with a loss of reserves by the monetary authorities [Kaminsky, Lizondo and Reinhart (1998)] or a foreign debt crisis\textsuperscript{11}. A debt crisis might arise from an inability to obtain further international financing or to meet repayments, or from an actual default on debt obligations. A sustainable current account deficit is, therefore one that can be sustained without experiencing any of these forms of external sector crises.

\textsuperscript{11} Frankel and Rose (1996) define a currency crash as a nominal exchange rate depreciation of at least 25%. Kaminsky, Lizondo, and Reinhart (1998), on the other hand perceive a currency crisis as a situation where a weighted average of monthly percentage change depreciations in the exchange rate and monthly percentage declines in reserves exceeds its mean by more than three standard deviations.
## Appendix II
### The Structure of Production (1960-97)
(in percentage)

<table>
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<tr>
<th>Year</th>
<th>Agriculture</th>
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<th>Construction</th>
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Source: Adapted from Oshikoya (1988); 1960-86
Central Bank of Nigeria, Statistical Bulletin (1998); 1987-97
CHAPTER 3
THE INTERTEMPORAL MODEL OF THE CURRENT ACCOUNT:
AN INTRODUCTION

3.1 Introduction

This chapter presents an introduction to the present value model of the current account (PVMCA). This chapter has six main sections. Section 3.2 is a review of the literature on the earlier versions of the intertemporal approach to modeling the current account. Section 3.3 deals with empirical investigations of these earlier theoretical intertemporal models of the current account. The empirical results from estimating the PVMCA are reviewed in section 3.4. Section 3.5 examines the assumptions of the intertemporal models of the current account and their applicability to the Nigerian economy. Section 3.6 concludes the chapter with a review of the existing literature on current account determination in Nigeria.

3.2 The Seminal Works on the Intertemporal Model of the Current Account

Intertemporal analyses of the current account became an active area of research in the early 1980s. These models of current account determination are based upon the permanent-income or life cycle hypothesis. Earlier theoretical intertemporal approaches to current account determination can be broadly divided into four groups.
The first group focused on establishing the major factors underlying international capital flows [Buiter (1981), Obstfeld (1986), Stockman and Svensson (1987)]. These studies postulated that countries' differing preferences are the major factor underlying international capital flows. Thus consumption tilting, which depends upon, among other factors, the difference between the subjective discount factor and the world interest rate, can be important in explaining the behavior of the current account. The desire to smooth consumption can also be an explanatory variable that must be taken into consideration in modeling the current account.

The second group emphasized the impact of changes in the terms of trade on the current account [Obstfeld (1982), Svensson and Razin (1983), Persson and Svensson (1985)]. The major conclusion of these studies is that the responsiveness of the current account balance to changes in the terms of trade depends on whether such changes are anticipated or not and whether they are temporary or permanent. This indicates that terms of trade changes need to be incorporated into modeling of the current account.

The third group examined the impact on the current account of temporary and permanent changes in government expenditures [Sachs (1982)]. According to Sachs, when agents face an intertemporal budget constraint, a decision to alter current indebtedness implies changes in future consumption possibilities and such change will be based on expectations of the entire future path of key variables and current variables. Using a continuous time model, he showed that temporary and permanent shocks to government expenditures have different impacts on the current account. Temporary disturbances affect the current account balance through their
impact on the optimal intertemporal consumption path of households. This is not the case with permanent changes.

The fourth group used an intertemporal framework to examine the optimal time path of consumption and external borrowing [Dornbusch (1983), Hercowitz (1986)]. These studies provided a framework that used the current account balance as an input into the derivation of the optimal time profile of external liabilities.

These studies served as theoretical foundations for earlier studies on empirical investigations of the intertemporal models of the current account. Literatures on earlier empirical analysis of these models are reviewed in the next section.

3.3 Early Tests of Intertemporal Current Account Models

Most structural time-series studies of the intertemporal approach to the current account essentially test implications of (3.1). Based on this equation, the current account depends on deviations of output, government spending, and investment from their permanent levels when the subjective discount factor equals the world market interest rate.

\[ \text{CA}_t = (Y_t - \bar{Y}_t) - (G_t - \bar{G}_t) - (I_t - \bar{I}_t) \]  

(3.1)

---

1 The derivation of (3.1) is presented in Chapter 4.
$Y_t$, $G_t$ and $I_t$ represent output, government expenditures, and investment respectively. The $\sim$ on a variable represents its permanent value. The central implication of the intertemporal approach is embodied in (3.1).

The econometric tests of the implication of (3.1) were mainly conducted for developed countries. Early econometric tests of the intertemporal approach, as represented by this equation, include those by Ahmed (1986), Johnson (1986) and Roubini (1988). Their major focus was to examine the relative impact on the current account of temporary and permanent changes in government expenditures. Based on the intertemporal approach, a one-unit permanent increase in government expenditures produces an associated one-unit permanent reduction in private consumption, but no effect on the current account. However, given consumption smoothing, a temporary change in government consumption has no impact on private consumption and therefore affects the current account significantly.

These studies shared a common econometric methodology: instrumental variables and non-linear estimation. Despite some differences in tests of the life-cycle hypothesis for the current account as noted by Otto (1992), they all found some support for at least some of the predictions of this model.

Ahmed (1986) studied the determinants of the United Kingdom's trade balance for the period 1900 to 1980. He found that changes in temporary government spending had a larger impact on the balance of trade than permanent changes. However, the study had difficulty in breaking down actual government expenditures into temporary and permanent components.
Johnson (1986) focused on Canada over the 1952-76 period. The author used instrumental variable techniques suggested by Hayashi (1982). The paper identified consumption smoothing and the stance of fiscal policy as the major determinants of the current account.

Roubini (1988) used the OECD data set to examine the validity of the intertemporal approach. He derived a model of the current account that is based upon the joint assumptions of consumption smoothing by private agents and tax smoothing by the fiscal authority. By combining the two optimization problems, Roubini found a relationship between the current account on the one hand and the budget deficit, private investment and transitory change in output on the other. He concluded that empirical tests of the model for a sample of 18 OECD countries presented good evidence that international capital markets are widely integrated and that the “Feldstein-Horioka puzzle” might be explained by the important role of fiscal deficits in the determination of the current account and saving behavior. Budget deficits and investment shared one-to-one negative associations with current account balances in most of the countries considered.

In this thesis, along the line of Otto (1992), we focus on the implications of a present-value model, which links today’s current account to expected, future changes in an economy’s net output. This model in its simplest form derives its conclusions from consumption smoothing behavior. It implies that an unanticipated temporary fall in output in a small open economy will produce a deterioration in the current account balance. This approach has its origin in Campbell and Shiller’s (1987) seminal work on the relationship between current saving and expected
change in labor income. Campbell (1987) showed that the standard rational-expectations consumption function has the implication that consumers will 'save for a rainy day': saving will increase when there is expectation of a decline in future labor income. The extension of this framework to current account determination can be found in Sheffrin and Woo (1990), Milbourne and Otto (1992), and Otto (1992). The equation describing this idea is:

\[
CA_t = -\sum_{t=T}^{\infty} \left( \frac{1}{1+r^*} \right)^{t-t} E_t \Delta Q_t, \quad \Delta Q_t = Q_t - Q_{t-1}
\] (3.2)

CA_t is the current account balance in period t, r* represents the world interest rate, Q_t is the net output (that is, the difference between gross domestic output, gross investment and government expenditure), E_t is the expectations operator and \Delta represents the change operator.

This approach has a number of advantages over some of the previous procedures for testing the validity of the intertemporal model of the current account. First, this approach allows a consistent treatment of the data's time series properties [Otto (1992)]. A second advantage is that the structure of the PVMCA is such that the permanent change in a variable is assumed to be zero, so that the model is restricted to testing the effects of temporary changes in output, investment and government expenditure on the current account.

The next section focuses on empirical tests of the present value model of the current account.
3.4 Tests of the Present Value Model of the Current Account (PVMCA)

Testing the PVMCA involves the use of present value tests. This is an approach that fully utilizes the model's structure to derive testable hypotheses and make possible a consistent treatment of the data's time series properties. The simple present value model of the current account indicates that a country's current account deficit should be equal to the present value of the expected future increase in output, net of investment and government expenditures (this is the 'Present Value Model of the Current Account, PVMCA). A vector autoregression including the current account and output can be used to compute a forecast of this present value, based on the households' information set.

The implications of the PVMCA include: the stationarity of the optimal current account based on the stationarity of the change in net output; the equality between the optimal and actual current account. The implication of this theory—that the VAR forecast of this present value should be equal to the current account—can be tested using a Wald statistic, or by comparing the movements of the actual current account with those of the optimal current account. Below, we review various studies on developed and developing countries that used present value tests to assess the validity of the intertemporal model of the current account.

Sheffrin and Woo (1990) analyzed four countries (Belgium, Canada, Denmark and the United Kingdom) over the period 1955-85. Their findings were mixed. Net output was found to be a stationary variable only for the United Kingdom. In all cases, they found current accounts to be non-stationary variables. These results run
contrary to the implications of the PVMCA, viz, that the changes in the net output and current account are stationary variables. Based on the statistical restriction of the model, which implies the equality of the actual and optimal current account, they rejected this implication for all the countries with the exception of Belgium. Sheffrin and Woo compared the variances of the actual and optimal current accounts. They found that the volatility of the actual current account exceeded that of the optimal account. One suggestion made by Sheffrin and Woo for improving the performance of the PVMCA was relaxation of the assumption of a single good and to make a distinction, perhaps, between tradable and nontradable goods. This would make the real exchange rate an important variable in the model.

Milbourne and Otto (1992), using quarterly data on the Australian economy over the period 1959:3 to 1989:1, found that the Australian data were not consistent with the version of the permanent-income hypothesis used in their analysis. The model did not explain most of the larger sustained movements in the current account. The authors suggested introducing variable interest rates and relative prices (the terms of trade and exchange rates) into the PVMCA.

The objective of Otto's (1992) study was to examine the extent to which a model that is based solely upon "consumption-smoothing" by forward-looking rational agents can explain the actual time series behavior of the economy's current account. The study found that the version of the consumption-smoothing hypothesis that was adopted failed to provide a statistically adequate explanation of the dynamic behavior of the USA or Canadian current account. Using quarterly data for both countries, covering 1950-88, they strongly rejected the restrictions implied by
the present-value relationship for the current account. However, the use of unrestricted vector autoregression (VAR) showed a much closer relationship between the actual and forecast series for the USA than for Canada. Thus, the Canadian data provided virtually no support for the PVMCA. The author speculated that, for a small open economy like Canada, the current account may be more affected by temporary changes in the resource prices and terms of trade. Therefore, the interest rates and terms of trade needed to be included in the PVMCA.

Ghosh (1995) considered five major industrial countries (Canada, Japan, Germany, United Kingdom and United states) over the period 1960:1–1988:4 (1962:1–1968:4 in the case of Germany). He used a quadratic utility function and a one-good model. He found some support for the PVMCA. The implication of the present value model, that the optimal current account is a stationary variable, was rejected only for Germany. The second implication, that changes in current account should help predict future changes in net output, was satisfied only for the United States. Moreover, a formal statistical test of the model based on the use of the Wald test, was rejected, except for USA. However, the consumption-smoothing model of the current account performed extremely well in characterizing the direction and turning points of the current accounts of all five of the countries studied. As to the volatility of both the actual and predicted current account balances, there was no significant difference between them in the case of the United States, while the actual was greater than the optimal for the other four countries. One important conclusion was that the observed excess volatility of the actual current account, in relation to
the optimal, emanated from short-term capital flows due to speculation in the foreign exchange markets.

Makrydakis (1999), using annual data over the period 1950-99 for Greece, found that optimal consumption smoothing did not take place over the sample period, suggesting that the existing restrictions to the free flow of capital were binding. His econometric analysis showed that the consumption-smoothing model was capable of explaining all major cyclical movements in Greece’s current account but failed to account for the full magnitude of these fluctuations. Also, he found that the stock of net foreign liabilities had been set on an unsustainable path following the 1989/90 balance of payments crisis; there was, however, clear evidence that this tendency had been gradually reversed during the last couple of years.

Ghosh and Ostry (1995) made the first attempt at applying the present-value approach to developing countries. They found that, across a large sample of developing countries, the level and volatility of net capital movements predicted by their consumption-smoothing model closely paralleled those in the data. The empirical results obtained for a number of African countries called for reformulating the theoretical basis of the PVMCA. In the first instance, the study found for African countries that the current account did not Granger-cause expected change in the net output. Also, the study discovered that the parameter differed frequently from its theoretically predicted value. Moreover, in five cases the data rejected the joint test of the parameter restrictions implied by the model. In the cases in which the data did not reject the model (eight of thirteen), the parameters were imprecisely estimated.
As observed by Bergin and Sheffrin (2000), the results from empirical implementation of the PVMCA are mixed at best. While the simple intertemporal model has often been found to work fairly well for large countries, it ironically tends to fail for many small open economies for which the assumptions of the theory should be most appropriate. A likely explanation is that external shocks, which are not considered in the simplest form of the intertemporal model, strongly affect small economies. External shocks will generally affect the small open economy via movements in the interest rate and the exchange rate. Using quarterly observations over the period 1960-96 for Australia, Canada and the United Kingdom, this study found that including the interest rate and the exchange rate improved the fit of the PVMCA compared to that in earlier studies: the model's predictions better replicated the volatility of current account data and better explained historical episodes of current account imbalances.

In line with Ghosh and Ostry (1995), this thesis suggests an extension of the intertemporal framework for modeling the behavior of the current account in Nigeria. Analyzing the evolution of the current account requires a model that emphasizes the microeconomic underpinnings of decisions relating to savings and investments. Modeling the evolution of the current account in Nigeria must reflect movements in the exchange rate, which is a manifestation of the changing oil price and other macroeconomic indicators in the country. The changing terms of trade must be considered in modeling the behavior of the current account in Nigeria as well. When we take into consideration the political and macroeconomic experiences in Nigeria, we are forced to consider the fact that Nigeria may have limited access to the
international financial markets. Chapter 4 presents the theoretical foundation for the empirical investigations carried out in Chapter 5.

The following section deals with the main assumptions of the present value model of the current account and the relevance of such assumptions in the context of the Nigerian economy.

3.5. Assumptions of the Intertemporal Model of the Current Account and the Applicability of the Model to the Nigerian Economy

One of the assumptions of the intertemporal model of the current account is that current consumption depends on permanent income. The PVMCA also assumes unrestricted access to the international financial market, such that any negative shocks to current output, with permanent income unchanged, will not affect current consumption but result in the accumulation of external liabilities. The important question is: how do these assumptions fare in a developing economy such as Nigeria?

Surveys by Gersovitz (1988) and Deaton (1989) provide several explanations as to why household consumption behavior in developing countries may be quite different from that of the developed countries. First, the members of the household in developing countries engage in resource sharing. Resource sharing implies that there is no need to save for the retirement years. The older generation supports the younger one by lowering their consumption. When the younger generation becomes older, they depend on the younger members of the household for their consumption.
expenditure. Thus, the life-cycle model of consumption with the assumption of "hump" saving cannot explain consumption behavior of the household in most developing countries. Also, the household lives forever through resource transfers from one generation to another, so that the permanent income hypothesis may capture the actual experience in developing countries.

The second factor distinguishing the household consumption behavior of developed economies from that of the developed countries is the high volatility of income. This reflects the agrarian base of most developing countries and changes in the terms of trade. In the face of uncertainty in income, there is a greater impetus to save for precautionary reasons, since this sort of uncertainty cannot be diversified through aggregate resource pooling [(Deaton (1989), Grimard (1997)]. In addition, a typical household in developing countries is often liquidity-constrained. This means that when income is less than its permanent level, the household may not be able to borrow in order to maintain the same level of consumption.

The fact that the households may not be able to smooth consumption in the face of negative income shocks constitutes a limitation of the application of the rational-expectation permanent income consumption for Nigeria. The theoretical framework developed for current account determination in Nigeria accounts for this by allowing for possible asymmetry in access to the international financial market.

There are a number of other factors that favor the use of the permanent income hypothesis in an economy like Nigeria. A high number of households in Nigeria, as in many developing countries, operate at near-subsistence income levels. This may strengthen the need to smooth consumption over time, so that a
sudden increase in income, which is considered to be temporary, is likely to be saved.

In addition, Nigeria experienced a civil war over the 1967-70 period. This was a period of increasing real government expenditures due to the civil war. If these expenditures were viewed as a temporary phenomenon, one would expect deficits in the current account in the course of this war. The Nigerian economy thus constitutes a natural framework for examining the validity of one of the implications of the intertemporal model of the current account, that is, an unexpected temporary increase in government expenditure generates a current account deficit.

Moreover, Nigeria can be taken to be a small open economy. The export-GDP ratio increased from an annual average of 10% in the 1960s to 18% in the 1970s, 21% in the 1980s and 43% in the 1990s. Therefore, the theoretical model of a small open economy should be applicable to current account determination in Nigeria.

Recurrence current account deficits are another feature of the Nigerian economy. Also, the external debt showed an increasing trend. The recurring current account deficits combined with the evolution of external debt shows the need of a framework to assess the excessiveness of the current account balance. We can use the PVMCA for this purpose.

As noted by Mwau and Handa (1995), a major point of contention in the economic literature on the developing economies is the extent to which the economic behavior of the government and the private sector can be adequately studied through the use of neoclassical models based on the assumption of rational
optimizing agents. There are two choices available to a researcher working on a developing economy like Nigeria. The first choice is to work with a neoclassical framework and adjust it for the special features of developing economies. An alternative choice is to make use of a descriptive or \textit{ad hoc} theoretical framework that is specific to the developing country being studied. This carries the implication that the results obtained from such analysis are only country-specific and cannot be used as a basis for policy formulation in other developing economies. We choose the former approach; we apply the intertemporal model of the current account to Nigeria. However, we take into consideration variables such as the terms of trade and the real exchange rate. We also consider the fact that economic agents in Nigeria may have asymmetric access to international financial markets.

3.6 Empirical Studies on Nigeria and Characteristics of the Nigerian economy

Since the early 1960s, Nigerian scholars have addressed the problem of the balance of payments and the major determinants of one of its components, the current account balance. Examples of such studies include Olayide (1968), Osagie (1973), Ojo (1973), and Enunenwosu (1984), Fakiyesi and Umo (1995), Komolafe (1996), Egwaikhide (1997). These studies have their foundations in the traditional
approaches to the current account and balance of payments: the elasticity, monetary, and absorption approaches\(^2\).

The major findings of these studies include: the existence of long-run relationships among non-oil exports supply, real exchange rate and a domestic capacity variable; imports were found to share long-run relationships with the exchange rate, income and foreign exchange receipts. While these studies identified the major determinants of the current account balance, they were static in nature and did not specify the process governing expectation formation and did not use the intertemporal framework as the basis of their analyses. Moreover, they cannot be used to analyze issues such as the role of the current account in assessing the extent of effective capital inflow into a country, and the excessiveness of the current account deficits.

\(^2\) Chapter 6 provides detailed information on these traditional approaches to current account determination.
CHAPTER 4

THE PRESENT VALUE MODELS OF THE CURRENT ACCOUNT

4.1 Introduction

This chapter develops the general theoretical framework for analyzing the current account balance in an intertemporal environment. The major focus of each of the theoretical analyses presented in this chapter is to show the linkage between expected future changes in the economy's net output (gross domestic product less government and investment expenditures; all expressed in real terms) and the current account balance. Within the present value model of the current account (hereafter PVMCA), a country's current account position will be in deficit (surplus) whenever net output is expected to rise (fall) over time. This has the implication that in the presence of high capital mobility, the current account (which, from the balance of payments identity, is identical to capital flows inclusive of reserve changes) should serve as a buffer to smooth consumption when there are shocks to output, investment, or government expenditure [Ghosh and Ostry (1995)]. This perspective to current account determination resembles Campbell's (1987) position that, given the permanent-income hypothesis, household savings should equal the expected present value of future declines in household labor income.

This way of analyzing the current account has a number of implications, which are derived in this chapter. These include: the stationarity of the actual and optimal current accounts and the equality of the variances of both the actual and
optimal current accounts. The PVMCA, based on the last implication, provides us with an alternative framework for assessing the degree of effective capital inflows into the Nigerian economy. Furthermore, the theoretical framework provided in this chapter is useful for assessing the excessiveness of current account deficits.

This chapter is divided into five parts. Section 4.2 develops the standard PVMCA that has been used by Ghosh and Ostry (1995) to test the validity of this approach for the Nigerian economy and other developing economies. This is referred to in this text as the ‘Benchmark Theoretical Framework’. The Benchmark Theoretical Framework assumes one tradable good; as a result, there is no possibility of changes in the terms of trade and in the real exchange rate impacting upon the current account. The benchmark framework also excludes any possible asymmetry in access to international financial markets.

An extension of the Benchmark Theoretical Framework model in section 4.3 allows for tradable and nontradable goods. Hence, movements in the real exchange rate and the interest rate are allowed to impact upon the current account. As noted by Bergin and Sheffrin (2000), a small open economy may be strongly affected by external shocks. These external shocks generally affect such economy through changes in the interest rate and the exchange rate. By explicitly incorporating changes in these two variables, we are able to capture two main channels through

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1 Bergin and Sheffrin (2000) made the first attempt at incorporating changes in the interest and exchange rates in the PVMCA. However, this thesis will be the first attempt at empirical implementation of their theoretical framework for the Nigerian economy.
which external shocks are likely to affect the Nigerian economy, especially the current account.

Section 4.4 extends the PVMCA by incorporating the terms of trade into the framework developed in section 4.3 and represents a unique contribution of this thesis. This is the first attempt at incorporating changes in the terms of trade in a PVMCA. As noted by Khan and Knight (1983), Nyatepe-Coo (1994), and other studies, transitory shifts in the terms of trade are crucial for the current account. Consequently, there is a need to factor changes in terms of trade into the PVMCA. We focus on the impact of changes in the terms of trade on the consumption-based real interest rate, the consumption path and the current account.

Apart from incorporating changes in the terms of trade, another theoretical contribution of this thesis is the inclusion of asymmetry in access to the international financial market, after taking into consideration changes in the interest rate, exchange rate and terms of trade. To this end, the theoretical framework in section 4.4 is further extended in section 4.5 to accommodate asymmetry in access to the international financial market\(^2\). This asymmetry is postulated to emanate from political instability with consequent macroeconomic instability. Specifically, we assume that economic agents in Nigeria are constrained from responding to a temporary reduction in net output; that is, they are unable to fully access external financial markets so as to smooth consumption. However, they are able to fully

\(^2\) This is the first time that a PVMCA with changes in interest rate, exchange rate and terms of trade will account for possible asymmetry in access to international financial market. This thesis makes another contribution in postulating a simple and direct way for testing this asymmetry.
respond to a temporary increase in net output, that is, there are no restrictions on capital outflows to smooth consumption. This extension is necessary given that the three frameworks mentioned above assume unrestricted access to the international financial market.

Despite various modifications extensions to ensure that the theoretical framework reflects the features of the Nigerian economy, it must be mentioned that precautionary savings are not considered in this thesis. Most empirical analyses delving into precautionary saving behavior have assumed constant absolute risk aversion CARA. However, the CARA utility function, despite its analytical tractability, is plagued by several uninteresting properties (see Carroll and Samwick 1995; Handa 2000, pp.116). To avoid the problems associated with the use of the CARA utility function, others have used the constant relative risk aversion (CRRA) utility function. However, such studies have to assume one good: with more than one good, CRRA will not allow a closed form approximation relating changes in such goods to income uncertainty. In the current context, there are a number of interesting issues that we want to capture, such as the effects on the current account of changes in the interest rate, exchange rate, and terms of trade. To achieve this, we have to go beyond the assumption of one tradable good. Therefore, the exclusion of precautionary savings (which have the impact of generating higher savings in the face of high variability in income) constitutes one of the limitations of this thesis.
4.2 The Benchmark Theoretical Framework of the Present Value Model of the Current Account

4.2.1 Derivation of Optimal and Current Account

Consider a small open economy that can lend and borrow at a constant real world interest rate, \( r^* \), and produces a single tradable good, \( Y_t \). The representative agent is assumed to have rational expectations. The infinitely lived household has the expected intertemporal utility function given by:

\[
E_t U = E_t \left\{ \sum_{t=1}^{\infty} \beta^{t-1} [U(C_t)] \right\}, \quad U'(C_t) > 0 ; \quad U''(C_t) < 0 ; \quad 0 < \beta < 1 \quad (4.1)
\]

where \( \beta \) is the subjective discount factor; \( E \) is the expectation operator; \( U(.) \) represents the period or temporal utility function; and \( C_t \) represents the consumption of the single good in period \( t \) and \( E_t U \) is the expected utility.

The assumption of a constant world interest rate is consistent with a one good model. However, it will be shown that when more than one good is assumed, given expected changes in the real exchange rate and the terms of trade, the interest rate will no longer be constant. Moreover, the assumption that the country is small in the international financial market implies that Fisherian separability is valid: investment

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\(^3\)The contribution in this section is the demonstration of the use of dynamic optimization technique to establish optimal consumption. This optimal consumption is used in deriving the optimal current account. The existing literature on the present value model of the current account provides the utility function, the dynamic budget constraint and the final equation for the current account. However, this section provides clearly all the steps involved in showing that, in a simple intertemporal open economy model, the current account surplus equals the expected future decline of the present discounted value of net output.
should be chosen so as to maximize the economy's expected wealth, irrespective of the consumption profile. In line with this position, Blanchard (1983) and Cooper and Sachs (1985) have demonstrated that investment should be undertaken until the marginal product of capital equals the world interest rate. This implies the separation of the consumption decision from that of the production decision.

The relationship between the net foreign asset and the current account balance is provided in (4.2):

\[ B_{t+1} - B_t = r^* B_t + Y_t - C_t - G_t - I_t = CA_t \]  

(4.2)

where: \( B_t \) is the net foreign assets; \( Y_t \) is the gross domestic product; \( C_t \) and \( G_t \) capture private and government expenditures, respectively; \( I_t \) is the sum of private and government investment; and \( CA_t \) is the current account balance in period \( t \).

Constraint (4.2) holds as an equality based on the assumption of non-satiation. By taking the expectation of (4.2) and by imposing a 'solvency condition' (transversality condition or no Ponzi game condition) to rule out the possibility of bubbles, iterating the dynamic budget constraint in (4.2) gives the intertemporal budget constraint facing the representative agent as:

\[ E_t \left\{ \sum_{t=T}^{\infty} \left( \frac{1}{1+r^*} \right)^{t-T} Y_t + (1+r^*) B_t \right\} = E_t \left\{ \sum_{t=T}^{\infty} \left( \frac{1}{1+r^*} \right)^{t-T} (C_t + I_t + G_t) \right\} \]  

(4.3)

\(^4\) Rewrite (2) as:

\[ (1+r^*) B_t = C_t + G_t + I_t - Y_t + B_t \]

By shifting the last equation forward by one period and dividing through by \((1+r^*)\), we have:

\[ B_{t+1} = \frac{C_{t+1} + G_{t+1} + I_{t+1} - Y_{t+1} + B_{t+2}}{1+r^*} \]

The equation above can now be used to eliminate \( B_{t+1} \):

(continued)
Assuming that the competitive equilibrium of this model exists, we allude to the Second Welfare Theorem, which states that every Pareto efficient allocation is a Walrasian equilibrium [Mascollel et al (1995): 551-558]. The implication of this theorem is that the competitive equilibrium of this model is equivalent to the planner's solution. We use the planner's solution because of its simplicity. The social planner maximizes (4.1), subject to the constraint indicated in (4.3). Maximizing (4.1) subject to (4.3) gives the optimal path of consumption. To derive this, from (4.2), solve for $C_t$ as:

$$C_t = Y_t + (1 + r^*)B_t - B_{t+1} - I_t - G_t$$

(4.4)

Substituting (4.4) into (4.1), we have:

$$V(B_t) = E_t \left\{ \max (B_{t+1}) \sum_{t=1}^{\infty} \beta^{t-1} \left\{ U(Y_t + (1 + r^*)B_t - B_{t+1} - I_t - G_t) \right\} \right\}$$

(4.5)

The value function in (4.5) is continuous and differentiable. The optimization problem in (4.1) has been transformed into one of choosing sequences of net foreign assets in (4.5). It is difficult to solve (4.5). To make it amenable to differentiation between two periods, we write it in the form of a Bellman equation:

$$(1 + r^*)B_t + C_t + G_t + I_t - Y_t = \frac{C_{t+1} + G_{t+1} + I_{t+1} - Y_{t+1}}{1 + r^*} + \frac{B_{t+2}}{1 + r^*}$$

As in two-period case, $B_{t+T+1} = 0$. Also, $\lim (1/1 + r)^T B_{t=1} = 0$.

By following this iterative substitution, successive values of $B_t$ can be eliminated. This would yield the intertemporal budget constraint as (4.3).
Equation (4.6) can be re-expressed as:

$$V(B_t) = E_t \left\{ \max \left\{ \beta \text{Max}(B_{t+1}) \sum_{t=r+1}^{\infty} \beta^{t-r} \left[ U(Y_t + (1+r^*) B_t - B_{t+1} - I_t - G_t) \right] \right\} \right\}$$

The second term on the right hand side of (4.7) has exactly the same form as (4.5), with $B_{t+1}$ replacing $B_t$. Therefore,

$$V(B_t) = E_t \left\{ \max(B_{t+1}) \left[ U(Y_t + (1+r^*) B_t - B_{t+1} - I_t - G_t) \right] \beta \text{Max}(B_{t+1}) \sum_{t=r+1}^{\infty} \beta^{t-r} \left[ U(Y_t + (1+r^*) B_t - B_{t+1} - I_t - G_t) \right] \right\}$$

Equation (4.8) is often referred to as the functional equation or the Bellman Equation. The planner maximizes (4.8) by choosing the net foreign assets for the next period, given that the initial or current net foreign asset position was optimally chosen. By differentiating (4.8) with respect to $B_{t+1}$, and using the definition of current consumption in (4.4), we have:

$$-U'(C_t) + \beta V'(B_{t+1}) = 0$$

Differentiating (4.8) with respect to $B_t$ gives:

$$U'(C_t) (1+r^*) = 0$$

Shifting (4.10) forward by one period, which is equivalent to differentiating with respect to $B_{t+1}$, produces:

$$(1+r^*) E_t \{ U'(C_{t+1}) \} = 0$$
Substituting (4.11) into (4.9) yields:

\[ U'(C_t) = (1 + r^t) \beta E_t \{ U'(C_{t+1}) \} \quad (4.12) \]

The next step is to establish an equation for the consumption function, which will be used to derive the equation of the current account balance. We assume that \( \beta = 1/(1+r^t)^5 \). Therefore, (4.12) becomes:

\[ U'(C_t) = E_t U'(C_{t+1}) \quad (4.13) \]

We follow the literature in assuming a quadratic utility function, given by:

\[ U(C) = C - \frac{\alpha_0}{2} C^2, \quad \alpha_0 > 0 \quad (4.14) \]

Differentiating (14) with respect to \( C \) yields:

\[ U'(C) = 1 - \alpha_0 C \quad (4.15) \]

Substituting (4.15) into the Euler equation (4.13) produces:

\[ (1 - \alpha_0) C_t = (1 - \alpha_0) E_t C_{t+1} \]

\[ E_tC_{t+1} = C_t \quad (4.16) \]

---

5 This implies that the representative agent plans for a constant stream of consumption, and that consumption tilting is zero.

6 Using the quadratic utility function implies that consumption is determined according to the certainty equivalence principle. However, this cannot be considered to be a rational basis for decisions. Despite the fact that this utility function provides us with a closed form solution for the consumption function, it has the inherent weaknesses of the marginal utility of consumption becoming negative (Handa, 2000, pp.120). Also, there are no additional benefits from precautionary savings since the third derivative of the utility function is zero. An isoelastic period utility function is used in other derivations in order to deal with the weaknesses of the quadratic utility function.
Equation (4.16) represents Hall’s (1978) conclusion that consumption follows a random walk (the martingale process). This has the implication that the expected value of $C_{t+1}$, conditional on all available information, is $C_t$. Noting that for any $t>T$,

$$E_tC_t = E_tC_{t-1} = E_tC_{t-2} = \ldots = E_tC_{t+1} = C_t$$  \hspace{1cm} (4.17)

Therefore, substituting $C_t$ for $E_tC_t$ in the expected-value budget constraint and rearranging yields:

$$\sum_{t=T}^{\infty} \left( \frac{1}{1+r^*} \right)^{t-T} C_t = E_t \left\{ (1+r^*)B_t + \sum_{t=T}^{\infty} \left( \frac{1}{1+r^*} \right)^{t-T} (Y_t - I_t - G_t) \right\}$$  \hspace{1cm} (4.18)

From (4.18), the permanent income consumption function equals:

$$C^*_t = \frac{r^*}{1+r^*} \left[ (1+r^*)B_t + \sum_{t=T}^{\infty} \left( \frac{1}{1+r^*} \right)^{t-T} E_t(Y_t - I_t - G_t) \right]$$  \hspace{1cm} (4.19)

The open economy rational expectations consumption function is given by (4.19). As in Hall (1988), planned consumption is constant but actual consumption will change as the stochastic processes in the economy evolve. Substituting (4.19) into (4.2) produces the optimal current account balance:

$$CA^*_t = Y_t + r^*B_t - \left\{ \frac{r^*}{1+r^*} \left[ (1+r^*)B_t + \sum_{t=T}^{\infty} \left( \frac{1}{1+r^*} \right)^{t-T} E_t(Y_t - I_t - G_t) \right] \right\} - I_t - G_t$$ \hspace{1cm} (4.20)

\[\text{We use the condition that the sum of}\]
\[1 + \frac{1}{1+r^*} + \left( \frac{1}{1+r^*} \right)^2 + \ldots = \frac{1}{1 - \frac{1}{1+r^*}} = \frac{1+r^*}{r^*} = \sum_{t=T}^{\infty} \left( \frac{1}{1+r^*} \right)^{t-T}\]
Equation (4.20) can be rewritten as:

\[
CA_t^* = Y_t - \frac{r^*}{1+r^*} \sum_{t=1}^{\infty} \left( \frac{1}{1+r^*} \right)^{t-T} E_t Y_t + \frac{r^*}{1+r^*} \sum_{t=1}^{\infty} \left( \frac{1}{1+r^*} \right)^{t-T} E_t G_t
\]

\[
+ \frac{r^*}{1+r^*} \sum_{t=1}^{\infty} \left( \frac{1}{1+r^*} \right)^{t-T} E_t I_t - G_t - I_t
\]

(4.21)

Equation (4.21) becomes:

\[
CA_t^* = \left( Y_t - E_t \hat{Y}_t \right) - \left( I_t - E_t \hat{I}_t \right) - \left( G_t - E_t \hat{G}_t \right)
\]

(4.22)

The basis of the intertemporal model of the current account is provided by (4.22): the current account serves as a buffer through which private agents can smooth consumption over time in response to temporary disturbances to output, investment, and government expenditures. A rise (fall) in the current output above (below) its expected permanent value leads to an improvement in the current account (a deterioration), reflecting consumption-smoothing. A temporary increase (decrease) in the current output above (below) its long run discounted average will

---

8 Defining the relationship between the permanent value of a variable and its current value as:

\[
\sum_{t=1}^{\infty} \left( \frac{1}{1+r^*} \right)^{t-T} \hat{Z}_t = \sum_{t=1}^{\infty} \left( \frac{1}{1+r^*} \right)^{t-T} Z_t
\]

Therefore, the permanent value of \(Z\) is given by:

\[
\hat{Z}_t = \frac{r^*}{1+r^*} \sum_{t=1}^{\infty} \left( \frac{1}{1+r^*} \right)^{t-T} Z_t
\]

[see Obstfeld and Rogoff (1998) p.74 for this definition of a permanent variable]
induce individuals to accumulate (deplete) interest-yielding foreign assets as a way of smoothing consumption over future periods. Similarly, foreign borrowing will be used to finance profitable opportunities. This will be accomplished by borrowing abroad instead of reducing current consumption to finance such investment and, consequently, the current account balance position will deteriorate. Finally, a temporary increase in government expenditures has the same effect as a temporary negative productivity shock: a higher current account deficit enables individuals to minimize the impact of such a shock in any particular period by spreading that impact over the entire future.

It is possible to write (4.22) in a more compact form, which will make it similar to the approach developed by Campbell (1987) for testing the permanent income hypothesis of consumption. This compact form is used to show that an expected positive change in net output in the future increases the current account deficit in the current period. We define net output as gross domestic output, less gross investment and government expenditures. That is,

\[ Q_t = Y_t - I_t - G_t \]  \hspace{1cm} (4.23)

Based on this definition, (4.22) takes the simple form:

\[ CA_{t}^* = Q_t - E_t \hat{Q}_t^* \]  \hspace{1cm} (4.24)

The permanent value of the net output, \( \hat{Q}_t^* \), can be written as:

\[ \hat{Q}_t^* = \frac{r^*}{1 + r^*} \sum_{t=1}^{\infty} \left( \frac{1}{1 + r^*} \right)^{t-1} E_t Q_t \]  \hspace{1cm} (4.25)

Substituting (4.25) into (4.24) gives:
Setting \( \frac{1}{1+r} = \psi \), we can rewrite (4.26) as:

\[
CA^*_t = Q_t - E_t \left( \sum_{t+1}^{\infty} \psi^{t+1} E_t Q_t \right)
\]

\[
= Q_t - E_t \left[ \sum_{t+1}^{\infty} \psi^{t+1} Q_t - \sum_{t+1}^{\infty} \psi^{t+1} Q_t \right]
\]

\[
= Q_t - E_t \left[ \sum_{t+1}^{\infty} \psi^{t+1} Q_t - \sum_{t+1}^{\infty} \psi^{t+1} Q_t \right] \quad (4.27)
\]

Note that

\[
\sum_{t+1}^{\infty} \psi^{t+1} Q_t = \sum_{t+1}^{\infty} \psi^{t+1} Q_{t-1}
\]

Therefore, (4.27) can be re-expressed as:

\[
CA^*_t = -E_t \left[ \sum_{t+1}^{\infty} \psi^{t+1} Q_t - \sum_{t+1}^{\infty} \psi^{t+1} Q_{t-1} \right]
\]

\[
= -E_t \left[ \sum_{t+1}^{\infty} \psi^{t+1} (Q_t - Q_{t-1}) \right] \quad (4.28)
\]

The current account in the current period based on (4.28) is:

\[
CA^*_t = -\sum_{t+1}^{\infty} \left( \frac{1}{1+r} \right)^{t+1} E_t (\Delta Q_t) \quad (4.29)
\]

From (4.29), temporary shocks lead to changes in the current account, and the extent of the movement in the current account depends on the persistence of the shock. A country will run a current account surplus only if it expects its net output to fall temporarily in the future. The analogy to household saving is illuminating: as
Campbell has shown, an implication of the rational-expectations permanent-income model is that households save when they expect their future labor income to decline. In our model, net output plays the role of labor income and the current account plays the role of savings.

This approach to looking at the current account balance has a number of policy implications. In the first place, the fact that the economy is experiencing current account deficits may not necessarily be indicative of structural problems. A temporary increase in government expenditure, in investment, or a decline in productivity, is expected to generate current account deficits. This shows that there is no need on the part of the government to initiate policy measures such as exchange rate devaluation, to correct such current account deficits. Secondly, if the observed current account deficit reflects consumption-smoothing of private economic agents, then current account deficits may not necessarily result in the accumulation of foreign liabilities that are not sustainable, as private agents borrow to smooth consumption. Finally, if indeed the current account acts as a buffer, this implies a high degree of capital mobility. Thus, the PVMCA can be used to assess the degree of effective capital inflows into a country.

4.2.2 The Testable Implications of the Benchmark Theoretical Framework

The first implication of (4.29) is the stationarity of the optimal current account, $CA_t^*$. From (4.29), if the change in net output ($\Delta Q_t$) is a stationary variable (i.e., $I(0)$), then the optimal current account $CA_t^*$ must also be stationary in levels, since it is a linear combination of $I(0)$ variables. The stationary of $CA_t^*$ conditional on the
stationarity of $\Delta Q_t$, constitutes a relatively weak implication of the present value model [Otto (1992)]. This implication can be tested using the Augmented Dickey-Fuller (ADF) unit root test [see Said and Dickey (1984)] and the Phillips-Perron unit-root test [see Phillips and Perron (1988)].

The second implication of (4.29) is that of equality between the actual and optimal current accounts. From (4.29), creating the optimal current account series requires estimating the present value of expected changes in net output, where the expectation is conditional on the information set used by economic agents. This is an uphill task: the information set on the basis of which agents forecast future values of the variables contained in net output is generally unknown to the researcher. However, precise knowledge of the content of information utilized by the agent is not needed. This is because, as Campbell and Shiller (1987) have shown in a different context, the current account itself reflects all the information available to agents for forecasting these variables. Indeed, under the null hypothesis of equation (4.29), the current account should itself incorporate all consumers' information on future net output changes.

Consumers' forecast of changes in net output ($\Delta Q_t$) for $t > \tau$ is based on the $p$-order vector autoregression (VAR) model in (30). For ease of exposition we set $p=1^9$.

---

$^9$It is straightforward to generalize this expression for higher order VARs by writing a $p$th-order VAR in first order form [see Otto (1992)]. The derivations here follow Obstfeld and Rogoff (1996).
where $V_{1t}$ and $V_{2t}$ are errors with a conditional mean of zero and where $\Delta Q_t$ and $CA_t$ are now expressed as deviations from unconditional means so that only the dynamic restrictions of the present value model of the current account are tested [see Campbell (1987), Campbell and Shiller (1987), Otto (1992), and Ghosh (1995)]. Equation (4.30) is used to forecast the expected value of $\Delta Q_t$ in (4.29). Taking the expectation of (4.30) yields:

$$
E_t\left[ \begin{bmatrix} \Delta Q_t \\ CA_t \end{bmatrix} \right] = E_t\left[ \begin{bmatrix} \psi_{11} & \psi_{12} \\ \psi_{21} & \psi_{22} \end{bmatrix} \begin{bmatrix} \Delta Q_{t-1} \\ CA_{t-1} \end{bmatrix} \right] + E_t\left[ \begin{bmatrix} V_{1t} \\ V_{2t} \end{bmatrix} \right]
$$

(4.31)

In (4.31) we use the condition that $E_t[X_{t+j}] = \Psi^jX_t$; $E (V_{1t})= E (V_{2t})=0.;$ and $\psi = \text{matrix } [\psi_{ij}]$. By pre-multiplying (4.31) by the 1x2 vector $[1 \ 0]$ we have:

$$
E_t\Delta Q_t = [1 \ 0]\begin{bmatrix} \psi_{11} & \psi_{12} \\ \psi_{21} & \psi_{22} \end{bmatrix}^{-1}\begin{bmatrix} \Delta Q_t \\ CA_t \end{bmatrix}
$$

(4.32)

Let $I$ be a 2x2 identity matrix. Substituting (4.32) into (4.29) yields:

$$
CA^* = -[1 \ 0]\begin{bmatrix} (1+r)^{-1} & -1 \\ 0 & (1+r)^{-1} \end{bmatrix}\begin{bmatrix} \Delta Q_t \\ CA_t \end{bmatrix}
$$

$$
= \begin{bmatrix} \Phi_{\Delta Q} & \Phi_{CA} \end{bmatrix}\begin{bmatrix} \Delta Q_t \\ CA_t \end{bmatrix}
$$

(4.33)

$^{10}$ The expression in (4.33) is valid as long as the infinite sum in (4.29) converges, which it will if the variables in the VAR are stationary.
Equation (4.33) is the predicted or optimal current account that will be compared with the actual current account data. Therefore, to evaluate the model statistically, we have to test the restriction that \([\Phi_{AQ} \Phi_{CA}] = [0 \ 1]\) in (4.33). This necessitates the use of delta method to calculate a \(\chi^2\) statistic for the hypothesis that 
\[ k = [\Phi_{AQ} \Phi_{CA}] = [0 \ 1]. \]
Let \( g \) represent the difference between the actual \( k \) and the hypothesized value. Then, 
\[ g \left( \frac{\partial k}{\partial \psi} \right) V \left( \frac{\partial k}{\partial \psi} \right)'^{-1} g \]
will be distributed chi-squared with two degrees of freedom, where \( V \) is the variance-covariance matrix of the VAR parameters, and \( \left( \frac{\partial k}{\partial \psi} \right) \) is the matrix of derivatives of the \( k \) vector with respect to these parameters.

The third implication of (4.29) under the null is the equality of the variances of the actual current account and the optimal current account. If this is found to be valid, then the Nigerian economy can be considered as receiving sufficient capital flows to ensure consumption smoothing. On the other hand, a low variance of the optimal current account balance relative to the actual would be indicative of excessive speculation. A high variance would suggest low capital mobility since, at the margin; a shock to either savings or investment does not result in corresponding movement of the current account balance.

The last implication of (4.29) is the stationarity of the actual current account balance. Given the null of equality between the actual and optimal current accounts, the optimal current account is an I(0) process; hence the actual current account must be an I(0) process too.
The summaries of the implications of the present value model of the current account tested are:

- That the stationarity of the optimal current account is due to the stationarity of the change in net output;
- That there is equality between the optimal and actual current account;
- That there is equality of variances of the optimal and current accounts; and finally,
- That the stationarity of the optimal current account implies the stationarity of the actual current account.

4.3 Consumption-Based Interest Rates and the Present Value Models of the Current Account (PVMCA)

A likely explanation of the mixed performance of the simple intertemporal current account in small open economies, as mentioned in Chapter 3, is the omission of external shocks that are likely to affect these economies significantly. It is important to incorporate those shocks that emanate from a country's larger neighbors or the world in general, rather than focus exclusively on shocks arising from the domestic economy, as is the case with the 'Benchmark Model' presented above. As individuals may adjust consumption and saving behavior in response to changes in the real interest rates, countries may also adjust their current account in response to movements in the world real interest rate. For example, a sudden increase in the interest rate that worsens the net factor payment position may
influence a government to reduce its consumption expenditure in order to achieve a target current position.

Furthermore, Dornbusch (1983) has demonstrated that an anticipated rise in the relative price of tradable goods can raise the cost of borrowing from abroad when interest is paid in units of these goods. Therefore, real exchange rate movements can impact upon the intertemporal allocation of consumption, with a consequent impact on the current account position similar to those impacts made by changes in the interest rate. In addition to these intertemporal effects, by inducing substitution between tradable and nontradable goods at any point in time, exchange rate changes can also have intratemporal effects. In recognition of these, we relax the assumptions of one tradable good. The introduction of tradable and nontradable goods provides a specific role in which exchange rate movements can make an impact upon the current account.

The presentation in this paper follows the lead of Campbell and Mankiw (1989) in their work on consumption, Huang and Lin (1993) in their work on fiscal deficits, and Bergin and Sheffrin (2000) in their work on the PVMCA. This thesis' objective is to provide detailed information on the derivation of each equation. The unique contribution of this thesis is the introduction, using the established theoretical framework provided by the studies indicated above, of the terms of trade and asymmetry in access to the international financial market.
4.3.1 Derivation of the Optimal Consumption

Consider a small open economy that can lend and borrow at a variable real world interest rate, \( r^* \). The economy produces both tradable and nontradable goods. The infinitely lived household maximizes the lifetime utility function given by (4.35) subject to the dynamic budget constraint in (4.36):

\[
E_t U = E_t \left\{ \sum_{t=0}^{\infty} \beta^{t-t} [U(C_t, C_{NT_t})] \right\}, \quad U'(C_t) > 0; \quad U''(C_t) < 0; \quad 0 < \beta < 1 \tag{4.35}
\]

\[
B_{t+1} - B_t = r_{t+1} * B_t + Y_t - (C_{TL} + P_t C_{NT}) - G_t - I_t \tag{4.36}
\]

The variables are as defined in Section 4.1, except that they are now measured in terms of traded goods. \( C_T \) is the consumption of tradable goods and \( C_{NT} \) is the consumption of nontradable goods. \( P_t \) is the relative price of nontradable goods in terms of tradable goods. The temporal utility function is isoelastic and the allocation of expenditure between tradables and nontradables is in the form of a Cobb-Douglas function:

\[
U(C_{TL}, C_{NT}) = \frac{1}{1-\sigma} \left( C_{TL}^\alpha C_{NT}^{1-\alpha} \right)^{-\sigma} \tag{4.37}
\]

\[ \sigma > 0, \quad \sigma \neq 1, \quad 0 < \alpha < 1 \]

The representative agent maximizes (4.35) subject to the dynamic budget constraint in (4.36). In carrying out this intertemporal exercise, we must first demonstrate that the dynamic budget constraint in (4.36) can be written as\(^{11}\):

\[^{11} \text{See Appendix IA for the derivation of (4.38). The derivation of the optimal consumption is based on the works of Dornbusch (1983) and Obstfeld and Rogoff (1996).} \]
\[ P_t \cdot C_t^* = Y_t + (1 + r_{t+1}^*)B_t - B_{t-1} - I_t - G_t \]  

(4.38)

where \( C_t^* = C_t^{CT}C_{NTR}^t \), is an index of total consumption. The consumption-based index, \( P_t^* \), is the minimum amount of consumption expenditure\(^{12}\) \( C_t = C_t^{CT} + P_tC_{NTR}^t \) such that \( C_t^* = 1 \). We can now rewrite (4.37) as:

\[ U(C_t^*) = \frac{1}{1 - \sigma} (C_t^*)^{1-\sigma} \]  

(4.39)

The problems of choosing tradable and nontradable goods intertemporally in (4.35) and intratemporarily in (4.37) have been transformed into one of choosing the composite consumption index \( C^* \). Solving for \( C^* \) from (4.38) and substituting into (4.35) we have:

\[ V(B_t) = E_t \left\{ \text{Max}_{t=1}^\infty \beta^{t-1} U \left[ \frac{Y_t + \left(1 + r_{t+1}^*\right)B_t - B_{t-1} - I_t - G_t}{P_t^*} \right] \right\} \]  

(4.40)

The procedures presented in equation (4.6) to (4.8) are used to derive the Euler equation. Following the same procedure combined with the utility function in (4.39) yields:

\[ E_t \left[ \beta(1 + r_{t+1}^*) \left( \frac{P_t^*}{P_{t+1}^*} \right) \left( \frac{C_t^*}{C_{t+1}^*} \right)^\sigma \right] = 1 \]  

(4.41)

To ensure empirical implementation, we need to rewrite (4.41) in terms of consumption expenditure and the relative price of nontradable goods. To achieve this, we re-express (4.41) as:

---

\(^{12}\) This is the total consumption expenditure from the dynamic budget constraint in (4.36).
Equation (4.42) is re-expressed as:

$$E_t \left[ \beta (1+r_{t+1}) \left( \frac{P_t C_t}{P_{t+1} C_{t+1}} \right)^\sigma \left( \frac{P_t}{P_{t+1}} \right)^{\sigma - 1} \right] = 1$$

(4.42)

Assume joint log normality, constant variances and covariances for the gross real world interest rate $(1+r_{t+1})$, consumption growth rate $(\Delta c_{t+1} = \log C_{t+1} - \log C_t)$, and for the percentage change in the relative price of nontradable goods $(\Delta p_{t+1} = \log P_{t+1} - \log P_t)$\(^{13}\). Based on the assumption of lognormal distribution, (4.43) may be rewritten in a log-linearized form as\(^{14}\):

$$E_t \Delta c_{t+1} = \gamma E_t \left[ r^*_{t+1} + \frac{1-\gamma}{\gamma} (1-\alpha) \Delta p_{t+1} \right] + \frac{1}{2} \left[ \sigma_c^2 + \gamma^2 \sigma_r^2 + (1-\gamma)^2 (1-\alpha)^2 \sigma_p^2 + 2\gamma\gamma_{cr} \right]$$

where $\gamma = 1/\sigma$ is the elasticity of intertemporal substitution.

(4.44)

Equation (4.44) assumes the approximation of $\log (1+r^*_{t+1})$ as $r^*_{t+1}$. The first bracket on the right hand side of (4.44) specifies the consumption-based real interest rate, which is different from the world real rate of interest when there is an expected change in the real exchange rate. This is the own rate of interest on the consumption index $C_t^*$, and is denoted $\hat{r}_t$. Thus, the rate of interest is no longer a

\(^{13}\) See Campbell et al (1997): 306-307, for the properties of a random variable that is conditionally lognormal distributed.

\(^{14}\) Given the condition that the empirical implementation of the model will be based on de-meaned variables, the preference parameter, a constant, is dropped from the equation (4.44).
constant and its movements are sensitive to expected changes in the real exchange rate. Therefore, the evolution of optimal consumption profile is given by:

\[ E_t \Delta c_{t+1} = \gamma E_t \hat{r}_{t+1} \; \text{where} \; \hat{r}_t = r^* + \frac{1 - \gamma}{\gamma} (1 - \alpha) \Delta p_{t+1} + \text{constant} \]  \hspace{1cm} (4.45) 

The relationship between the evolution of optimal consumption and consumption-based interest rate, \( \hat{r}_t \), is given by (4.45). The consumption-based real interest rate combines both the world interest rate \( r^* \) and the change in the relative price of nontradable goods. Previous empirical investigations of the intertemporal model of the current account emphasize a consumption profile where the expected change in consumption is zero: households always try to smooth consumption over time by participating in the international financial markets. When the real interest rate is variable, as shown in (4.45), the representative consumer may decide to alter the path of consumption over time by increasing or decreasing consumption in some periods through changes in the terms of borrowing and lending.

A change in the relative price of nontradable goods can have similar intertemporal effects as that of a change in the conventional interest rate. For example, an increase in the conventional real interest rate, \( r^* \), makes current consumption more expensive in terms of foregone future consumption, and induces substitution toward future consumption with elasticity \( \gamma \). Relating this scenario to the relative price of nontradable goods, if the price of nontradable goods is temporarily

---

\[ \text{The constant term at the end of the expression will drop out of the empirical model when we later de-mean the consumption based interest rate using (4.45).} \]
high and expected to fall, then the future repayment of a loan contracted in the current period in traded goods has a higher cost in terms of the consumption bundle than in terms of tradable goods alone. As a result, the consumption-based interest rate, \( \hat{r} \), rises above the conventional interest rate, \( r^* \). This induces a fall in the current total consumption expenditure by elasticity \( \gamma(1-\alpha) \). Apart from this intertemporal substitution, a change in the relative price of nontradable goods also induces intratemporal substitution. In the event of a temporarily high relative price of nontradable goods, a household will substitute towards traded goods by the intratemporal elasticity, which is unity under a Cobb-Douglas specification. This increases total current consumption expenditure by elasticity \( (1-\alpha) \). This intratemporal effect will dominate the intertemporal effect if the intertemporal elasticity, \( \gamma \), is less than unity.

### 4.3.2 Log-Linearization of the Intertemporal Budget Constraint

The dynamic budget constraint in (4.36) can be re-written as:

\[
CA_t = Y_t - I_t - G_t - (C_t + P_t C_{Nt}) + r^{*}_{t+1} B_t
\]

\[
= Q_t - C_t + r^{*}_{t+1} B_t
\]

(4.46)

where \( Q_t = Y_t - I_t - G_t \), and \( C_t = (C_t + P_t C_{Nt}) \). Define \( R_{t,t}^{*} \) as the market discount factor for date \( t \) consumption, so that
We sum over all periods of the infinite horizon, and impose the no ponzi game constraint as in Section 4.1. Combining this with (4.47), equation (4.46) becomes:

\[ R_{t,t} = \frac{1}{\prod_{j=t+1}^{\infty} (1+r^*_t)} \]  

(4.47)\(^{16}\)

Using the Huang and Lin (1993) procedures, (4.48) is log-linearized. The first step is to log-linearize the present value of net output. Define:

\[ \Gamma_0 = \sum_{t=0}^{\infty} E_0 (R^*_t Q_t) \]  

(4.49)

Appendix IB shows that (4.49) implies that:

\[ q_0 - \varphi_0 = \sum_{t=1}^{\infty} \rho \left( r^*_t - \Delta q_t \right) + \eta \]  

(4.50)\(^{17}\)

where \( q_0 = \ln Q_0 \), \( \varphi_0 = \ln \Gamma_0 \), \( \Delta q_t = q_t - q_{t-1} \); and \( \eta \) is a constant; \( \rho \) is a constant, slightly less than one and can be interpreted as the average value of 1-Q/\( \Gamma^* \).

The second step involves log-linearization of the present value of current and future consumption:

\[^{16}\text{This is necessary given the assumption of a variable interest rate. It replaces the usual discount factor } \sum_{t=0}^{\infty} \left( \frac{1}{1+r^*} \right)^t \text{ under the assumption of a constant interest rate. Also, } R_{t,t} = 1;\]

\[^{17}\text{Appendix IB provides the detailed derivation of this equation. The same procedure is used in transforming (4.51) and the entire intertemporal budget constraint.}\]
\[
X_0 = \sum_{t=0}^{\infty} E_0 (R_t \cdot C_t) \tag{4.51}
\]

Using the procedures in appendix IB, (4.51) implies that:

\[
c_0 - x_0 = \sum_{t=1}^{\infty} \rho^{t-1} (r_t^* - \Delta c_t) + \eta \tag{4.52}
\]

where \(c_0=\ln C_0; x_0=\ln X_0; \Delta c_t = c_t - c_{t-1}; \eta \) is a constant; \( \rho \) is constant, slightly less than one and can be interpreted as the average value of \(1-C/X\).

Based on the same procedures in Appendix (IB), the intertemporal budget constraint \(\Gamma_0=X_0+B_0\), implies that:

\[
x_0 - \varphi_0 = \left(1 - \frac{1}{\Omega}\right) \left[b_0 - \varphi_0\right] + k \tag{4.53}
\]

where \(b_0=\ln B_0; \Omega \) is constant, slightly less than one, and can be interpreted as the average value of \(1-B/X\); and \(k \) is a constant.

Substituting for \(\varphi_0\) and \(x_0\) respectively from (4.50) and (4.52) into (4.53), produces the following log-linearized intertemporal budget constraint for the representative agent for \(t \geq 0\).

\[
- \sum_{i=1}^{\infty} \rho^i \left( \Delta q_i \right) \left[ \frac{1}{\Omega} \Delta c_t - \frac{\Omega-1}{\Omega} r_t^* \right] = q_0 - \frac{1}{\Omega} c_0 - \frac{\Omega-1}{\Omega} b_0 \tag{4.54}
\]

Taking the expectation of (4.54), and using the optimal consumption profile in (4.45), equation (4.54) may be written as:

\[
- \mathbb{E}_t \sum_{i=1}^{\infty} \beta^i \left( \Delta q_i \right) - \frac{\gamma}{\Omega} r_{t+1} - \frac{\Omega-1}{\Omega} r_t^* = q_t - \frac{1}{\Omega} c_t + \frac{\Omega-1}{\Omega} b_t \tag{4.55}
\]

The right-hand side of (4.55) is similar to the definition of the current account in (4.46), except that its components are in log terms. We designate the transformed
representation of the current account as CA**. This is the optimal current account balance when the interest rate is not constant and expected change in the real exchange rate or the relative price of nontradable goods is taken into consideration. We follow the convention of choosing the steady state around which we linearize to be the one in which net foreign assets are zero. In this case, \( \Omega = 1 \) and (4.55) may be re-expressed as:

\[
CA_t^{**} = -E_t \sum_{t=T+1}^{\infty} \beta^{t-t} (\Delta q_t - \gamma r_t^*)
\]  

(4.56)

This condition stipulates that an expected increase in net output would produce a current account deficit in the current period as the representative agent smooths consumption. Apart from the shocks emanating from the three components of the net output, (4.56) also implies that a fall in the consumption-based interest rate will lead to a deterioration in the current account position by inducing the representative household to increase consumption above its smoothed level. The restrictions implied by (4.56) are tested using the framework described in section 4.1 but augmented with an additional variable, \( f_t \). This produces:

\[
\begin{bmatrix}
\Delta Q_t \\
CA_t \\
\hat{r}_t
\end{bmatrix} =
\begin{bmatrix}
\psi_{11} & \psi_{12} & \psi_{13} \\
\psi_{21} & \psi_{22} & \psi_{23} \\
\psi_{31} & \psi_{32} & \psi_{33}
\end{bmatrix}
\begin{bmatrix}
\Delta Q_{t-1} \\
CA_{t-1} \\
\hat{r}_{t-1}
\end{bmatrix} +
\begin{bmatrix}
V_{1t} \\
V_{2t} \\
V_{3t}
\end{bmatrix}
\]

(4.57)

\(^{18}\) This condition is similar to that of equation (4.29), except for the inclusion of the consumption-based interest rate and for the fact that the variables are in log form.
We need to determine the expected values of $\Delta Q_{t+i}$ and $\hat{r}_{t+i}$. To arrive at (4.57), we use the conditions that $E_t[X_{t+j}] = \Psi^i X$; that $E(V_{1t}) = E(V_{2t}) = E(V_{3t}) = 0$; and that $\Psi = \text{matrix } [\Psi_{ij}]$. Therefore,

$$h_{t+1} = -\sum_{t+1}^{\infty} \beta^{t+1} (g_1 - \gamma g_2) \Psi^{t+1} z_t.$$  

(4.58)

where $z_t = (\Delta Q_t, CA_t, \hat{r}_t)'$, $g_1 = [1 \ 0 \ 0]$, $g_2 = [0 \ 0 \ 1]$, and $h = [0 \ 1 \ 0]$. (Again this can be generalized for a larger number of lags). For a given $z_t$, the right hand side of the last equation can be re-expressed as:

$$CA_t^{**} = k z_t,$$  

(4.59)

$$k = -(g_1 - \gamma g_2) \beta \Psi (I - \beta \Psi)^{-1}.$$

Equation (4.59) provides the model’s prediction for the current account consistent, with the VAR and the restrictions of the intertemporal theory.

To evaluate the model, we have to test the hypothesis that $k = [0 \ 1 \ 0]$ in (4.59) so that $CA^{**} = CA$, by using the delta method to calculate a $\chi^2$ statistic. Let $k^*$ be the difference between the actual $k$ and the hypothesized value. Then $k^* \left( (\partial k / \partial \Psi) V (\partial k / \partial \Psi)' \right)^{-1} k^*$ will be distributed chi-squared with 3 degrees of freedom, where $V$ is the variance-covariance matrix of the VAR parameters, and $(\partial k / \partial \Psi)$ is the matrix of derivatives of the $k$ vector with respect to these parameters.

Below is a summary of the implications of the PVMCA when the interest rate is not constant and expected change in the real exchange rate is accommodated.
• That stationarity of the optimal current account is due to the stationarity of the change in net output adjusted for the consumption based interest rate;
• That there is equality between the optimal and actual current account;
• That there is equality of the variance of the optimal and actual current accounts;
• That the actual current account is stationary.

4.4.1 Consumption-Based Interest Rate with Terms of Trade Changes and the Present Value Model of the Current Account

Allowing for changes in the terms of trade requires disaggregating the tradable goods into exportables and importables. It is assumed that the exportable is not consumed at home. In Nigeria shifts in the terms of trade play an important role in the relative domestic demand between importable and nontradable goods.

The consumption-based interest rate and world interest rate will differ from each other whenever the terms of trade (the relative price of importables) or the real exchange rate (the relative price of nontradables) is not expected to remain constant through time. Allowing for the consumption of importables and nontradables permits the incorporation of the terms of trade changes, where the terms of trade are now the relative price of importables in terms of exportables, and the real exchange rate is the relative price of nontradables in terms of the price of exportables. This formulation is along the lines of Ostry and Reinhart (1992) and Ostry (1988). The uniqueness of this thesis is the incorporation of changes in the terms of trade in the present value model of the current account.
4.4.2 Derivation of Optimal Consumption and Current Account

Consider a small open economy that can lend and borrow at a varying real world interest rate, $r^*$, and consumes both importables and nontradable goods. The infinitely lived household maximizes the expected value of the lifetime utility function in (4.60), subject to the dynamic budget constraint in (4.61):

$$E_t U = E_t \left[ \sum_{t=1}^{\infty} \beta^{t-1} \left[ U(C_{mt}, C_{NTI}) \right] \right], \quad U'(C_t) > 0; \quad U''(C_t) < 0; \quad 0 < \beta < 1$$

(4.60)

$$\frac{P^m_t}{P^e_t} C_{mt} + \frac{P^n_t}{P^e_t} C_{NTI} = \frac{Y_t + (1+r^*)B_t - B_{t+1} - I_t - G_t}{P^e_t}$$

$$P^m_t C_{mt} + P^n_t C_{NTI} = Y_t + (1+r^*)B_t - B_{t+1} - I_t - G_t$$

$$P^* t C^* t = Y_t + (1+r^*)B_t - B_{t+1} - I_t - G_t$$

(4.61)\(^{19}\)

The variables are as defined in Section 4.1 except that they are now measured in terms of exportable goods. $C_{mt}$ is the consumption of imported goods and $C_{NTI}$ is the consumption of non-traded goods. The relative price of importables in terms of exportables is given by $P^m_t / P^e_t = P_{mt}$ (this is the case because exportables are the numeraire and their price is set to 1). The relative price of nontradable goods in terms of exportables is captured by $(P^n_t / P^e_t = P_{nt})$.

The intratemporal utility function is isoelastic and the allocation of expenditure between tradables and nontradables is in the form of a Cobb-Douglas function:

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\(^{19}\) We allude to the derivation in Appendix IA. Further details are provided in Appendix IC.
Appendix IC derives the first-order conditions for this problem and uses them to derive the following optimal consumption profile:

\[ E_t \left( \beta (1+r_{t+1}) \left( \frac{C_t}{C_{t+1}} \right)^{\sigma} \left( \frac{P_{nt}}{P_{nt+1}} \right)^{(1-\sigma)(1-\alpha)} \left( \frac{P_{mt}}{P_{mt+1}} \right)^{\alpha(1-\sigma)} \right) = 1 \]  

Equation (4.63) can be re-written as:

\[ E_t \left( \beta^\gamma (1+r_{t+1})^{\gamma} \left( \frac{C_t}{C_{t+1}} \right)^{(1-\gamma)(1-\alpha)} \left( \frac{P_{nt}}{P_{nt+1}} \right)^{(1-\gamma)(1-\alpha)} \left( \frac{P_{mt}}{P_{mt+1}} \right)^{(1-\gamma)(\alpha)} \right) = 1 \]  

where \( \gamma = 1/\sigma \), the elasticity of intertemporal substitution. Based on the assumption of lognormal distribution, (4.64) may be rewritten in a log-linearized form as \(^{20}\):

\[ E_t \Delta C_{t+1} = \gamma E_t \left[ r^*_{t+1} + \frac{1-\gamma}{\gamma} (1-\alpha) \Delta P_{nt+1} + \frac{1-\gamma}{\gamma} \alpha \Delta P_{mt+1} \right] \]  

Therefore, the evolution of optimal consumption profile is given by:

\[ E_t \Delta C_{t+1} = \gamma E_t \hat{r}_{t+1} ; \text{ where } \hat{r}_t = r^* + \frac{1-\gamma}{\gamma} (1-\alpha) \Delta P_{nt+1} + \frac{1-\gamma}{\gamma} \alpha \Delta P_{mt+1} \]  

The difference between the evolution of consumption in (4.66) and that in (4.45) is the inclusion of changes in the terms of trade. All the restrictions derived in Section 4.3.2 are equally applicable here, but with the difference that the

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\(^{20}\)Given the condition that the empirical implementation of the model will be based on de-meaned variables, the preference parameter is dropped from equation (4.66).
consumption based interest rate, \( \hat{r} \), is now defined to include changes in the terms of trade. The optimal current account is given by:

\[
CA_t^{**} = -E_t \sum_{t'=t+1}^{\infty} \beta^{t-t'}(\Delta q_t - \gamma \hat{r}_t)
\]

Equation (4.67) is similar to (4.56), except that (4.67) adjusts the consumption-based interest rate for changes in the terms of trade.

4.5 Asymmetry in Access to International Financial Markets and the Present Value Model of the Current

One of the weaknesses of the standard consumption-smoothing model of the current account is its assumption of unrestricted access to the international financial market. An important extension of the model considered important is to include the asymmetry in access to the international financial markets. While private agents can easily lend abroad, it may be difficult for them to borrow in the face of unanticipated negative shocks to net output. This may be a result of the perception of the lenders that the negative shock has reduced the ability of the private agents to pay back\(^{21}\). Explicitly incorporating restrictions on the international financial market in a PVMCA that already takes into account changes in the interest rate and exchange rate constitutes another contribution of this thesis.

\(^{21}\) This may be quite extreme as this implies that there is no change in the current account position in the face of negative external shocks. The best scenario would have been one where the capital inflow is insufficient to smooth consumption.
We follow Callen and Cashin (1999) in allowing for asymmetric behavior on the part of economic agents in their response to temporary shocks to net output. However, while Callen and Cashin interpreted this asymmetric behavior as resulting from capital controls imposed by the government, we perceive it in the current context as emanating from macroeconomic and political instabilities in an economy like Nigeria. Macroeconomic instability, for example, reduces the growth potential of the economy and thereby reduces the ability of private agents to repay back funds secured on the international financial markets. International financial markets, anticipating this, may not be willing to lend to private agents in Nigeria to smooth consumption.

To implement the constrained model, the actual current account $CA_t$ is decomposed into two main components as follows:

$$CA_t^h = D_t^h CA_t$$

where $D_t^h = \begin{cases} 1 & \text{if } CA_t > 0 \\ 0 & \text{if } CA_t \leq 0 \end{cases}$

$$CA_t^l = D_t^l CA_t$$

where $D_t^l = \begin{cases} 1 & \text{if } CA_t < 0 \\ 0 & \text{if } CA_t \geq 0 \end{cases}$

where $CA_t^h$ ($CA_t^l$) equals $CA_t$ when $CA_t$ is positive (negative) and $CA_t^h$ ($CA_t^l$) is zero otherwise. The variables $\Delta Q_t^h$ and $\Delta Q_t^l$ are defined similarly as:

$$\Delta Q_t^h = D_t^h \Delta Q_t$$

where $D_t^h = \begin{cases} 1 & \text{if } \Delta Q_t > 0 \\ 0 & \text{if } \Delta Q_t \leq 0 \end{cases}$

$$\Delta Q_t^l = D_t^l \Delta Q_t$$

where $D_t^l = \begin{cases} 1 & \text{if } \Delta Q_t < 0 \\ 0 & \text{if } \Delta Q_t \geq 0 \end{cases}$
In the intertemporal model of the current account, an expected rise in output is expected to generate an increase in the current consumption and, with a constant current income, a decrease in saving. With unchanged investment, the current account balance deteriorates. However, with partial access to the international financial market, the current account position will not be fully affected by expectations of an increase in output. On the other hand, the domestic economic agents can fully lend abroad. When agents expect a decline in their future output, they can reduce current consumption, thereby increasing saving, with a consequent improvement in the current account position. Therefore, in the presence of credit asymmetric access, the relationship between the net cash flow and current account takes two forms. If the postulate of asymmetry in access to international financial market is binding, then $CA_t^h$ will Granger-cause future changes in net output, as defined by $\Delta Q_t^i$. However, no Ganger causality should be found between $CA_t^i$ and $\Delta Q_t^h$.

Another test of the appropriateness of the constrained consumption-smoothing model can be carried out by estimating the VAR system including the variables of interest. To do this, we estimate a five-variable VAR of current and lagged changes in net output ($\Delta Q_t^h$ and $\Delta Q_t^i$), current and lagged values of the actual current account ($CA_t^h$ and $CA_t^i$), and consumption based interest rate of the form:
From (4.72), the restrictions on the optimal current account (with asymmetry in access to the international financial market) is given by:

$$h_z = -\sum_{t=1}^{\infty} \beta^{t-t}(g_1 - \gamma g_2)\Psi^{t-t}z_t$$

(4.73)

where $$z_t = (\Delta Q_t^h \Delta Q_t^l \text{CA}_t^h \text{CA}_t^l \hat{r}_t)'$$, $$g_1 = [1 \ 1 \ 0 \ 0 \ 0]$$, $$g_2 = [0 \ 0 \ 0 \ 0 \ 1]$$, and $$h = [0 \ 0 \ 1 \ 1 \ 0]$$. (This can also be generalized for a larger number of lags). These restrictions are consistent with the joint null hypotheses of consumption-smoothing and the absence of credit constraints. This restriction implies that movements of the actual current account reflect those of the optimal current account. The alternative hypothesis is that asymmetry in access to the international financial markets is binding and therefore the restrictions captured in $$h$$ are not valid. For a given $$z_t$$, the right hand side of (4.73) can be re-expressed as:

$$\text{CA}_t^{****} = kz_t$$

(4.74)

where: $$k = -(g_1 - \gamma g_2)\beta\Psi(1-\beta\Psi)^{-1}$$. This enables us to derive an estimate of the optimal current account (with asymmetry in access to the international financial market). The $$CA_t^{****}$$ is the optimal current account, given the presence of asymmetry in access to the international financial markets.
Other tests of the validity of the PVMCA (with asymmetry in access to the international financial market), \( CA_i \), can be tested by investigating the following restrictions:

- there is equality between the mean and variance of the optimal current account (with asymmetry in access to the international financial market) and the actual value of the current account;

- That \( CA_i^h \) Granger-causes future changes in net output, as defined by \( \Delta Q_i^h \) and that the \( CA_i^1 \) does not Granger-cause \( \Delta Q_i^h \). This is to check the postulation that expected higher output in the future (\( \Delta Q_i^h \)) does not impact upon the current account in the current period and that expected future decline in output (\( \Delta Q_i^1 \)) generates current account surplus in the current period.

This Chapter has provided several variants of the present value model of the current account, ranging from models based on the assumption of a constant interest rate to a model that explicitly takes into consideration changes in the exchange rate, terms of trade and asymmetry in access to international financial markets. The theoretical contribution of this thesis lies in using some of the features of the Nigerian economy described in Chapter 3 to produce a PVMCA that captures these features. We have extended for the first time the established PVMCA to accommodate terms of trade changes. We further extended the theoretical framework to accommodate possible asymmetry in access to international financial markets. We have suggested, as testing for a presence of asymmetry in the
PVMCA, additional conditions for testing the validity of the PVMCA, given the introduction of changes in interest rate, exchange rate and terms of trade. While this thesis may not have covered all the distinctive characteristics of the Nigerian economy, it represents a step in the right direction in formulating the appropriate theoretical framework for analyzing its current account. This framework can be used to analyze the current account of small industrial open economies as well as of developing countries. It is suitable for assessing the issue of excessiveness of current account deficits.
Appendix IA

This Appendix demonstrates the equality of (4.36) and (4.38). To show this, we first need to derive an expression for $P_t^*$. To achieve this, we use the period utility function in (4.37) and the constraint that $C_t = C_{Tt} + P_t C_{NTt}$ to solve for the optimal intratemporal allocation of expenditure between the tradable and nontradable goods. Using the first-order condition that the marginal rate of substitution between tradable and nontradable goods should equal their relative price, we have:

\[
C_{NTt} = (1-\alpha) \frac{C_t}{P_t}, C_{mt} = \alpha C_t
\]  

(4.75)

The optimal values of tradable and nontradable goods are substituted into the definition for $C^*$, which yields:

\[
C_t^* = (\alpha C_t) \left[ (1-\alpha) \frac{C_t}{P_t} \right]^{1-\alpha}
\]  

(4.76)

Now use the condition that $P^*$ is defined such that $C^*=1$. This produces:

\[
C_t^* = \left( \alpha P_t^* \right) \left[ (1-\alpha) \frac{P_t^*}{P_t^*} \right]^{1-\alpha} = 1
\]  

(4.77)

Solving (4.77) for the consumption-based price index, $P_t^*$, yields:

\[
P_t^* = P_t (1-u) \left[ \frac{1}{\alpha^\alpha (1-\alpha)(1-u)} \right]
\]  

(4.78)
Note that \( \frac{C_t}{P_t^*} \) is the ratio of spending, measured in units of tradables, to the minimum price, in tradables, of a single unit of the consumption index. Therefore, \( \frac{C_t}{P_t^*} \) is the index of the total real consumption of an optimizing consumer. Let

\[
C_t^* = \frac{C_t}{P_t^*}
\]

Given that:

\[
C_t^* = \frac{C_T + p_1 C_{Nt}}{P_t^*}
\]

\[
P_t^* C_t^* = C_t + p_1 C_{Nt} \quad (4.79)
\]

This provides the justification for writing the dynamic budget constraint in (4.36) as (4.38).
Appendix IB

Equation (4.49) was:

\[ \Gamma_0 = \sum_{t=0}^{\infty} E_0(R^*, Q_t) \]

Equation (4.49) implies the law of motion for \( \Gamma_t \):

\[ \Gamma_{t+1} = (1+r^*)(\Gamma_t - Q_t), \quad \text{for } t \geq 0. \]  

(4.80)

Dividing (4.80) by \( \Gamma_t \), and taking logarithms on both sides, yields:

\[ \varphi_{t+1} - \varphi_t = \ln(1+r^*) + \ln \left( 1 - \frac{Q_t}{\Gamma_t} \right) \]

\[ \approx r^* + \ln(1 - \exp(q_t - \varphi_t)) \]  

(4.81)

where \( \varphi = \log \Gamma \) and we made use of the approximation that \( \log (1+r^*)=r^* \)

Next, take a first-order Taylor expansion of \( \ln (1-\exp(q_t-\varphi_t)) \) in (4.81) around a normal level of \((q_t-\varphi_t)\). This yields:

\[ \ln(1-\exp(q_t - \varphi_t)) \approx k + \left( 1 - \frac{1}{\rho} \right)(q_t - \varphi_t) \]  

(4.82)

Therefore, we can write (4.81) as:

\[ \varphi_{t+1} - \varphi_t \approx r^*_t + k + \left( 1 - \frac{1}{\rho} \right)(q_t - \varphi_t) \]  

(4.83)

where

---

22 This presentation follows the work of Huang and Lin (1993) closely. While their presentation focuses on fiscal policy, it is equally applicable in analyzing the current account balance.
\[ p = 1 - \exp(q_t - \varphi_t) = 1 - \frac{Q_t}{\Gamma_t}, \text{a number slightly less than one, and} \]

\[ k = \ln(p) - \left(1 - \frac{1}{p}\right) \ln(1-p) \]

Note that

\[ \varphi_{t+1} - \varphi_t \approx \Delta q_{t+1} + (q_t - \varphi_t) - (q_{t+1} - \varphi_{t+1}) \]  

(4.84)

Substituting (4.83) into (4.84) yields:

\[ -(q_{t+1} - \varphi_{t+1}) + \left(1 - \frac{1}{p}\right)(q_t - \varphi_t) \approx -\Delta q_{t+1} + r^*_t + k \]  

(4.85)

Solving the above difference equation forward produces

\[ q_0 - \varphi_0 = \sum_{t=1}^{\infty} \rho^t (r^*_t - \Delta q_t) + \eta \]  

(4.86)

where: \( q_0 = \ln Q_0; \varphi_0 = \ln \Gamma_0; \Delta q_t = q_t - q_{t-1}; \) and \( \eta \) is a constant.
Appendix IC

The derivation here is quite similar to that in Appendix IA. Our intention is to show that the dynamic budget constraint in (4.61) is valid. Using the first-order condition that the marginal rate of substitution between importable and nontradable goods should equal their relative price, we have:

\[ C_{NTt} = \frac{(1-\alpha)}{P_{nt}} C_{t}; \quad C_{mt} = \frac{\alpha}{P_{mt}} C_{t} \]  
\[ (4.87) \]

Once we have derived the optimal choice of both importable and nontradable goods, they are substituted in the definition for \( C^* \), which in turn yields:

\[ C_t^* = \left( \frac{\alpha}{P_{mt}} C_t \right)^{\alpha} \left[ \frac{1 - \alpha}{P_t \cdot P_{nt}^*} \right]^{1-\alpha} \]  
\[ (4.88) \]

Now we use the condition that \( P^* \) is defined such that \( C^* = 1 \). This gives:

\[ C_t^* = \left( \frac{\alpha}{P_{mt}} P_t^* \right)^{\alpha} \left[ \frac{1 - \alpha}{P_t \cdot P_{nt}^*} \right]^{1-\alpha} = 1 \]  
\[ (4.89) \]

Solving (4.89) for the consumption-based price index, \( P_t^* \), produces:

\[ P_t^* = P_{mt}^* P_{nt}^* \left[ \frac{1}{\alpha \left(1 - \alpha \right)^{1-\alpha}} \right]^{\frac{1}{\alpha (1-\alpha)}} \]  
\[ (4.90) \]

Note that \( C_t/P_t^* \) is the ratio of spending, measured in units of exportables, to the minimum price, in exportables, of a single unit of the consumption index. Thus \( C_t/P_t^* \) equals the level of the total real consumption index \( C_t^* \) that an optimizing consumer enjoys. Therefore:

\[ C_t^* = \frac{C_t}{P_t^*}; \quad C_t = P_{mt} C_{mt} + P_{nt} C_{NTt} \]
\[ C_t^* = \frac{p_m C_{mt} + p_{nt} C_{NTt}}{P_t^*} \]

\[ P_t^* C_t^* = p_{mt} C_{mt} + p_{nt} C_{NTt} \quad (4.91) \]

This provides the justification for writing the dynamic budget constraint as

(4.61).
CHAPTER 5

ECONOMETRIC ESTIMATION OF THE PRESENT VALUE MODEL OF THE CURRENT ACCOUNT

5.1 Introduction

This chapter conducts an empirical investigation of the present value model of the current account (PVMCA) presented in chapter four. To recast, the standard PVMCA was extended in chapter four to accommodate the impact of changes in the interest rate, exchange rate and terms of trade on the current account. Also, given political and macroeconomic instabilities in Nigeria, during the period covered by the thesis, 1960-97, possible asymmetry in access to the international financial market was taken into consideration.

This chapter seeks to answer one important question: to what extent is the PVMCA an adequate framework for analyzing the current account of Nigeria? Apart from the overall objective of providing answers to this question, we are also interested in the fit of the PVMCA. The major contributions of this chapter are the following.

First it estimates an intertemporal model of the current account that includes changes in the interest rate and exchange rate for the Nigerian economy. As mentioned in Chapters 3 and 4, the obvious mixed empirical support for the PVMCA could be attributed to the exclusion of transmission channels through which external
shocks could impact on the current account. It is expected that taking these variables into consideration would likely enhance the performance of the PVMCA.

Second, this chapter estimates a PVMCA that accommodates changes in the terms of trade. In the context of the Nigerian economy, unexpected changes in the terms of trade are the major source of external shocks. The oil price shock of the early 1970s is a good example of the sensitivity of the Nigerian economy to developments in the world oil markets. It is, therefore, important to assess whether including changes in the terms of trade in a PVMCA that already accommodates variations in the interest rates and exchange rates would change the results obtained from not taking it into consideration.

Third, this chapter estimates a PVMCA that allows for asymmetry in access to the international financial capital markets. In chapter 4, we noted that one of the inherent weaknesses of the standard consumption-smoothing model of the current account is its assumption of unrestricted access to the international financial market. We remarked that private economic agents in Nigeria may have no difficulty smoothing consumption in anticipation of lower income, however, they may not be able to use the international financial market fully to smooth consumption in the event of expected higher income or unanticipated decline in income. This inability may result from a number of factors, including poor macroeconomic management, political instability and high levels of existing external debts. Asymmetrical access could also emanate from inability to service external obligations in the past. If we indeed can establish asymmetry in access to the international financial market, this implies that economic agents in Nigeria will not be able to borrow to maintain a
smoothed level of consumption, with consequent fall in their welfare level. If the sources of asymmetry can be established, this provides a basis for recommending policy measures to enhance more access to the international financial market. Our interest in assessing asymmetry in access also arises from the need to examine the excessiveness of current account deficits. In the event of an asymmetry in access to the international financial markets, deviations of actual current account balances from an optimal benchmark derived from the assumption of free capital mobility would not reveal the actual degree of external imbalances.

Moreover, as a follow-up to possible asymmetry in access to the international financial markets, we explore whether the oil prices shocks of the early 1970s increased the Nigerian economy’s access to the international financial market. It has been noted that the oil boom of the 1970s hastened the integration of the oil-exporting countries into the international financial market. The important thing to establish is whether the PVMCA can capture this. We also investigate whether the introduction of the Structural Adjustment Program (SAP) has increased the access of the Nigerian economy to the international financial market. Market-oriented measures such as the market determination of the interest rates and exchange rates accompanied the introduction of the SAP. Market determination of the interest and exchange rates, coupled with sound and consistent macroeconomic management should increase international capital markets participant’s confidence in the Nigerian economy and culminate in additional international capital flows to the economy for the consumption-smoothing purposes. To capture these developments, the impacts
of the oil price shock of 1973 and the introduction of Structural Adjustment Program in 1986 on the Nigerian current account are evaluated.

Apart from extending the PVMCA theoretically, its various variants are estimated using time series data on Nigeria. Overall, after taking into consideration interest rate movements, changes in the exchange rate and the terms of trade and possible restrictions on the international financial markets, we conclude that the PVMCA is a valid theoretical framework for analyzing the current account: most of the implications of the model are satisfied by the Nigerian data.

The PVMCA is also able to capture the evolution of the actual current account balance. Nonetheless, the actual current account is more volatile than the optimal, suggesting that speculative factors are a major driving force behind capital flows. Policies of administrative determination of the nominal exchange rate and interest rate, especially before 1986, along with macroeconomic instability, have engendered speculative capital flows (including capital flights and reversals) in Nigeria. Given the condition that the current account is simply the capital account component of the balance of payments and changes in net international reserves, volatility in capital flows have been reflected in current account volatility.

There is evidence that the introduction of the Structural Adjustment Program has not altered the relationship between the change in net output and the current account, while oil prices shocks did increase Nigerian access to the international
financial market\textsuperscript{1}. This implies that the introduction of the SAP has not led to an increase in access of the Nigerian economy to the international financial market. On the other hand, the oil prices shocks of early 1970s did bring about a significant increase in the Nigerian economy’s access to the international financial markets.

This chapter has nine sections. Section 5.2 deals with data presentation, detailing the derivation of the variables used to conduct the empirical investigation of the PVMCA and sources of the data. Section 5.3 focuses on the results obtained from the empirical implementation of the benchmark model, which does not consider, interest rate, changes in the exchange rates and the terms of trade and possible asymmetry in access to the international financial markets. Section 5.4 presents the results of a PVMCA that extends the benchmark model to accommodate changes in the interest rate and the exchange rate. Section 5.5 presents the results obtained from extending the PVMCA to account for changes in the terms of trade. Section 5.6 examines the effects of incorporating asymmetry in access to the international financial markets. Section 5.7 reports the results of accommodating the oil prices shock of 1973. Section 5.8 presents the results from accounting for the introduction of the structural adjustment program in 1986. The last section concludes the chapter and indicates the need for caution on the part of the Nigerian government in its reactions to external shocks, since private agents, to

\textsuperscript{1} One criterion to testing the validity of the PVMCA is to examine whether current account Granger-cause expected change in net output (the difference between GDP, investment and government expenditure). This is used to examine whether there has been a change in the relationship between the current account and the change in the net output both in pre-and post-SAP and oil prices shock periods.
some extent, could allocate consumption intertemporally and intratemporally. Also, the need to identify the source of current account deficits before any policy measures could be put in place is emphasized.

5.2 Data and Parameter Values

We use annual data during the 1960-97 period. We collected data on private consumption, government consumption, investment and gross domestic product (GDP). All variables are cast in real per capita terms by dividing the nominal variables by the GDP deflator (1995=100) and the level of total population. The National Income Accounting (NIA) data used for the analysis originate from the World Bank, Social Indicators of Development database. The data on the variables used for the analysis are provided in Appendix I.

The actual current account series, \( c_{at} \), was constructed by subtracting the log of per capita real private consumption expenditure from the log of net output, \( (q_t)^2 \). The net output series, \( q_t \), is computed by subtracting government and investment expenditures from the GDP. We took the log and first difference of \( q_t \), which gives the change in net output, \( c_{net} \).

We compute a proxy for the world real interest rate, \( r_t^* \). The expected real interest rate is defined as the London Interbank Offer Rate (LIBOR) adjusted for expected rate of inflation in the industrial countries. This is consistent with previous

\[ \text{Bergin and Sheffrin (2000) used the same approach to arrive at the current account balance.} \]
studies on the current account determination for a developing country such as Nigeria [Nyatepe-Coo (1993), Khan and Knight (1983)].

The available time series data on the real effective exchange rate for Nigeria covers the 1980-97 period. In order to arrive at estimates of the real effective exchange rate during 1960-97, we first compute the bilateral exchange rates between Nigeria and a trading partner. This is summed across six major trading partners: France, Germany, Japan, Netherlands, U.K, and the USA. The weight assigned to a trading partner reflects the extent of trade flows between that partner and Nigeria. The terms of trade is defined as the relative price of imports in terms of exports. The ex-ante expected change in the exchange rate and terms of trade are computed using a one-year autoregression. The first set of the consumption-based interest rate, \( \hat{r} \), is given by the world interest rate \( r^* \) adjusted for the expected change in the exchange rate. The second set of the consumption-based interest rates, \( \hat{\bar{r}} \), adjusts for both changes in the exchange rate and the terms of trade. Given the interest in the dynamic implications of the model, the series cneot, cat, \( \hat{r} \), and \( \hat{\bar{r}} \) are expressed as deviations from their means in the VAR processes.

There are three other parameters that are important for implementing the PVMCA empirically: the elasticity of intertemporal substitution, \( \gamma \), the share of tradable/importable goods in the total consumption expenditure, \( \alpha \), and the preference parameter, \( \beta \). We use outside studies in order to arrive at estimates for these parameters. Arguments abound in the literature as to the size of the intertemporal elasticity parameter. Given the fact that this study allows for
nontradable goods, we tend to support the position of Ostry and Reinhart (1992), that the intertemporal elasticity of substitution is different from zero. In their study, the intertemporal elasticity of substitution ranged between 0.38 and 0.50\(^3\). The preference parameter fell in the range of 0.96-0.99\(^4\). We use the estimate derived by Ostry and Reinhart and conduct present value tests using 0.85\(^5\) as the share of tradable goods in the consumption basket. The results reported in this chapter use intertemporal elasticity of substitution of 0.451, as there were hardly any qualitative and quantitative differences between the model under assumptions of 0.4551 or 0.443. The econometric techniques used to conduct the empirical implementation of the PVMCA are presented in Appendix II.

\(^3\) The intertemporal elasticity (\(\gamma\)) using instrument set I is found to be 0.451 for African countries and 0.443 using instrument set II. The distinction between the two instruments is that in the first one, the levels of consumption of importable and non-traded goods are used as instruments, whereas, their ratio was used as instrument in the second instrument.

\(^4\) In the current context, \(\hat{\beta} = \frac{1}{1 + \hat{r}^*} = 0.97\). \(\hat{r}^*\) is the average of the computed real LIBOR rate.

\(^5\) One approach to determining the share of the nontradables in the consumption basket is to break down expenditure by categories Kravis \textit{et al.} (1982). Expenditures on the following categories are normally used as proxy for nontradables: rent, fuel, transportation and communication. In Nigeria, using these expenditure items, the share of nontradables is about 15 percent of the consumption basket.
5.3 The Standard Present Value Model of the Current Account

Following the derivations in section (4.2) of Chapter 4, the equation describing the optimal current account balance, when changes in the interest rate, exchange rate and possible asymmetry in access to the international financial market are excluded, is re-presented in equation (5.1) for ease of presentation:

$$\begin{align*}
    \text{ca}^* &= -[1 \ 0] (\beta \Psi') (1-\beta \Psi)^{-1} \begin{bmatrix}
        \text{cneo}_t \\
        \text{ca}_t
    \end{bmatrix} \\
    &= [\Phi_{\Delta \text{cneo}} \ \Phi_{\text{ca}}] \begin{bmatrix}
        \text{cneo}_t \\
        \text{ca}_t
    \end{bmatrix}
\end{align*}$$

(5.1)

where: $\Psi$ is the VAR parameters, and $r^*$ is the world interest rate, which is proxied by the London Interbank Offer Rate (LIBOR) in this thesis. To evaluate the model, we have to test the restriction that $[\Phi_{\Delta \text{cneo}} \ \Phi_{\text{ca}}] = [0 \ 1]$ using the delta method to calculate a $\chi^2$ statistic for the hypothesis that $k = [\Phi_{\Delta \text{cneo}} \ \Phi_{\text{ca}}] = [0 \ 1]$. Assuming the difference between the actual $k$ and the hypothesized value is $g$; and the standard errors needed for this test are $\left( \frac{\partial k}{\partial \psi} V \left( \frac{\partial k}{\partial \psi} \right)' \right)^{-1}$; then $g \left( \frac{\partial k}{\partial \psi} V \left( \frac{\partial k}{\partial \psi} \right)' \right)^{-1} g$ will be distributed chi-squared with two degrees of freedom, where $V$ is the variance-covariance matrix of the VAR parameters, and

---

As noted in Chapter 4, the summaries of the implications of the present value model of the current account tested are: that the stationarity of the optimal current account is due to the stationarity of the change in net output; that there is equality between the optimal and actual current account; that there is equality of variances of the optimal and current accounts; and finally, that the stationarity of the optimal current account implies the stationarity of the actual current account. All these implications are applicable to the various variants of the PVMCA.
\((\frac{\partial k}{\partial \psi})\) is the matrix of derivatives of the \(k\) vector with respect to these VAR parameters.

The variables entering the VAR in (5.1), \(c_{neO_t}\) and \(c_{a_t}\), must be stationary. The results of applying the ADF and PP tests, presented in Table 5.1, do not include a constant and a time trend, since the variables are expressed in deviations from their means. The current account \((c_{a_t})\) and the change in net output \((c_{neO_t})\) are found to be stationary variables at significance levels of 5%. Moreover, the intertemporal model of the current account as indicated in equation (5.1), implies that the optimal current account is a stationary variable. If the intertemporal model is valid—that is, the actual current account equals the optimal current account—the actual current account must also be stationary. Using the Augmented Dickey Fuller and the Phillips-Perron Unit root tests, this implication is found to be valid, as the actual current account appears to be stationary. This constitutes evidence in favor of the present value model of the current account.

The vector autoregression in \(c_{neO_t}\) and \(c_{a_t}\) required for the evaluation of (5.1) is estimated by applying OLS to its constituent equations. A one-lag VAR for the variables of interest, \(c_{neO_t}\) and \(c_{a_t}\), is chosen by the Akaike Information Criterion (AIC) and Schwarz Criterion (SC). The VAR parameters needed to derive the optimal current account balance in (5.1) are presented in Table 5.2a.

Tests of restrictions implied by the PVMCA are reported in Table 5.2b. As shown in Fig 5.1, the standard model is able to predict the general direction of current account movements, especially the current account deficits in the 1960s, the
1974 and 1979-80 current account surpluses arising from global increases in oil prices, the 1981-83 current account deficits and the improvements in the current account position in the last three years covered by this study. Despite this performance, the statistical test rejects the model. With one lag and two variables, the k-vector based on the PVMCA is expected to be [0 1]. However, the estimated values are [-0.11 0.71]. While the coefficient on the current account at date t is statistically different from zero, it is quite different from 1 (see Table 5.2b). However, the change in net output, cneO_t is found not to be significantly different from its theoretical value of zero. The model’s current account is only 44 percent as volatile as the actual. Overall, the χ² test strongly rejects the model, with a p-value of zero. As noted by Bergin and Sheffrin (2000), this result is typical of most previous empirical investigations in this area: while a simple graphical analysis appears to suggest that the standard PVMCA can explain a significant portion of the movements in the actual current account, the model rarely satisfies statistical tests.

The failure of the model in terms of statistical tests could be attributed to the exclusion of channels through which external shocks could impact upon the current account. In Nigeria, current account deficits in the mid-1980s partly reflected the policy of fixed exchange rate determination, which culminated in the appreciation of the real exchange rate. Real exchange rate appreciation lowered the cost of imported goods, which lowered the consumption-based interest rate and therefore led to the deterioration of the current account balance. It is therefore not a surprise that the economy embarked upon a Structural Adjustment Program in 1986.
Table 5.1  Unit Root Tests*

<table>
<thead>
<tr>
<th>Variable (First Difference)</th>
<th>ADF</th>
<th>PP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in net output (cneo)</td>
<td>-5.23</td>
<td>-5.81</td>
</tr>
<tr>
<td>Actual Current account (ca)</td>
<td>-3.28</td>
<td>-3.40</td>
</tr>
<tr>
<td>Optimal current account (ca*)</td>
<td>-3.19</td>
<td>-3.72</td>
</tr>
</tbody>
</table>

* ADF indicates the augmented Dickey-Fuller test; PP represents the Phillip-Perron test.

Fig 5.1

Actual and Optimal Current Accounts

(Excluding Changes in Interest Rate, Real Exchange rate and Terms of Trade)
Table 5.2  VAR components of the Present Value Model of the Current Account

<table>
<thead>
<tr>
<th>Equation</th>
<th>Regressors**</th>
</tr>
</thead>
<tbody>
<tr>
<td>$c_{net}$</td>
<td>$c_{net_{i-1}}$</td>
</tr>
<tr>
<td></td>
<td>0.184 (0.186)</td>
</tr>
<tr>
<td>$ca_i$</td>
<td>0.129 (0.166)</td>
</tr>
</tbody>
</table>

Table 5.2b Tests of the Present Value model of the Current Account

<table>
<thead>
<tr>
<th>Equation</th>
<th>Regressors**</th>
</tr>
</thead>
<tbody>
<tr>
<td>$c_{net}$</td>
<td>-0.11 (0.13)</td>
</tr>
<tr>
<td>$ca_i$</td>
<td>0.71 (0.02)</td>
</tr>
</tbody>
</table>

$\chi^2=384.59; p\text{-value}=0.000; \text{var} (ca_i)/\text{var} (ca_i)=44.32$

** Standard errors in parentheses

5.4 The Standard Model Adjusted for Changes in the World Interest Rate and Real Exchange Rate

As explained both in Chapters 3 and 4, the exclusion of channels (interest rate and exchange rate) through which external shocks could impact on the current account provides a possible explanation for the rejection of the stringent restriction of the PVMCA. The results presented in Table 5.2b are broadly consistent with the findings of the previous studies that exclude changes in the interest rate and
Section (4.3) in Chapter 4 presented a PVMCA that includes changes in the interest rate and the exchange rate.

The equation for the optimal current account balance, with changes in the interest rate and exchange rate is given by:

\[ hz_t = -\sum_{t=1}^{\infty} \beta^{t-1} (g_t - \gamma g_2) \Psi^{t-1} z_t \]  \hspace{2cm} (5.2)

The variables in (5.2) are defined as follows: \( z_t = (\text{cneot}, \text{cat}, \hat{r}_t) \), \( g_1 = [1 0 0] \), \( g_2 = [0 0 1] \), and \( h = [0 1 0] \) and \( \hat{r}_t \) is the consumption-based interest rate that includes the world real interest rate, and expected change in the exchange rate. Equation (5.2) can be re-written as:

\[ \text{ca}_t^{**} = kz_t \]  \hspace{2cm} (5.3)

\[ k = - (g_1 - \gamma g_2) \beta \Psi (I - \beta \Psi)^{-1} \]

We examine the time series properties of \( \text{cneot}, \text{cat}, \text{and} \hat{r}_t \), as they have to be stationary in order to enter the VAR process. We employ the value of 0.45 for the intertemporal elasticity and we use 0.85 for the share of the tradable goods. The ADF and PP unit root tests reveal the stationarity of the consumption-based interest rate. Table 5.3 reports the unit root tests. The consumption-based interest rate and the optimal current account balance are stationary variables at the 5% significance levels. The VAR parameters are shown in Table 5.4a, while the present value tests are reported in panel b of the same Table. By introducing expected change in the real exchange rate, the PVMCA model is not rejected; this is contrary to a model that excludes a consumption-based interest rate above. With one lag and three
variables, the theoretically expected k-vector is [0 1 0]. However, the estimates are [-0.07 0.68 -0.39]. The coefficient on the change in net output is closer to its theoretical value of zero, relative to the benchmark model, while the coefficient on the current account in a model that includes consumption-based interest rate is less than that of the benchmark model. There appears to be no significant differences between the volatility of the optimal current account, when exchange rate and interest rate movements are factored in, relative to a model that excludes them, as it remains at 44 percent of the actual\textsuperscript{7}. This indicates that the lower volatility of the optimal current account cannot be attributed to the exclusion of the source through which changes in external shock affect the current account balance in the context of the Nigerian economy.

In respect to the overall performance of the intertemporal model, the $\chi^2$ test does not reject the model, with a p-value of 0.7. While the stringent restriction implied by the PVMCA is rejected in the case of the benchmark model in section 5.3, it appears that including changes in interest rate and exchange rate matters for current account determination. The optimal current account when the consumption-based interest rate is introduced is shown in (Fig 5.2) and is able to closely track the evolution of the actual current account balance during the period 1963-97.

While Chapter 4 demonstrated the impact on the current account of changes the interest rate and the exchange rate, Nigeria maintained what amounted to a

\textsuperscript{7} This result is similar to those obtained by Bergin and Sheffrin (2000) for Canada, where there was a difference between the theoretical k-vector and the actual k, and the stringent restriction of the PVMCA was not rejected and the optimal current account is 50% as volatile as the actual.
fixed nominal exchange rate up to 1986. With administrative determination of the exchange rate, the Nigerian economy missed one channel that would have been used to reduce the external imbalances associated with the declining terms of trade in the first half of 1980s. The adverse effects of nominal exchange rate overvaluation were reinforced by high domestic inflation, and growing fiscal deficits after the collapse in oil prices. This explains why the current account was excessive during 1981-1983: there was exchange rate real appreciation that favors excess consumption.

Table 5.3. Unit Root Tests*

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADF</th>
<th>PP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in net output (cneo)</td>
<td>-5.23</td>
<td>-5.81</td>
</tr>
<tr>
<td>Actual Current account (ca)</td>
<td>-3.28</td>
<td>-3.40</td>
</tr>
<tr>
<td>Optimal current account (CA*)</td>
<td>-3.23</td>
<td>-4.04</td>
</tr>
<tr>
<td>Consumption-based Interest rate</td>
<td>-3.88</td>
<td>-4.17</td>
</tr>
<tr>
<td>($\gamma=0.45; \infty=0.85; \text{exchange rate}$)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* ADF indicates the augmented Dickey-Fuller test; PP represents the Phillip-Perron test.

Fig 5.2

Actual and Optimal Current Accounts
(Including changes in the interest rates and exchange rates)
Table 5.4a  VAR components of the Present Value Model of the Current Account

<table>
<thead>
<tr>
<th>Equation</th>
<th>Regressors**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>cneo_{t-1}</td>
</tr>
<tr>
<td>cneo_t</td>
<td>0.118</td>
</tr>
<tr>
<td></td>
<td>(0.186)</td>
</tr>
<tr>
<td>ca_t</td>
<td>0.065</td>
</tr>
<tr>
<td></td>
<td>(0.164)</td>
</tr>
<tr>
<td>\hat{f}_t</td>
<td>-0.001</td>
</tr>
<tr>
<td></td>
<td>(0.066)</td>
</tr>
</tbody>
</table>

Table 5.4b  Tests of the Present Value model of the Current Account

<table>
<thead>
<tr>
<th>Equation</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>cneo_t</td>
<td>-0.07979</td>
</tr>
<tr>
<td></td>
<td>(0.35024)</td>
</tr>
<tr>
<td>ca_t</td>
<td>0.68926</td>
</tr>
<tr>
<td></td>
<td>(0.28534)</td>
</tr>
<tr>
<td>\hat{f}_t</td>
<td>-0.39251</td>
</tr>
<tr>
<td></td>
<td>(0.50460)</td>
</tr>
</tbody>
</table>

\( \chi^2 = 1.42129; \ p-value = 0.701; \ \text{var} (\text{ca}_t^*)/\text{var} (\text{ca}_t) = 43.8 \)

** Standard errors in parentheses
5.5 The Standard Model Adjusted for Changes in the World Interest Rate, Real Exchange Rate and Terms of Trade

One particular variable that might have made an impact on the current account balance of the Nigerian economy could be changes in the terms of trade. In order to reflect this, in section (4.4) of Chapter 4, we extended the PVMCA to capture expected change in the terms of trade. With the introduction of expected change in the terms of trade, the current change in the consumption-based interest rate could come either from expected changes in the world real interest rate, in the real exchange rate as well as the terms of trade or a combination of these.

With the introduction of changes in the terms of trade into a model that already has changes in the interest rate and the exchange rate, the optimal current account balance, as demonstrated in chapter four, is given by (5.4):

\[ h_{zt} = - \sum_{t=1}^{\infty} \beta^{t-z} (g_1 - \gamma g_2) \Psi^{t-z} z_t \]  

(5.4)

where: 
- \( z_t = (c_{neot}, c_{at}, \hat{r}_t)' \),
- \( g_1 = [1 \ 0 \ 0] \),
- \( g_2 = [0 \ 0 \ 1] \), and
- \( h=[0 \ 1 \ 0] \) and \( \hat{r}_t \) is the consumption-based interest rate that includes the world interest rate, expected change in the exchange rate and the terms of trade. Equation (5.5) can be rewritten as:

\[ c_{at}^{**} = k z_t \]  

(5.5)

\[ k = - (g_1 - \gamma g_2) \beta \Psi (I - \beta \Psi)^{-1} \]

The variables entering the VAR, \( c_{neot}, c_{at} \), and \( \hat{r}_t \), are examined for their degrees of integration. We use 0.45 as the value for the intertemporal elasticity and
0.85 for the share of tradables. The unit root tests show that the variables of interest are integrated of order zero. Table 5.5 reports the unit root tests. The consumption-based interest rate and the optimal current account balance are found to be stationary at the 5% significance level. The stationarity of the optimal current account balance is evidence in favor of the PVMCA. The VAR parameters are shown in Table 5.6a and the present value tests are reported in panel b.

The incorporation of changes in the terms of trade does not appear to improve the fit of the PVCMA (when changes in the interest rate and exchange rate have already been taken into consideration). However, it outperforms a model that does not incorporate the transmission mechanisms through which an external source can impact on the current account. The coefficient on the current account at date t was 0.680, instead of the theoretical value of 1. This is less than 0.69, when the changes in the interest rate and exchange rate are considered. The coefficient on the change in net output, $c_{no_t}$, is -0.12, which is different from its theoretical value of 0 and -0.08, when the terms of trade were not considered. The value on the consumption-based interest rate when the terms of trade were taken into consideration was -0.02, whereas it was 0.39 when only the expected change in the exchange rate was taken into consideration.

Moreover, the volatility of the optimal current account is 43 percent of that of the actual current account (which is closer to the value obtained when changes in the terms of trade are excluded). Lastly, the $\chi^2$ test does not reject a PVMCA that includes interest rate, and changes in the real exchange rate and the terms of trade.
Recognizing that an unexpected temporary deterioration in the terms of trade produces income effect, intertemporal and intratemporal effects can explain the above results. Given consumption-smoothing, the income effect of an increase in the relative price of importables would produce current account deterioration. The intratemporal effect would encourage postponing the consumption of tradables in the current period. The fall in the terms of trade makes nontradables cheaper, leading to increased demand for the nontradables, with consequent real exchange rate appreciation. Thus, the overall impact of a temporary, but unanticipated change in the terms of trade depends on the income, intratemporal and intertemporal effects. The inclusion of the change in the terms of trade and the real exchange rate in the definition of the consumption-based interest implied that the terms of trade is capturing the intertemporal effects and the real exchange rate is capturing the intratemporal effect. The apparent significant similarity between a model that accommodates real exchange rate and the one that does not in an intertemporal framework suggests that the intratemporal effect of a shock may be more important than that of the intertemporal effect in the Nigerian context.
Table 5.5  Unit Root Tests*

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADF</th>
<th>PP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in net output (cneo)</td>
<td>-5.23</td>
<td>-5.81</td>
</tr>
<tr>
<td>Actual Current account (ca)</td>
<td>-3.28</td>
<td>-3.40</td>
</tr>
<tr>
<td>Optimal current account</td>
<td>-3.33</td>
<td>-3.88</td>
</tr>
<tr>
<td>Consumption-based Interest rate (γ=0.45; α=0.5; exchange rate)</td>
<td>-4.64</td>
<td>-5.66</td>
</tr>
</tbody>
</table>

* ADF indicates the augmented Dickey-Fuller test; PP represents the Phillip-Perron test.

Figure 5.3

Actual and Optimal Current Accounts
(Including changes in the interest rates, exchange rates and the terms of trade)
Table 5.6a  VAR components of the Present Value Model of the Current Account

<table>
<thead>
<tr>
<th>Equation</th>
<th>Regressors**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>c neo_t_1</td>
</tr>
<tr>
<td>c neo_t_1</td>
<td>0.219</td>
</tr>
<tr>
<td></td>
<td>(0.188)</td>
</tr>
<tr>
<td>ca_t</td>
<td>0.177</td>
</tr>
<tr>
<td></td>
<td>(0.165)</td>
</tr>
<tr>
<td>( \hat{f}_t )</td>
<td>-0.106</td>
</tr>
<tr>
<td></td>
<td>(0.507)</td>
</tr>
</tbody>
</table>

Table 5.6b Tests of the Present Value model of the Current Account

<table>
<thead>
<tr>
<th>Equation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>c neo_t_1</td>
<td>-0.119</td>
</tr>
<tr>
<td></td>
<td>(0.363)</td>
</tr>
<tr>
<td>ca_t</td>
<td>0.680</td>
</tr>
<tr>
<td></td>
<td>(0.613)</td>
</tr>
<tr>
<td>( \hat{f}_t )</td>
<td>-0.016</td>
</tr>
<tr>
<td></td>
<td>(0.896)</td>
</tr>
</tbody>
</table>

\( \chi^2=1.69; \) p-value=0.639; \( \text{var (ca\_t^*)}/\text{var (ca\_t)}=42.83 \)

** Standard errors in parentheses
5.6 Asymmetry in Access to the International Financial Market

It was postulated in chapter 4 that private agents in Nigeria may not have full or complete access to the international financial markets, possibly reflecting political instability, macroeconomic instability and a high level of existing external obligations. The existence of these factors could weaken the ability of economic agents to meet existing and new external obligations that may fall due.

In order to test this proposition, we extend the PVMCA that already has changes in the interest rate and exchange rates to reflect this market imperfection. Taking this factor into consideration produces the path of a current account balance that is different from the one under the assumption of unrestricted access to the international financials market. Such an attempt adds to our understanding of the current account from an intertemporal perspective. Despite the fact that the economy may be solvent, the prevalence of factors that weaken the ability of private agents to meet their external obligations may reduce the willingness of creditors to continue lending on current terms.

From (5.6), the restriction on the optimal current account (with asymmetry in access to the international financial market) is given by:

\[ h z_t = - \sum_{t=1}^{\infty} \beta^{1-t} (g_1 - \gamma g_2) v^{1-t} z_t \]

(5.6)

where \( z_t = (cneo_t^h \ cneo_t^l \ ca_t^h \ ca_t^l \ \hat{r}_t)^t \), \( g_1 = [1 1 0 0 0] \), \( g_2 = [0 0 0 1] \), and \( h = [0 0 1 1 0] \); \( ca_t^h \ (ca_t^l) \) equals \( ca_t \) when \( ca_t \) is positive (negative) and \( ca_t^h \ (ca_t^l) \) is zero, and
cneo\textsuperscript{t} = (cneo\textsuperscript{t}) equals cneo\textsubscript{t} when cneo\textsubscript{t} is positive (negative) and cneo\textsuperscript{t} = (cneo\textsubscript{t}) is zero. Re-expressing (5.6), we have:
\begin{equation}
ca\textsubscript{t} = kz\textsubscript{t} (5.7)
\end{equation}
where: 
\[k = -(g1 - yg2)\beta\psi(1 - \beta\psi)^{-1}\]

When a possible asymmetry in access to the international financial markets is introduced, the model is not rejected, as indicated by a p-value of 0.6. This implies that the imposition of asymmetry in access to the international financial market is a valid restriction. The estimated k vector is given by [0.14 -0.18 0.72 0.49 -0.46]; which is quite different from the theoretical expected k vector of [0 0 1 1 0].

To further investigate this, a simple Granger-causality test was conducted to examine if the expectations of higher output lead to current account deficits and if the expectations of lower output result in current account surplus in the current period. According to this test, the current account is said to cause the change in net output if the change in net output is significantly better predicted using the past values of both the change in net output and the current account balance than using the past values of the change in net output. In the event that expectations of an increase in net output do not Granger-cause current account deficit, and that expectations of a decrease in net output do Granger cause current account surplus, this would be evidence in favor of restricted access to the international financial market. The null of no Granger-causality between ca\textsubscript{t} (equals ca\textsubscript{t} when ca\textsubscript{t} is negative and zero otherwise—current account deficit) and cneo\textsuperscript{t} (equals cneo\textsubscript{t}, when cneo\textsubscript{t} is positive and zero—expectations of an increase in net output) is not
rejected at the 5 percent level—it has an F-value of 0.13 and a p-value of 0.72. This can be interpreted to mean that expectations of higher output do not necessarily result in a current account deficit in the current period in the context of the Nigerian economy. However, the null that \( ca_t \) (equals \( ca_t \) when \( ca_t \) is positive and zero otherwise—current account surplus) does not Granger cause \( c_{neo} \) (equals \( c_{neo} \), when is \( c_{neo} \) positive and zero otherwise—expectations of a fall in net output) is rejected—the F-value is 4.09 and the associated p-value is 0.03.

The results above indicate that that asymmetry in access to the international financial market is important for the current account. As we earlier indicated, the existence of asymmetry confirmed by this chapter could reflect the macroeconomic and political situations in which Nigeria operates, with resultant lack of confidence in the economy. One would have expected the market to take these perceived risks into consideration and thereby charges higher interest rates, however the private sector may not be ready to access the market given higher interest rate resulting in a reduced ability to use the capital markets. This carries the policy implications that a stable macroeconomic condition matters for capital flows into an economy.

The graphical representations of both the actual and optimal current accounts (with asymmetry in access) are presented in Fig 5.4.
5.7 The Present Value Tests and the Structural Adjustment Program

To accommodate the introduction of the Structural Adjustment Program in 1986, both the current account and the change in net output were partitioned into two groups: before and after the introduction of the adjustment program in 1986. This produces two current accounts and two changes in net output, which gives four restrictions; the associated k-vector is [0 0 1 1 0]. However, the estimation shows that the k coefficient vector is given by (-0.20, -0.165, 0.511 1.086 -0.3824). The $\chi^2$ test rejects the model, with a p-value of 0.00. We used Granger-causality to examine the relationship between the current account and the change in the net output before and after the introduction of the structural adjustment program. The hypothesis that the current account does not Granger-cause the change in the net output in the pre-SAP period is rejected at the 0.004 significance level; the same hypothesis for the post-SAP era is rejected at the 0.00 significance level. This tends to show that the introduction of the SAP might not have made a significant impact on the ability of the economic agents in Nigeria to smooth consumption in response to temporary
shocks\textsuperscript{8}. Figure 5.5 graphs the actual current account balance and optimal current account (with the introduction of the Structural Adjustment taken into consideration).

**Figure 5.5**

*Actual and Optimal Current Accounts*

*(Including changes in the interest rates and exchange rates)*

5.8 The Present Value Tests and the oil price shock

To reflect the impact of the 1973 oil shock on current account determination, both the current account and the change in net output were divided into two categories: before and after the oil shock in 1973. This produces two current accounts and two changes in net output. This produces four restrictions, the coefficients on the two changes in net outputs are expected to be zero and the two current accounts have the expected value of 1. However, the estimation shows that the \( k \) coefficient vector is given by \((-0.11, -0.67, 0.47, 0.63, -0.79)\). The restrictions implied by introducing the pre-and post oil-periods were not rejected, as indicated by a \( p \)-value of 0.45. We used Granger-causality to examine the relationship between

\textsuperscript{8} This is not an attempt to evaluate the impact of the SAP on the Nigerian economy. The basic question is whether the introduction of this Program led to an increase in access to the international capital markets or not.
the current account and the change in net output before and after the oil prices shock of 1973. The F test rejects the hypothesis that the current account Granger-causes the change in the net output in the pre-oil price shocks era, with a p-value of 0.58. However, the same hypothesis for the post-oil prices shock was not rejected by the F-test, which has a p-value of 0.02. The oil-prices shock of 1973 opened the Nigerian economy to the international financial market. After the drop in oil prices the country was unable to maintain consumption at a sustainable level and resorted to short-term borrowings. It is not a surprise that we see a change in the relationship between the change in net output and the current account after the oil shock of 1973. Figure 5.6 graphs the actual current account balance and optimal current account (taking the oil price shock of 1973 into account).

**Figure 5.6**

*Actual and Optimal Current Accounts*

*(Including changes in the interest rates and exchange rates and Oil-Price Shock)*

5.9 Conclusion

The standard version of the PVMCA allows for domestic shocks arising from government expenditure, investment expenditure and output shocks, without
accommodating the channels through which external shocks could impact upon the current account. An extension of the PVMCA to accommodate the real exchange rate implies that we are taking into consideration the transmission mechanism through which external shocks impact on the current account. By explicitly taking into consideration the impact of changes in the terms of trade on the current account, we are factoring in one of the significant determinants of the current account balance. This Chapter estimated various variants of the PVMCA.

The standard PVMCA that excludes changes in the interest rate, terms of trade and real exchange rates is statistically rejected. On the other hand, accommodating changes in the interest rate and the real exchange rate results in non-rejection of the PVMCA. However, the volatility of the optimal current account remains the same.

Introducing the terms of trade does not improve the fit of the PVMCA. One possible explanation for this is that the intratemporal effect of changes in the terms of trade is more important than the intertemporal effect. This empirical result clearly shows that in analyzing the current account from an intertemporal perspective, the channels through which external shock impact on the current account must be taken into consideration.

Establishing that changes in the terms of trade have intratemporal and intertemporal effects is important for policy making. This is important for understanding the behavior of the household in responding to external shocks, such as the terms of trade deterioration in the absence of government intervention. This is crucial for the government that is interested in using policy instruments at its
disposal to respond to external shocks. For example, if the government is interested in achieving a given current account balance, an unexpected terms of trade shock may be perceived by the government to result in its inability to achieve that target. The government may consequently decide to use, fiscal, exchange and trade policy measures to achieve the target. However, such a reaction could be counterproductive and generates distortion. If the government knew that an unanticipated change in the terms of trade would be accompanied by intratemporal and intertemporal effects and that the overall impact on the current account would be less than what would be expected when these effects are not taken into consideration, would determine the magnitude of, for example, the exchange rate or fiscal policy measures to be taken.

Support for the intertemporal model of the current account implies that before the government starts reacting to a given current account deficit, the source of the deficits must be identified. For example, within this framework, an unexpected temporary increase in government expenditures will be associated with a decrease in current income relative to permanent income. Under the consumption-smoothing hypothesis, current saving decreases, and with a constant investment level, the current account position deteriorates. This current account deficit represents a rational response on the part of economic agents and there is no need for policy measures to address the imbalance.

The hypothesis of asymmetry in access to the international financial market was tested in this chapter but was not rejected. This was confirmed by the Granger-causality test, which indicated that the expectations of higher output were
accompanied by current account surpluses, while; expectations of lower output did not necessarily lead to current account deficits

Irrespective of the theoretical framework used for the empirical investigation, the actual current account is more volatile than the optimal current account. This has the implication that capital movements are sensitive to speculative factors. Capital flows have been excessive in the sense that they are driven by speculative forces rather than by economic fundamentals. Given asymmetry, which this chapter establishes, in an atmosphere of macroeconomic and political instabilities, there will be excessive capital outflows. Noting that the current account can be defined as the sum of capital account plus the change in the net international reserves. In as much as private capital flows are not absorbed in reserves, they must be reflected in the current account.

This model has proved to be a good fit for the Nigerian economy. The consumption driven external imbalances in the face of declining net output in the mid-1980s resulted in an unsustainable consumption levels and the introduction of an adjustment package in 1986. In terms of future policymaking, this model can be used as basis for policy formulation in Nigeria, where unexpected increases in the oil prices have always resulted in increases in government expenditures. On the other hand, unexpected falls in world oil prices always culminated in sharp reductions in public investment. An oil stabilization arrangement would be useful, whereby the government saves out of temporary increases in oil revenue.

Finally, it has been recognized in the economic literature that not all current account deficits point to the existence of overvaluation of the exchange rate (as the
elasticity approach would suggest) or unsustainable aggregate expenditures (as would indicate consumption-smoothing in the face of temporary and unanticipated shocks (as in the intertemporal model). A temporary reduction in the domestic output (for example, a temporary negative productivity shock) will be accompanied by a current account deficit, as agents smooth consumption. The intertemporal approach thus adds another perspective to thinking about the current account balance and prevents an interventionist policy on the part of the government that may not necessarily be needed. The important policy question is: which current account imbalances are justified and which ones are not? The answers to this question are provided in Chapter 6
Appendix 1

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Sources: Social Indicators Database, World Bank
International Financial Statistics database, IMF
Appendix II

Econometric Techniques and Issues

This section presents a succinct description of the econometric techniques used to conduct the empirical investigations of the basic traditional model of the current account and the PVMCA. In particular, we discuss the following techniques: Unit Roots Tests, Vector Autoregression, Granger Causality tests, and statistical inference.

Unit Roots Tests

The standard inference procedures depend significantly on the assumption of stationary time series. In the event that this assumption is violated, the inference drawn from the estimated parameters is invalid [Dolado et al (1990)]. The recognition of this has culminated in the development of various procedures for testing the presence of unit roots in time series data. In order to test for the presence of unit roots, and hence the degrees of integration of these variables, two unit root tests are used: the Augmented Dickey-Fuller (ADF) unit-root test [see Said and Dickey (1984)] and the Phillips-Perron unit-root test [see Phillips and Perron (1988)]. These approaches have low power against plausible trend-stationary alternatives. This weakness should be kept in mind when interpreting the results obtained from their application. To determine whether the relevant time series are stationary, we ran an Augmented Dickey-Fuller (ADF) test for a unit root. This involves the regression of the first difference of each variable against each lagged value, and lagged difference terms. The critical values developed by McKinnon are
then used to determine the significance of the coefficients on the lagged values of the variable. If the coefficients of the lagged variable are not significantly different from 0, the null hypothesis implying the existence of a unit root cannot be rejected.

The ADF test makes a parametric correction for higher order correlation by assuming that the relevant time series follows an AR (p) process and therefore controls for higher-order correlation by adding lagged difference terms of the dependent variable to the regression equation. To complement the results obtained from the use of the ADF test, we employ the Phillips and Perron (1988) unit root test. Phillips and Perron proposed a nonparametric method for controlling for higher-order serial correlation in a series. The correction is nonparametric because it uses an estimate of the spectrum of the residual at frequency zero that is robust to heteroscedasticity and autocorrelation of unknown form.

Vector Autoregression

The vector autoregression technique is commonly used to explore relationships among systems of interrelated time series. The VAR approach models every endogenous variable in the system as a function of the lagged values of all of the endogenous variables in the system. Since only the lagged values of the endogenous variables appear on the right-hand side of each equation, there is no issue of simultaneity, and ordinary least square (OLS) is the appropriate estimation technique. The OLS is used in the estimation of the basic model of current account determination and the VAR is used in the empirical implementation of the PVMCA.
Granger Causality

The Granger (1969) approach to the question of whether x causes y is to see how much of the current y can be explained by past values of y and then to see whether adding lagged values of x can improve the explanation; y is said to be Granger-caused by x if x helps in the prediction of y, or equivalently if the coefficients on the lagged x’s are statistically significant.

There are three principal issues concerning our use of the Granger-causality test. First, we want to explore the proposition that in the face of asymmetry in the access to the international financial market, the expected decrease in the net output will result in an increase in the current account balance, while the expectations of higher output may not necessarily result in a current account deficit in the current period. Second, we aim to investigate whether there is any significant difference between the change in net output before and after the oil prices shock of 1973. Third, we are interested in exploring the relationship between the change in net output before and after the introduction of the Structural Adjustment Program.

5.1.4 Statistical Inference

Most of the statistical inferences depend on the normality of the error terms in the regression equation. We use the Jarque-Berra (J-B) statistic to test for the assumption of normality of residual. Under the null hypothesis of a normal distribution, the J-B statistic is distributed as a $\chi^2$ with 2 degrees of freedom. The reported probability is the probability that a J-B statistic exceeds (in absolute value) the observed value under the null hypothesis of a normal distribution. Under the null,
the hypothesis of normality in the error terms is rejected if the computed statistic is less than the critical value. The Lagrange Multiplier (LM) test, which is applicable to any form of autocorrelation and is independent of the influence of lagged dependent variables, is also reported. The LM statistic is distributed as a $\chi^2$ with degrees of freedom equal to the number of lagged error terms in the regression (i.e., the form of autocorrelation). The null hypothesis of the LM test is that there is no serial correlation up to lag order $p$. In addition, we report the ARCH statistic, which tests for the existence of autoregressive conditional heteroscedasticity in the residuals. As noted by Engle (1982), this type of heteroscedasticity is common in time series data. The ARCH statistic is distributed as a $\chi^2$, as in the LM test. It should, however, be noted that the J-B, LM and the ARCH statistics are not exact. Their distributions are known for large sample sizes and care should be taken in using them when the sample size is small.

Standard errors needed to test the restrictions of the PVMCA are calculated numerically as $\left(\frac{\partial k}{\partial \psi}\right)V\left(\frac{\partial k}{\partial \psi}\right)'$, where $V$ is the variance-covariance matrix of the underlying parameters in the VAR, and $\left(\frac{\partial k}{\partial \psi}\right)$ is the matrix of derivatives of the $k$ vector with respect to these underlying parameters.$^9$

$^9$ The $k$-vector is the expected coefficients on the change in net output, current account and consumption-based interest rate. Paul Bergin (UCLA) and Paul Cashin (IMF) provided the Gauss codes used for the estimation.
CHAPTER 6

THE TRADITIONAL MODELS OF THE CURRENT ACCOUNT AND EXTERNAL IMBALANCES SUSTAINABILITY IN NIGERIA

6.1 Introduction

The main objective of this chapter is to assess the external position of the Nigerian economy during the period covered by this thesis (1960-97). Three important and highly connected questions are regularly asked in assessing the severity of external imbalances: Are the current account imbalances sustainable? Is the debtor country solvent? Are the current account imbalances excessive\(^1\)? Given the historical experience of recurring current account deficits and the broad increase in debt to GDP ratio, answers to these questions are important in the context of the Nigerian economy.

In respect to sustainability, one approach that has been used in the literature, which is adopted in this chapter\(^2\), is to consider a wide array of macroeconomic and structural factors to assess the possibility that a country is likely to experience external crisis given the continuation of the current policy mix. Justifications for using macroeconomic and structural variables to assess the external position of an

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\(^1\) See Chapter 2 for discussions on the following concepts: Sustainability, Solvency and Excessiveness.

\(^2\) A number of macroeconomic indicators were used to assess the sustainability of the Nigerian external imbalances, especially in the early to mid 1980s. This chapter focuses on variables that are not captured in chapter 2.
economy have both intratemporal and intertemporal underpinnings. Hence, both the traditional approaches (static analyses) and the intertemporal approaches are relevant.

As remarked by Corsetti et al (1997), rather than providing a unifying theoretical framework for the study of external imbalance, the approach based on the notion of sustainability primarily focuses on the empirical analysis of macroeconomic performance during crisis episodes. In light of this, this chapter uses macroeconomic and structural indicators that reflect the position of various theories of current determination, especially the traditional approach and the PVMCA to determine the sustainability of the Nigerian external imbalances during the periods preceding the external crisis of 1986. The use of additional macroeconomic and structural indicators in this chapter equally point to the unsustainability of the Nigerian current account deficits in the period preceding the 1986 external crisis.

Answering the question of whether the economy is solvent or not requires a forward-looking analysis. Since traditional models are based on a static framework, they cannot be used to answer this question. However, the PVMCA meets this requirement, as it recognizes the constraint that, over an infinite horizon, the present discounted value of income must equal consumption for a given economy. This chapter deals with the solvency issue by using an empirical approach that determines a current account balance that ensures that external debt to GDP ratio is constant over time. A constant external debt to GDP ratio is considered to be a signal that the economy is in a position to service its external obligation. In this regard, this chapter determines the level of the current account balance (exclusive of
interest payments) that ensures that the external debt to GDP ratio is non-increasing over time. The current account balance that ensures the constancy of external debt to GDP is then compared with the actual current account balance. The difference between the two gives some indication as to the extent of the resource gap in the economy and whether the external position is sustainable or not. A non-increasing external debt GDP ratio condition is used to assess the sustainability of the Nigerian external position in the 1980s; the results reveal significant resource gaps in the year preceding the occurrence of the external crisis in 1986.

To determine whether a given current account balance is excessive, we need a model that yields a prediction of the optimal current account balance in the face of optimal capital flows. The PVMCA is an intertemporal approach that can be used to construct this optimal current account, but the traditional model cannot be used for this purpose, since it is not designed to deal with this interesting issue. Therefore, this chapter assesses the excessiveness of the Nigerian current account deficits during the period 1960-97. Using the PVMCA, we establish that the Nigerian current account deficits were excessive in the period preceding the external crisis of 1986. It was therefore not a surprise that the country experienced an external crisis in 1986.

This chapter appears to be the first in-depth country analysis for any sub-Saharan African country using the concepts of sustainability and excessiveness. Previous studies did this for industrial and emerging economies. In addition, it is established that capital outflows from Nigeria are important variables for assessing the external position of the Nigerian economy.
Before we investigate the external position of the Nigerian economy, the next three sections of this chapter are devoted to the traditional approaches to modeling the current account (section 6.3), the econometric specification of the determinants of the current account based on these traditional models and other variables (section 6.4) and empirical results (section 6.4). This, we believe, will ensure ease of exposition as to why we would choose one model above another in answering each of the three questions raised above.

Section 6.4 reveals that changes in the world real interest rate, exchange rate, terms of trade and fiscal balance are important determinants of the current account. This section has its unique contributions. First, in terms of data coverage, this section encompasses a longer data span than any other study on current account determination in Nigeria. Second, it examines the time series properties of the relevant variables for stationarity, before proceeding to further estimation.

Section 6.5 compares the PVMCA and the traditional models of the current account. The basic message arising from this comparison is that the fact that static regression supports the position of the traditional models of the current account does not validate these models. Intertemporal models can be used to characterize the results as well. Therefore, we identify and discuss some criteria that can be used to choose between the PVMCA and the traditional approaches. Section 6.6 presents the results from using additional structural and macroeconomic indicators to assess the sustainability of the Nigerian current account balance before the year 1986. Empirical implementation of the solvency condition is presented in section 6.7. Section 6.8 presents the results of using the PVMCA to determine the
excessiveness of the Nigerian current account deficits. Section 6.9 concludes the chapter.

6.2 The Traditional Models of the Current Account

This section presents traditional theories of current account determination to motivate the choice of explanatory variables used to establish quantitative relationships between the current account and its major determinants in section 6.4. The three traditional approaches to current account modeling are the elasticities, absorption and monetary approaches. These models have the implications that external imbalances are driven by domestic policy and can be corrected by an appropriate combination of exchange rate and monetary policies. Each of these approaches is discussed in turn, with special attention to their derivations and weaknesses.

6.2.1 The Elasticities Approach

The elasticities approach focuses on the trade balance component of the current account, and accordingly emphasizes relative international prices as its central determinant. It deals with the impact of devaluation on the trade balance. Within this context, a devaluation policy improves the trade balance of the country

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3 See, for example, Mwau and Handa (1994), Hooper and Marquez (1995) for further details on the traditional approaches to modeling the current account.
concerned if the sum of the elasticities of imports and exports is greater than one. This is the so-called Marshall-Lerner condition.

A policy of exchange rate devaluation improves the trade balance by increasing foreigners' demand for exports of goods and services of the home economy, and by discouraging imports of foreign goods and services. The inclusion of relative prices in the empirical specification of the determinants of the current account in equation (6.12) is based on the following equations:

\begin{align*}
EX_t &= EX_t(R_t, Y_t) \quad (6.1) \\
IM_t &= IM_t(R_t) \quad (6.2) \\
R_t &= e_t \frac{P_f}{P_d} \quad (6.3) \\
TB_t &= EX_t(R_t, Y_t) - R_t \cdot IM_t(R_t) \quad (6.4)
\end{align*}

where \(EX\) captures exports, \(IM\) represents imports, \(R\) is the real exchange rate, \(TB\) is the trade balance expressed in terms of domestic goods, \(Y_t\) is the foreign income, \(P_f\) represents the foreign country price index, \(P_d\) is the home country price index, \(e\) is the nominal exchange rate defined as the domestic price of a unit of foreign currency.

Equation (6.1) gives the demand function for exports, while equation (6.2) gives that of imports. Equation (6.3) defines the real exchange rate. Equation (6.4) defines the trade balance as the difference between exports and imports. From (6.4), three variables determine the current account balance, the nominal exchange rate, the foreign price index relative to that of the home country and the foreign...
income. As the current account balance contains both the trade balance and interest payments on outstanding foreign liabilities, equation (6.4) can be re-written as:

\[ TB_t = EX_t(R_t, Y_t) - R_t . IM_t(R_t) + r^* B_{t-1} \]  

(6.5)

where: \( r^* \) is the real world interest rate and \( B \) is the outstanding stock of foreign liabilities. Equation (6.5) captures the basic insight of the elasticity approach by including real exchange rate among the principal determinants of the current account.

The elasticity approach has a number of inherent weaknesses. First, it does not consider the whole current account, but only a portion of it. Second, while the elasticity approach has the impact of devaluation on the current account as its main theme, no attempt is made to explicitly incorporate the non-tradable goods in order to arrive at the real exchange rate. Third, the central implication of the elasticity approach—that a nominal devaluation equals real devaluation requires appropriate fiscal and monetary policies that will prevent devaluation from leading to increase in domestic prices. In the event that a devaluation policy was accompanied by an expansionary fiscal policy and monetary accommodation of fiscal policies, the domestic price level increase and the initial nominal devaluation would have little or no impact on the real exchange rate and consequently no effect on the trade balance.
6.2.2 The Absorption Approach

While the elasticity approach deals with the responses of imports and exports to a reduction in the value of a country's currency, the absorption approach examines the income effects of the same policy. Currency devaluation is expected to generate expenditure-switching and expenditure-reducing effects. These two effects are expected to produce an improvement in the trade balance [Meade (1951), Alexander (1952)].

The absorption approach to the current account seeks to remove external imbalance through adjustments in the absorption of goods and services. In equilibrium in the commodity market, domestic output or income (Y) equals expenditure, which consists of the private consumption (C), government consumption (G), investment (I), exports (EX) and imports (IM).

\[ Y = C + I + G + EX - IM \]  \hspace{1cm} (6.6)

Combining C+I+G expenditure terms into a single term, A, we have domestic absorption (i.e., total domestic expenditure) and X-M terms into TB (trade balance), we have:

\[ Y = A + TB \]  \hspace{1cm} (6.7)

Equation (6.7) can be re-expressed as:

\[ TB = Y - A = Y - C - G - I \]  \hspace{1cm} (6.8)

Based on (6.8), the absorption approach identifies reductions in the level of absorption as the principal means of improving the current account balance in the short-run. The policy instrument identified to achieve this is the exchange rate. Exchange rate devaluation through the substitution effects (expenditure switching)
encourages a reduction in imports as economic agents switch from consuming foreign goods to domestic goods. The income effects (expenditure reducing) also enhance a reduction in consumption, leading to an improvement in the current account balance.

The absorption approach focuses on the income effects of devaluation without an analysis of the price effects of the same policy, as postulated by the elasticity approach. Moreover, it lacks an intertemporal context by tying current consumption to current income. This weakness is also applicable to the elasticities approach.

6.2.3 The Monetary Approach

The main argument of the monetary approach is that the balance of payments determination is essentially a monetary phenomenon. A disequilibrium in the money market will be associated with balance of payments disequilibrium (i.e., a deficit or surplus). This approach has the testable implication that a government that engages in continuous money supply expansion experiences a reduction in the level of official reserves [Polak (1957), Frenkel and Johnson (1976) and IMF (1977)]. Consequently, improvements in the levels of international reserves of a monetary authority require a contractionary monetary policy.

The simplest version of the monetary approach to the balance of payments can be derived from the following identities:\(^4:\)

---

\(^4\) See Polak (2001) for this definition of the money stock.
\[ M_t = NFA_t + NDA_t \]  \hspace{1cm} (6.9)

where: M is the stock of money; NFA is the net foreign assets and NDA is the net domestic assets of the domestic financial system. Approximating (6.9) by its growth form, we have:

\[ \frac{\Delta NFA_t}{NFA_{t-1}} = \frac{\Delta M_t}{M_{t-1}} - \frac{\Delta NDA_t}{NDA_{t-1}} \]  \hspace{1cm} (6.10)

The relationship between the current and capital accounts of the balance of payments is given by:

\[ NFA_t = CA_t + KA_t \]  \hspace{1cm} (6.11)

where: CA is the current account and KA is the capital account of the balance of payments.

We assume an open economy with a fixed exchange rate regime. Equation (6.9) represents the basic identity in the money market. The stock of money is defined as the net foreign assets plus the net domestic assets. Equation (6.10) specifies that the change in net foreign assets equals the difference between the change in the money stock (or the flow demand for money) and the domestic component of money supply (i.e., net domestic assets). Equation (6.11) captures the balance of payments identity, that the change in the net foreign assets equals the sum of the current and the capital accounts.
Equation (6.10) is the fundamental equation of the monetary approach to the balance of payment. It postulates that reserves will decrease (increase) if the domestic money supply growth (credit creation) exceeds (is below) domestic money demand. In addition, from equation (6.11), a balance of payments deficit (surplus) will be reflected in a decline (increase) in net international reserves. This implies that an increase in credit creation, with a constant demand for credit, will result in a decline in reserves, and hence a deterioration of the balance of payments.

The main insight from the monetary approach is that disequilibrium in the money market has a bearing on current account determination. Despite its usefulness in identifying monetary expansion as the source of internal and external disequilibria, the monetary approach fails to account for real factors such as the real exchange rate and the terms of trade that are important for the determination of net exports and the current account in Nigeria. Moreover, this approach is more applicable to an economy with fixed exchange rates, as its implications may not hold when the market determines the exchange rate. It is more or less a model of the balance of payments adjustment and not principally that of a current account determination.

6.3 Empirical Specification of the Traditional Approaches to Modeling the Current Account

Based on equation (6.5) and the insights from the monetary approach in (6.10) and (6.11), a quantitative relationship between the current account balance
and its different determinants is given by (6.12). This specification includes additional variables apart from those identified by the traditional models. The current account balance for Nigeria is specified for econometric estimation as:

\[
cagdp = f(R, r^*, Y_t, fdgdp, tot)
\]

(6.12)

where: \(cagdp\) is the current account balance expressed as a percentage of \(GDP\), \(R\) is the real effective exchange, \(r^*\) is the world real interest rate, \(fdgdp\) stands for the domestic budget balance as a ratio of \(GDP\), \(Y_t\) is the real output in the industrial countries and \(tot\) is the terms of trade. The specification in (6.12) is along the lines of similar studies for small open economies [Khan and Knight (1983), Pastor (1989)].

Within the traditional models of current account determination, we expect an improvement in the terms of trade or an increase in the growth rates of industrial countries to bring about an improvement in the current account. However, a rise in the foreign real interest rate or an appreciation in the real effective exchange rate or a deterioration of the fiscal position would tend to worsen it.

An improvement in the terms of trade—for example, because of an increase in the export price—increases the value of net exports and this tends to improve the current account position. An increase in the export price may also encourage a transfer of resources from the non-tradable sector to the tradable sector, leading to an increase in the supply of export products. On the other hand, favorable terms of trade may be accompanied by real exchange rate appreciation, leading to deterioration in the current account position. The overall impact depends on the relative magnitude of the first and second effects.
An increase in the growth rate of the industrial countries affects the current account through two channels. The first channel arises from an increase in the demand for the exports of the domestic economy. This increases tends to increase the current account position. Second, an improvement in the economic situation in the developed countries will be associated with an outward shift of the demand for the domestic country exports, with positive impact on the current account through improvements in the terms of trade.

An increase in foreign interest rates would tend to increase the cost of new external debt and the servicing of outstanding debt, and would increase the current account deficit. An appreciation of the real effective exchange rate reduces the competitiveness of the tradable sector, leading to a reduction in exports and current account deterioration. An increase in fiscal deficit that is financed through monetary expansion has the effect of increasing aggregate demand, with a negative impact on the current account balance.

6.4 Traditional Models of Current Account Determination: Empirical Results
Five macroeconomic variables are used to evaluate the determinants of the current account. The real interest rate \( (r^*) \) is defined as the London Interbank Offer rate (LIBOR) minus the rate of inflation in the industrial countries. The terms of trade \( (\text{tot}) \) is defined as the unit import price index divided by the export unit index. The real effective exchange rate is as the weighted average of the bilateral real exchange rate. The world output \( (\text{wo}) \) is captured by an index of industrial countries' output. The fiscal deficit is as defined above. Two dummies are introduced to capture the
impact of the oil price shock in 1973 (D1) and the introduction of the Structural Adjustment Program in 1986 (D2). The data on the variables used for the empirical estimation of (6.12) are provided in Appendix I.

We examined the current account, terms of trade, world output, world interest rate, real effective exchange rate, and the fiscal deficits for the presence of unit roots. Of these variables, we found, using the Augmented Dickey Fuller and Phillip-Perron Tests, that the current account and the fiscal deficits as a ratio of GDP were stationary. The rest of the variables are first-difference stationary at the 5% significance level. The time plots of these variables are shown in Figure 6.1, while Table 6.1 and 6.2 summarize the ADF and PP unit root tests. The results reported from applying the ADF and PP tests include a constant and a time trend. The presence or absence of unit roots in the variables of interest is not sensitive to the number of lags included.

In estimating (6.12), we use changes in the terms of trade, the real exchange rate and the terms of trade, given the fact that their levels are nonstationary. The terms of trade show a significant negative relationship with the current account, indicating that a rise in the import price of goods being imported into Nigeria will be associated with current account deterioration. The coefficient on the real interest rate is negative and significant, as expected. The growth rate for industrial countries does not appear to impact significantly on the Nigerian current account; hence we exclude it from the results reported in Table 6.3. This partly reflects the small share of manufactured goods in the Nigerian GNP. Import demand increased persistently in the 1970s, following the increase in the international oil price, thereby reducing the
sensitivity of the current account balance to the evolution of the industrial countries' output. After the fall in oil prices, the restrictive trade policy measures initiated by the government (tightening of exchange controls and quantitative restrictions) were quite effective in offsetting the direct effects of the economic deterioration in industrial countries. The fiscal balance has a positive and significant relationship with the current account balance; indicating that an increase in fiscal deficits in the context of the Nigerian economy is associated with a deterioration in the current account balance. This observed positive relationship between the increase in fiscal deficits and the current account deterioration is easily explained in the context of the Nigerian economy. In the aftermath of the significant fall in oil prices, instead of allowing the real exchange rate to absorb the shock and thereby remove external imbalance, the Nigerian government resorted to the use of international credit markets for additional funds to maintain the unsustainable consumption levels. In addition, the budget deficits of the 1980s were monetized, thus expanding private spending and extending the adverse effects on the current account. The coefficient on the change in the real exchange rate suggests that appreciation in the real exchange rate has had a negative and significant impact on the current account. Overall, both the oil price shock of 1973 and the introduction of the Structural Adjustment Program in 1986 have had significant positive impact on the current account during the period considered by this thesis, as reflected in positive and significant coefficients on D1 (oil price shock) and D2 (Structural Adjustment Program Shock); the two dummies are jointly significant. The diagnostic statistics
suggest the absence of serial correlation, non-normality and heteroscedasicity as shown in the respective LM, J-B (probability) ARCH statistics reported in Table 6.3.

It must be noted that arguments provided by the traditional models of the current account are used to characterize the relationship between the current account and its determinants. However, the intertemporal model can also be used to characterize this observed relationship.

**Figure 6.1:**

**Graphical Representations of the Determinants of the Current Account**

![Graphical Representations of the Determinants of the Current Account](image-url)
Table 6.1 Unit Root Tests*

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADF</th>
<th>PP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Account/GDP(cagdp)</td>
<td>-4.10</td>
<td>-4.16</td>
</tr>
<tr>
<td>Terms of Trade (tot)</td>
<td>-1.69</td>
<td>-1.70</td>
</tr>
<tr>
<td>World output (wo)</td>
<td>-2.98</td>
<td>-2.98</td>
</tr>
<tr>
<td>World Interest Rate (r*)</td>
<td>-2.20</td>
<td>-2.38</td>
</tr>
<tr>
<td>Real Effective Exchange Rate (R)</td>
<td>-2.62</td>
<td>-1.77</td>
</tr>
<tr>
<td>Fiscal Deficit/GDP (fdgdp)</td>
<td>-3.20</td>
<td>-3.57</td>
</tr>
</tbody>
</table>

* ADF indicates the augmented Dickey-Fuller test; PP represents the Phillip-Perron test.

Table 6.2 Unit Root Tests*

<table>
<thead>
<tr>
<th>Variable (First Difference)</th>
<th>ADF</th>
<th>PP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terms of Trade</td>
<td>-4.8</td>
<td>-5.7</td>
</tr>
<tr>
<td>World output</td>
<td>-4.3</td>
<td>-4.4</td>
</tr>
<tr>
<td>World Interest Rate</td>
<td>-4.5</td>
<td>-6.3</td>
</tr>
<tr>
<td>Real Effective Exchange Rate</td>
<td>-4.2</td>
<td>-3.7</td>
</tr>
</tbody>
</table>

* ADF indicates the augmented Dickey-Fuller test; PP represents the Phillip-Perron test.
Table 6:3  Dependent Variable, current account as a ratio of GDP (cagdp)*

<table>
<thead>
<tr>
<th>Regressors</th>
<th>Coefficient</th>
<th>Std. errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-3.978</td>
<td>1.280</td>
</tr>
<tr>
<td>Change in Terms of Trade (tot)</td>
<td>-0.259</td>
<td>0.050</td>
</tr>
<tr>
<td>Change in World Interest Rate (r*)</td>
<td>-0.728</td>
<td>0.359</td>
</tr>
<tr>
<td>Change in Real Effective Exchange Rate (R)</td>
<td>-0.093</td>
<td>0.026</td>
</tr>
<tr>
<td>Fiscal Deficit/GDP (fdgdp)</td>
<td>0.355</td>
<td>0.136</td>
</tr>
<tr>
<td>D1 (Structural Adjustment)</td>
<td>4.520</td>
<td>1.596</td>
</tr>
<tr>
<td>D2 (Oil shock)</td>
<td>3.588</td>
<td>1.687</td>
</tr>
</tbody>
</table>

R2=0.67; F-statistic=12.42; AR (2)=0.84; ARCH (1)=0.81; N (2)=0.53

* AR (2), ARCH (1), and N (2) are the standard LM test for no second order serial correlation under the null, the LM tests for the maintained hypothesis of no first order conditional heteroscedasticity and the Jarque-Berra test for normality respectively. Only the corresponding p-values of these tests are reported.

6.5 Comparisons of the PVMCA and the traditional Models of the Current Account

From the PVMCA perspective, the current account balance reflects the outcome of optimizing decisions by private, forward-looking economic agents. The PVMCA presented in chapter 4 identified expected changes in net output, exchange rate, terms of trade and the interest rate as the determinants of the current account. However, the traditional approaches perceive the current account deficit as resulting from real exchange rate appreciation and excess money supply. They view observation of current account deficit as requiring a policy adjustment, either through nominal exchange rate devaluation or through a contraction of the money supply.
The objectives of this section are twofold. First, we demonstrate that the results from empirical estimation of (6.12) can be explained by the PVMCA as well, focusing on government expenditures and the terms of trade. Second, we establish criteria that can be used to choose between the traditional models of the current account and the PVMCA.

6.5.1 Predictions of the PVMCA and the Traditional Models

- **Increase in Government Expenditure:** The traditional approach uses the monetary, elasticities and absorption approaches to explain the impact of an increase in government expenditure on the current account. An increase in government expenditure financed by monetary expansion generates an increase in liquidity leading to an increase in aggregate demand for both domestic and foreign goods. This results in deterioration of the current account balance. First, the nature of the impact that a temporary change in government expenditure will have on the current account will depend on whether the change is expected or not. An unexpected increase in government expenditure reduces resources available to the private sector for consumption. To smooth consumption, the government borrows abroad in order to maintain the same level of consumption, which leads to a deterioration in the current account balance. However, if the change is expected, the agents reduce their current consumption and this results in a current account surplus in the current period. The PVMCA can explain an
observed positive relationship between the current account deficit and the fiscal deficit. The increase in fiscal deficits with negative impact on the current account is consistent with the traditional models of the current account. This indicates that an increase in government expenditure financed by monetary accommodation would generate an increase in absorption and lead to a current account deficit. However, an unexpected temporary increase in government expenditure would produce deterioration in the current account position. This shows that results from empirical implementation of (6.12) cannot be used as bases for choosing between the PVMCA and the traditional models of the current account.

- **Terms of Trade:** A temporary appreciation in the terms of trade has an ambiguous impact on the current account within the context of the PVMCA. On the one hand, the “consumption-smoothing” motive implies that agents will maintain the same level of spending in the event of a temporary increase in the real income. This induces an improvement in the current account balance if the temporary appreciation in the terms of trade takes place in the current period and is unexpected. However, this same appreciation will lead to an improvement in the current account balance if it is anticipated to take place in the future.

Apart from this income effect, there are also intertemporal and intratemporal substitution effects. First, a temporary unexpected current
(expected future) appreciation in the terms of trade reduces (increases) the cost of current consumption in terms of future consumption. This fall (rise) in the consumption-based real interest rate, when associated with temporary current (expected future) improvements in the terms of trade, discourages (increases) saving and hence engenders a deterioration in the current account in the case of a current shock, but a worsening of the current account position in the case of a future shock. This is the intertemporal substitution effect. Second, a temporary change in the terms of trade changes both the level and composition of aggregate real spending, of which nontradable goods are included. A current unanticipated improvement in the terms of trade implies an increase in the price of tradable goods relative to the nontradable goods. Economic agents, in response, will shift toward consuming nontradable goods and this will produce an increase in the price of nontradable goods, leading to a real exchange rate appreciation and a negative impact on the current account. If the improvement in the price of tradables is anticipated, then the current price of tradable goods is relatively cheaper compared to that of nontradables. Agents will thus shift towards consuming tradable goods, which will lead to a fall in the price of nontradable goods and then to a real exchange rate depreciation and a consequent improvement in the current account. This clearly shows that the impact on the current account of changes in the terms of trade depends on whether it is anticipated or not. Moreover, the overall impact of changes in the terms of
trade depends on the relative strength of the consumption-smoothing, intertemporal and intratemporal effects.

In the traditional model, an increase in the terms of trade increases the export price relative to the import price and, given static identity, this improves the current account balance. There is no indication as to whether the change in the terms of trade is expected or not. Both the traditional approach and the PVMCA can explain a finding of negative relationship between the current account and the terms of trade, as reported in section 6.4.

This section has shown that that the way in which the PVMCA and the traditional model establish a linkage between an economic variable and current account is quite different, especially as these different ways reflect the issue of expectation. The difficulty is to interpret empirical regularity in the data; both the traditional models and the PVMCA can explain an observed relationship between a macro variable and the current account.

6.5.2 Choosing Between the PVMCA and the Traditional Models

A difficulty with the estimation of (6.12) is that the results are consistent with any models we may have in mind, depending on how we want to explain these results. An alternative would have been to decompose each of these variables into their permanent and temporary components; however, as earlier literature on the intertemporal approach has indicated, this can be difficult. As an illustration, Ahmed (1986) decomposed government expenditure into temporary and permanent components and found that temporary changes in government expenditures and not
the permanent changes are important for the current account. Obstfeld and Rogoff
(1994), using a cross section of 15 OECD countries found that neither current nor
permanent government spending is important in explaining the behavior of the
current account balance. They interpret the results to indicate that it is not clear
whether the intertemporal approach is simply false, or whether the many extraneous
simplifications and maintained hypotheses imposed by the econometrician are to
blame. Moreover, Cardia (1997) replicated standard consumption function tests of
the Ricardian equivalence using series generated from a model which nests
Ricardian equivalence within a non-Ricardian alternative. She found that no
conclusion could be drawn from observing a low correlation between the current
account and government budget deficits. All these findings point to the fact that the
empirical results obtained from estimating (6.12) cannot be used as bases for
choosing between the intertemporal model and the traditional models of the current
account.

There are a number of factors favoring the use of the PVMCA rather than
traditional approaches. An important issue is the optimal dynamic responses of
savings and investment to external and internal shocks. The traditional models of the
current account are not designed to deal with this issue; it can, however, be dealt
with in the context of the PVMCA.

Another important fact that favors the use of the PVMCA is Lucas' (1976)
position that policy analysis must be based on the actual forward-looking decision
rules of economic agents. Obstfeld and Rogoff (1994) interpreted this as implying
that open-economy models based on the optimization problems of a household may
yield more reliable policy conclusions than *ad hoc* econometric specification such as demonstrated by equation (6.12).

Another advantage of a microeconomic foundation is that it imposes more structure on the macro model. Consequently, the corresponding empirical work involves fewer “free” parameters (parameters that are not constrained by theoretical considerations and can thus take on whatever value that will maximize the fit of the model). Since the variables entering the empirical estimation of the PVMCA are theoretically derived, this restricts the number of variables that could enter the estimation.

Given the issues that we are examining in this thesis—the solvency of the Nigerian economy and the excessiveness and sustainability of its current account deficits, the use of the PVMCA appears more appropriate. As earlier indicated in this chapter, the PVMCA provides a framework for analyzing the excessiveness of the current account current account deficits. Second, addressing the issue of the economy’s solvency is an intertemporal issue, given the fact that the PVMCA has an intertemporal underpinnings, this makes it more appealing relative to the traditional approaches.

### 6.6 Additional Indicators of Current Account Deficits Sustainability

Chapter 2 presented a number of macroeconomic variables that can be used to assess the sustainability of the external position of an economy. In tracing the evolution of the Nigerian economy during the period 1960-97, we discovered in
Chapter 2, a remarkable current account deficit, an increase in external debt GDP ratio, a sharp real exchange rate appreciation, low economic growth, a sharp increase in fiscal deficits and a drastic fall in foreign exchange reserves in the periods before the external crisis of 1986. This section focuses on additional indicators of current account deficits sustainability. We look at the following variables: capital flight, openness and trade composition, composition of current account balance, and political instability.

6.6.1 Capital Flight

A relevant factor in assessing the external position of a country is the size of the potential capital flight. Higher levels of capital flight during certain periods may reflect anticipations of devaluation, fiscal deficits, inflation, and financial repression culminating in a negative real interest rates and political instability. Hence, capital flight is a summary indicator that reflects the degree of economic distortion and is relevant for assessing whether the country is likely to experience an external crisis or not.

Given the relative importance of capital in a capital-scarce economy like Nigeria, the most relevant definition of capital flight is one that unitizes the “sources and uses” of capital (Ajayi, 1995). Given this condition, we use the World Bank
The definition of capital flight from the World Bank (1985) perspective is given by:

\[ \text{KF} = \text{CD} + \text{NFD} + \text{CAB} + \text{CIR} \]  

where KF is the capital flight; CD is the change in external debt; NFD is net foreign direct investment; CAB represents the current account balance and CIR is the change in official reserves. Equation (6.13) implies that any inflows that do not finance direct foreign investment and official reserve increases leave the country in the form of capital flight.

We use the estimate of capital flight derived from (6.13) to gauge the extent of illegal capital outflows before 1986. Figure 6.2 shows the evolution of capital flight from Nigeria during the period 1972-97. There were dramatic changes over the period 1972-97. Capital flight stood at an annual average of US$496 million during 1972-79, increased to US$1,478 million in the pre-crisis period (1980-86) and then to US$3,071 million during 1987-94. This points to higher capital flight preceding the external crisis. Macroeconomic instability might have produced the increase in the capital flight during the period 1987-1994. However, a reversal in capital flows took place during 1995-97.

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5 There exists a huge literature on various approaches to measuring capital flight. Our focus is on examining the evolution of the capital flight for Nigeria and to see whether it increased tremendously before the crisis year 1986.

6 Estimates of capital flight were negative in some years. This reflects capital flight net of unrecorded capital inflow (Curdington, 1986) and these years can be considered as years of capital repatriation.
6.6.2 Composition Of Capital Inflows

The sustainability of current account deficits depends on how they are financed: direct foreign investment (FDI), portfolio investment (equity securities, debt securities), loans and trade deficits. A current account deficit financed through FDI, for instance, is likely to be more sustainable as it does not create debt and contributes to the economy’s growth potential. It is therefore, important, to examine the source of financing current account deficits.

Foreign direct investment was the major source of financing current account deficits over the period 1960-73. This was also the case up to 1979 (Figure 6.3). Over the period 1982-85, which preceded the external crisis, the short-term capital inflows emerged as the major source of financing current account deficits. The change in the composition of capital inflows reflected the lack of confidence in the Nigerian economy by foreign investors and their anticipation of a possible external crisis.
In more recent years, there is evidence of significant outflows of capital, as shown by persistent net short term capital outflows. In a capital-scarce economy like Nigeria, one would have expected a net inflow. This is not to suggest that a country is better off financing its current account deficits through short term capital inflows, but simply to note that persistent capital outflows tend to suggest the existence of structural problems. The political uncertainty over the period 1992-97 is the likely reason for the net outflows.

**Figure 6.3**

**Foreign Direct Investment and Short-Term Capital Inflow, 1960-97**

($US$ millions)

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### 6.6.3 Openness and Trade Composition

A more open economy (with a higher exports-GDP ratio) is expected to generate higher foreign exchange earnings, and is in a better position to service its external debt. Nonetheless, a high degree of openness could increase the vulnerability of the country to external crises, especially when the export base is thin. An economy that has a diversified export base may not experience an external crisis.
as a result of a fall in the terms of trade for a particular export category. However, an economy that derives a significant portion of its export earnings from one product may suffer an external crisis in the event of a fall in its relative price.

The degree of external orientation, as measured by the ratio of exports to GDP, increased considerably for Nigeria over the 1960-97 period from an annual average of 10% in the 1960s to 18% in the 70s, 21% in the 80s and 43% in the 90s (Figure 6.4).

The increased export-GDP ratio was combined with high dependence on oil receipts and this tended to increase the vulnerability of the Nigerian economy to developments in the world oil markets. The share of oil receipts in total exports was on average 19% in the 1960s, 86% in the 1970s and 1980s, and 90% in the 1990s. The immense dependence on oil exports shows that a given current account position that may be ordinarily considered to be sustainable may easily deteriorate to an unsustainable path given an unexpected fall in the world oil prices.
6.6.4 Political Instability And Policy Uncertainty

Political instability negatively affects the level of investment and consequent growth and thus bears on the ability of the country to service its debt. For this reason, we have included this variable in assessing the sustainability of current-account deficits.

In the context of current-account sustainability, political instability can be relevant, since it subjects domestic and foreign investors to the risk of a sudden policy reversal, reducing the credibility of the current policy stance. Replacement of a government favoring free capital mobility by one prone to the imposition of capital controls makes the occurrence of capital outflows more likely.

Nigeria has experienced considerable political instability. Its system of governance has oscillated between military regimes and civilian administrations. This political instability produced instability in the macroeconomic policy stance of the government. If we assess external sustainability on the basis of this indicator, Nigeria does not fare well. The country experienced civil war over the period 1967-70. The military took over from the civilians in 1983 and assumed control over the Nigerian economy up to the end of the period covered by this study. There were a series of coups and counter-coups. This political turmoil did not favor the inflow of foreign resources, but rather encouraged capital flight.
6.7 Solvency and Resource Balance Gaps

Solvency can be established by making use of the following relationship between the change in the net foreign assets position of a country and the current account balance:

\[(1+r^*)B_t = C_t + G_t + I_t - Y_t + B_{t+1}\]  \hspace{1cm} (6.14)

where \(r^*\) is the constant world interest rate; \(B\) is the net foreign assets; \(C\) is private consumption, \(G\) is government expenditures, \(I\) is private and government investment expenditures and \(Y\) is gross domestic product. Shifting (6.14) forward by one period and dividing through by \((1+r^*)\) yields:

\[B_{t+1} = \frac{C_{t+1} + G_{t+1} + I_{t+1} - Y_{t+1} + B_{t+2}}{1+r^*} \]  \hspace{1cm} (6.15)

Dividing both sides of (6.14) by \((1+r^*)^2\) and shifting the result forward by two periods in order to eliminate \(B_{t+2}/(1+r^*)\) from (6.15), we obtain:

\[B_{t+2} = \frac{C_{t+2} + G_{t+2} + I_{t+2} - Y_{t+2}}{(1+r^*)^2} + \frac{B_{t+3}}{(1+r^*)^2} \]  \hspace{1cm} (6.16)

From (6.16), the current net foreign assets is given by:

\[B_t = \left[ \frac{Y_t - C_t - G_t - I_t}{1+r^*} + \frac{Y_{t+1} - C_{t+1} - G_{t+1} - I_{t+1}}{(1+r^*)^2} + \frac{B_{t+2}}{(1+r^*)^2} \right] \]  \hspace{1cm} (6.17)

By following this iterative substitution, successive values of \(B_{t+i}\) can be eliminated. For ease of exposition, assume that we are interested in a two-period analysis. Assume \(B_{t+2}=0\), i.e., any external debt is paid off by the end of \((t+2)\) and there are no
foreign assets. The elimination of $B_{t+2}$ from (6.17) based on this condition implies that:

$$B_t = \left[ \frac{NX_t}{1+r^*} + \frac{NX_{t+1}}{(1+r^*)^2} \right]$$

(6.18)

where $Y - C - G - I = NX$, $NX$ is net exports inclusive of services.

In a two-period analysis, (6.18) is the solvency condition; it indicates that the present value of net exports must be equal to the current indebtedness. Extending (6.18) to an infinite horizon and taking its mathematical expectation produces:

$$E_t \{ (1+r^*) B_t \} = \left[ E_t \left( \sum_{t=1}^{\infty} \left( \frac{1}{1+r^*} \right)^{-T} (Y_t - C_t - I_t - G_t) - \left( \frac{1}{1+r^*} \right)^{T} B_{t+T+1} \right) \right]$$

(6.19)

The assumption of non-satiation prevents $B_{t+2}$ from being positive (the rest of the world does not owe the economic agents in the domestic economy at the end of the period) and no Ponzi game constraint prevents it from being negative (agents cannot owe the rest of the world at the end of the game). As in the two-period case, $\lim_{T \to \infty} \left( \frac{1}{1+r^*} \right)^T B_{t+T+1} = 0$. Consequently, (6.19) becomes:

$$E_t \{ (1+r^*) B_t \} = -E_t \left( \sum_{t=1}^{\infty} \left( \frac{1}{1+r^*} \right)^{-T} (NX_t) \right)$$

(6.20)

Now divide both sides of (6.20) by $(1+r^*)$, so that we can solve for $B_t$. This yields:
Equation (6.21) can be re-written so that it is similar to the case of the two period analyses, this yields:

$$B_t = \left[ \sum_{t=1}^{\infty} \frac{1}{1 + r^*} \left( \frac{1}{1 + r^*} \right)^{t-1} \left( E_t, NX_t \right) \right]$$

Equation (6.22) has the same interpretation as (6.18)—that is, an economy is considered to be solvent as long as it can generate sufficient net exports surpluses in the future to meet preexisting external obligation as captured by $B_t$.

As noted in Chapter 2, using the solvency condition to assess the external position of an economy has a number of limitations. First, there is uncertainty in forecasting the ability of a country to generate sufficient future trade surpluses to repay the current debt obligations. Second, solvency does not distinguish between the ability and the willingness to pay and lend. Therefore, instead of working with the solvency condition, we use an established 'test' of the solvency condition, which is a non-increasing external debt to GDP ratio. A country is likely to remain solvent as long as the ratio is not growing.

Milesi-Ferretti and Razin (1996) demonstrated that a non-increasing external debt GDP ratio is a function of the real interest rate, real growth rate of domestic output, changes in the real exchange rate and the net exports. The equation capturing this relationship is presented in (6.23):
where: $b_t$ is now the stock of foreign assets denominated in foreign goods. The ratio of foreign assets to output ($b_t$) equals $B_t/q_tY_t$; $q_t$ is the real exchange rate; $r^*$ is the real world interest rate, $g$ is the growth rate and $\varepsilon$ is the rate of real appreciation.

From (6.23), changes in the ratio of foreign assets to GDP are driven by both trade imbalances ($nx_t$) and a "debt dynamics" term that is positively related to the world real rate of interest and negatively related to the rate of real exchange rate appreciation and the rate of domestic economic growth.

It is important to determine the long term net resource transfer (positive net exports) required to maintain a constant net foreign assets output ratio. To achieve this, we assume that, at the steady state, the net foreign asset position remains constant. Based on constant net foreign assets as a ratio of real output, the net resource transfer ($nx_t$) required to stabilize the ratio of net foreign assets to output is given by:

$$nx = \frac{(1+r^*)-(1+g_t)(1+\varepsilon_t)}{(1+g_t)(1+\varepsilon_t)}b$$

(6.24)

where: $nx$ is the long-term net exports. The resource balance gap is the difference between the net exports required to stabilize the net foreign assets GDP ratio and the actual current net exports (both as percentages of GDP). Using (6.24), the sustainability of the current account position of a country can be carried out. If the

---

7 See Milesi-Ferretti and Razin (1996, pp.10)
net exports required stabilizing the net foreign assets as a ratio of output is greater than the currently observed net exports, this indicates unsustainability and calls for a policy change such as a devaluation of the currency in order to boost exports and reduce imports. Furthermore, (6.24) adds another twist to analyzing the sustainability of the external position of a country. It may be the case that a country is experiencing a current account surplus but the observed surplus may not be sufficient to ensure a stable net foreign asset output ratio. In such a situation, despite a positive current account balance, it may be necessary to further enhance the current account position so as to ensure that the intertemporal solvency condition is satisfied.

We assume different scenarios in order to establish which current account path will likely ensure a constant debt to GDP ratio. In all the scenarios considered, the expected exchange rate depreciation\(^8\) is taken to be zero and, as a result, the equation for calculating the current account surplus required to stabilize the external debt GDP ratio reduces to:

\[
x = \frac{r^* - g_t - b}{(1 + g_t)}
\]

(6.25)

Under the first scenario (Table 6.4), we report the current account surplus that stabilizes the external debt GDP ratio at its pre-crisis (1985) level of 66 percent, given varying assumptions about the real growth rate and the real international interest rate. Using the annual average growth rate of 3 percent during the period

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\(^8\) This assumption is consistent with Corsetti et al (1998) and Obstfeld and Rogoff (1999, pp.68.)
1961-85, and an assumed real international interest rate of 4 percent, the goods and services deficit (inclusive of transfers) required to maintain a constant external debt GDP ratio as of 1985 was 0.67 percent. In order to assess the external position of the Nigerian economy before the occurrence of an external crisis in 1986, this ratio was compared with the average of the net trade balance inclusive of services and transfers during the period 1981-83\(^9\). The actual average of net trade balance during the period 1981-83 was \(-6.33\) percent of GDP. This indicates a resource gap of about \(-7\) percent of GDP.

As indicated above, the current account balance (excluding interest payments) that ensures a constant external debt to GDP ratio is 0.67. This implies that to maintain a constant external debt to GDP ratio in the future, the goods and services surplus (inclusive of transfers) must average 0.67 percent of GDP. Given the outstanding cost of external debt, the calculated interest payment on servicing external debt equals about 2.64 percent of GDP. The overall annual current account deficit of \(-1.97\) percent of GDP is permissible. In the event that the Nigerian economy is able to achieve a higher growth rate of 5 percent, with a real international rate of 4 percent, the trade balance inclusive of services and transfers must average a deficit of \(-0.67\) of GDP and the economy can afford an overall deficit of about 3.31 percent of GDP.

\(^9\) This is the case, because the government put in place austerity measures and strict exchange and import controls that appeared to reduce the imports of goods and services during the 1984-85 period.
In the period 1986-97, the actual current account surplus averaged about 1.5 percent of GDP, which is higher than the required current account balance of 0.67. However, increasing the real interest rate, interest expenditure on outstanding debt stock, or a reduction in the growth rate would change this conclusion.

Table 6.4 presents various scenarios pointing to the fact that a higher growth rate for the Nigerian economy augments its ability to increase its current account deficits without increasing the external debt to GDP ratio. On the other hand, higher interest rate lower the ability of the Nigerian economy to have a larger current account deficit that will be sustainable.

<table>
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<tr>
<th>Real Interest Rate (percent)</th>
<th>Scenario 1 (Stabilize Debt-GDP ratio)</th>
<th>Scenario 1 (Reducing Debt-GDP ratio)</th>
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<td>Growth Rate of Real Income</td>
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<td>3.00 5.00 7.00</td>
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</tr>
<tr>
<td>6.00</td>
<td>1.98 0.66 0.00</td>
<td>0.99 0.33 0.00</td>
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**6.8 Excessiveness of the Current Account Balance**

From Chapters 4 and 5, the equation for the optimal current account balance, with changes in the interest rate and exchange rate (with asymmetry excluded) is given by:
The variables in (6.26) are defined as follows: $z_t = (c_{n, t}, c_{a, t}, r_t)'$, $g_1 = [1, 0, 0]$, $g_2 = [0, 0, 1]$, and $h = [0, 1, 0]$ and $r_t$ is the consumption-based interest rate that includes the world real interest rate, and expected change in the exchange rate. Equation (6.26) is re-written as:

$$
ca_{t}^{**} = k z_t
$$

(6.27)

$$
k = -(g_1 - \gamma g_2) \beta \Psi (I - \beta \Psi)^{-1}
$$

As we are interested in examining the excessiveness of the current account deficits, possible asymmetry in access becomes important. As was established in Chapter 5, there is evidence that a restriction of asymmetry in access to the international financial markets cannot be rejected. We therefore focus on two optimal current accounts—optimal current account that reflects asymmetry and the one that does not. The optimal current account (with asymmetry in access to the international financial market) is given by:

$$
hz_t = - \sum_{t=1}^{\infty} \beta^{t-1}(g_1 - \gamma g_2) \Psi^{t-1} z_t
$$

(6.28)

where $z_t = (c_{n, t}^h, c_{n, t}^i, c_{a, t}^h, c_{a, t}^i, \hat{r}_t)'$, $g_1 = [1, 1, 0, 0, 0]$, $g_2 = [0, 0, 0, 1, 0]$, and $h = [0, 0, 1, 1, 0]$. Re-expressing (5.6), we have:

$$
ca_{t}^{***} = k z_t
$$

(6.29)

where: $k = -(g_1 - \gamma g_2) \beta \Psi (I - \beta \Psi)^{-1}$
We employ the value of 0.45 for the intertemporal elasticity, $\gamma$ and we use 0.85 for the share of the tradable goods. The PVMCA is then used to assess the excessiveness of the Nigerian current account imbalances before the year 1986. The actual current account, and estimates of the optimal current account without asymmetry in access (changes in interest rates and exchange rates considered—optimal 2), and the current account in the face of asymmetry in access (optimal 5) are shown in Figure 6.5. For most of the period, the three current account balances were in deficit. The first important observation is that, for most of these years, the actual current account balances could be considered excessive relative to either the constrained or unconstrained current account. In the period before 1986, especially 1981–83, the current account balances were persistently excessive. The strict trade and exchange policy measures curbed this trend during 1984–85. However, the unsustainability of such policy measures was reflected in a dramatic widening of the gap between the optimal and actual current account balance in 1986.

Finally, for most of the years, the optimal current account deficit, in the absence of unrestricted access to the international financial market, is greater than that of the optimal current account that allows for possible asymmetry. This is a further confirmation of the fact that in the face of unexpected shocks, the economic agents in Nigeria would not be able to use the international financial markets to the extent they desired.
6.9 Conclusion

This chapter has used macroeconomic indicators to examine the external position of the Nigerian economy over the 1960–97 periods. In view of the empirical results, we note the following observations. First, current account surpluses achieved by stringent exchange controls can still produce external crises due to adverse external shocks. This reflects the fact that current account surpluses arising from exchange controls do not address the fundamental causes of the problems and are, therefore, not sustainable. In the same vein, it is crucial to examine whether the observed current account surpluses are sufficient to ensure that the intertemporal solvency condition is satisfied.

Second, and most important for the current study, is the fact that the underlying factors behind a given path of current account balances determines whether they will generate an external crises or not. Although there were consistent current account deficits over the period 1960-73, there was no evidence of exchange rate depreciation, foreign debt crises, or lack of access to the international financial
market. Thus, in spite of the consistent current account deficits over that period, there was no occurrence of external crises. However, the external imbalances over the 1981-85 period culminated in an external crisis in the form of exchange rate depreciation and foreign debt crisis\textsuperscript{10}. There was also a considerable amount of resource gap during the same period.

The use of various indicators to assess the sustainability of the Nigerian current account deficits allows additional insight. An assessment of the sustainability of external imbalances must be based on a wide range of relevant macroeconomic indicators. Current account deficits associated with exchange rate appreciations and fiscal deficits appear not to be sustainable. Current account deficits that are associated with low savings, a high concentration of exports in a particular commodity, lower economic growth, growing external debt, high debt servicing, inadequate foreign exchange reserves and political instability could degenerate into external crises.

It is important to note that the PVMCA is able to establish the excessiveness of current account deficits in most of the years covered by this thesis: for most of the years, the actual current account balances were excessive relative to the optimal current accounts. In the period before 1986, especially, 1981-1983, the current account balances were persistently excessive. The strict trade and exchange policy measures curbed this trend during 1984-85. However, the unsustainability of such

\textsuperscript{10} This is not to dispute the fact that increased world interest rates and declining terms of trade necessitated the sharp policy reversal of 1986
policy measures was reflected in a dramatic widening of the gap between optimal and actual current account balance in 1986.

Finally, continual use of the floating exchange rate, reduction in fiscal deficits, increased savings rate, diversification of the export base, increased economic performance as measured by the growth rate of the economy, efficient debt management strategy, and political stability must be pursued in Nigeria. This policy package is essential if the country is to sustain deficits that may be associated with increased investment rates in the future. Moreover, by pursuing this policy package consistently, economic agents in Nigeria could have increased access to the international financial markets.
## Appendix II

<table>
<thead>
<tr>
<th>Year</th>
<th>Current Account to GDP</th>
<th>Terms of Trade Index (1995=100)</th>
<th>Industrial Countries Output (Index 1995=100)</th>
<th>World Real Interest Rate</th>
<th>Real Effect. Exc. Rate</th>
<th>Fiscal Deficits to GDP</th>
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Source: International Financial Statistics database, IMF
Oshikoya (1988)
CHAPTER 7

SUMMARY AND CONCLUSIONS

This thesis has investigated the appropriateness of using the Present Value Model of the Current Account as the framework for analyzing the current account. It has also analyzed the impact upon the current account of introducing changes in the interest rate, exchange rate, terms of trade and asymmetry in access to the international financial market. Moreover, given the reoccurring and persistent current account deficits during the period covered by this thesis, we extended the analysis to examine the issue of excessiveness and sustainability of current account deficits.

The second chapter focused on the structure of the Nigerian economy, the occurrence of external shocks and policy responses and the evolution of relevant macroeconomic variables. This was considered important for understanding the relevance of the variables used to assess the Nigerian external position before and after 1986. It also examined concepts such as solvency, sustainability, excessiveness, and external crisis. The third chapter laid the foundation for the models presented in chapter 4. This chapter discussed the various intertemporal approaches to modeling the current account, with special emphasis on the PVMCA. The standard PVMCA has a number of inherent weaknesses—which include exclusion of changes in the interest rate, exchange rate and terms of trade—and fails to allow for the fact that agents may not have unrestricted access to the international financial market in the face of, for example, an unexpected deterioration in the terms of trade. This chapter reviewed the empirical literature on the intertemporal model of the current account. It also discussed the
applicability of the assumptions underlying the PVMCA to the Nigerian economy and reviewed the empirical literature on the determination of Nigeria's current account.

Chapter 4 developed the general theoretical framework for analyzing the current account balance in the intertemporal context. We first derived the standard theoretical framework that excludes changes in the interest rate, exchange rate and terms of trade. We then extended this standard framework to accommodate changes in the interest rate and the exchange rate. This was further extended to allow for changes in the terms of trade. We then extended this last framework to accommodate possible asymmetry in access to the international financial market.

Chapter 5 carried out the empirical investigation of the models developed in Chapter 4. The overall results showed that a current account model must accommodate the channels through which changes in the external shocks impact upon the current account. There is evidence pointing to the fact that what matters for current account determination in an intertemporal setting, using the Nigerian data, is the channel through which external shocks impact on the current account. The hypothesis of asymmetry in access to the international financial was not rejected.

In conclusion, the PVMCA appears to be a valid theoretical framework for the current. Governments need to understand private sector response to external shocks before they initiate any policy measures to deal with such external shocks. Any model of current account determination that the government has in mind must accommodate channels through which external shocks impact upon the current account. Also, the intratemporal and intertemporal effects that are associated with external shocks, such
as terms of trade must be considered. Consideration of this suggestion is important in preventing the use of counter-productive policies.

The use of various indicators to assess the sustainability of the Nigerian current account deficits revealed that assessing the sustainability of external imbalances must be based upon a wide range of relevant macroeconomic indicators. Current account deficits associated with exchange rate appreciation and fiscal deficits appear not to be sustainable. Current account deficits that are associated with low savings, high concentration of exports in a particular commodity, lower economic growth, growing external debt, and high debt servicing, inadequate foreign exchange reserves and political instability, could degenerate into an external crisis. Therefore, Nigeria must pursue policies of continual use of the floating exchange rate, reduction in fiscal deficits, increased savings rate, diversification of the export base, increased economic performance as measured by the growth rate of the economy, efficient debt management strategy and political stability.
REFERENCES


