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ADDIS ABABA UNIVERSITY
COLLEGE OF BUSINESS AND ECONOMICS
DEPARTMENT OF MANAGEMENT

DETERMINANTS OF FOREIGN EXCHANGE RESERVE IN
ETHIOPIA: A TIME SERIES ANALYSIS

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Addis Ababa, Ethiopia

ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES
COLLEGE OF BUSINESS AND ECONOMICS
DEPARTMENT OF MANAGEMENT

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ETHIOPIA: A TIME SERIES ANALYSIS

A Thesis Submitted to the School of Graduate Studies of Addis Ababa University in Partial Fulfillment of the Requirements for the Degree of Masters of Science in International Business (Strategic Investment Management)

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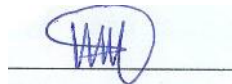
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ABSTRACT

Using time series data, this paper sought to investigate the factors that affect Ethiopia's foreign exchange reserves. Secondary data on variables such real effective exchange rate, current account balance, debt service, loans to the private sector, Real GDP, and growth rates of price regressed on foreign currency reserves were used in the study, which covering the time frame of 1987 to 2022. The data collected from the National Bank of Ethiopia were used in this study using an ARDL model. Based on the findings, the REER, inflation, and real GDP all play a substantial and favorable role in determining Ethiopia's foreign currency reserves. In contrast, Ethiopia's foreign exchange reserves are significantly and adversely impacted by the debt service. Therefore, this analysis suggests that the government of Ethiopia should keep its external borrowing to a minimum in order to lower debt servicing costs, boost domestic economic growth, encourage the appreciation of the birr, and improve current account balance through exports in order to increase foreign exchange reserves.

Key words: Foreign exchange reserve, autoregressive distributed lag, time series, debt service

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Acronym

CA – Current Account

CPS = Credit to private sector

DS = Debt Service

FER = Foreign exchange reserve (dependent variable)

IMF=International Monetary Fund (IMF)

INF = Inflation

NBE: National Bank of Ethiopia

OLS = ordinary least squares (OLS)

REER= Real Effective Exchange rate

RGDP= Real Gross Domestic Product

SDRs =Special Drawing Rights

VAT= Value Added Tax

CHAPTER ONE

1. INTRODUCTION

The introduction of the article is covered in this chapter. It starts with a description of the study's background before moving on to the problem explanation, an hypothesis, an objective, significances, scope, limitations, and organization of this study.

1.1 Background of the Study

To finance trade imbalances, to regulate currency fluctuations and to deal with other matters that fall under the central bank's purview, monetary authorities hold foreign currency holdings, which include “foreign currency, deposits denominated in foreign currency, monetary gold, Special Drawing Rights (SDRs), and reserve positions in the International Monetary Fund” (IMF) (Global Economy, 2022). This imperative object is becoming a cornerstone for the global economy, specifically for developing countries.

Developing countries have had difficulties to mobilizing foreign exchange reserves needed to cover the amount economy require (Ghosh, 2005; Naude, 2009; Dooley et al., 2007). It has been evidenced that foreign exchanges in developing countries have been hampered by either unstable or low foreign exchange reserves. As a result, increasing foreign exchange reserves is a policy priority for many of these countries (WB, 2013). More importantly, the need to raise additional foreign exchange reserves is fundamental for developing economies seeking to improve imbalance in trade finance, reduce reliance in foreign countries, and help the economy

(Andriyani et al., 2020). Reflecting this, increasing foreign exchange reserves is an explicit central aim of policies in many developing countries these days often underpinned by specific quantitative targets (IMF, 2018; WB, 2020). A natural starting point for countries aiming to increase foreign exchange reserves is to consider the question: what are the contributors of foreign reserves which are specific to the economy or countries?

History has demonstrated that the worldwide forces influencing foreign investment frequently have a significant capital inflows which have experienced numerous booms and busts due to a cyclical component or increased foreign exchange reserves, as stated by Calvo et al. (1996). They emphasized that domestic variables continue to have a significant role in determining the size and make-up of foreign reserves. Strong domestic fundamentals drew more money and a higher percentage of long-term investment to their countries. These fundamentals (determinants), which can be estimated through empirical investigation, will be the theme of this study. Finding the contributors (the determinants) are a much deeper question, the answer to which will rely on a number of variables such as debt servicing, imbalance in trade finance, stability in exchange rate, and the efficiency with which foreign currency held can be spent. Estimating the main determinants of foreign exchange reserves needed for a country, this study will aim to suggest the policies desired to improve the foreign exchange reserves.

Many countries want to raise additional foreign exchange reserves, be it primarily for financing the trade imbalances, stabilizing foreign exchange fluctuations and/or addressing other economic issues. Regardless of foreign exchange reserves mobilization plans, economic and institutional conditions limit the amount of reserves that a country can raise within the bounds of reason. In spite of the fact that, many countries fail to raise sufficient foreign exchange reserves to finance

investment and stimulate economic growth; especially low foreign reserve is a common feature of most Sub-Saharan African countries (IMF, 2022).

Similarly, different studies and reports in Ethiopia (Union, 2008; Gelaw, 2022; NBE report, 2021) indicated that Ethiopia's net foreign asset of the banking system amounted to USD 298.7 million at the end of 2020/21 as net foreign assets of commercial banks increased to 685.1 million while that of the NBE showed a USD 386.4 million drawdown. This amount only covers 2.2 months of non-factor service and good imports according to the reports. This slowdown in foreign reserves may be attributed to the various factors that are unique to the countries' different socio-economic and political situations. Therefore, this paper will try to figure out what elements go into foreign exchange reserves in Ethiopia during the years from 1987 to 2022 using time series analysis taking into consideration of its prevailing structural economic, demographic and institutional characteristics.

1.2 Problems Statement

As a replacement for the "Growth and Transformation Plan", the Ethiopian government has released a 10-year development plan with the slogan "Ethiopia: An African Beacon of Prosperity for the years 2020/21 to 2030/31". The new Plan intends to maintain the nation's economic expansion and deal with the primary problems the nation had with earlier development plans. Over the course of the following ten years, this plan seeks to accomplish yearly economic growth of 10 percent or higher. With a targeted 13% growth per year, the manufacturing sector is anticipated to be the primary engine of growth throughout the planned time.

With the goal of raising per capita income to USD 2220 by 2030 and putting the countries into

the middle-income status, it envisaged that This quick economic expansion will result in considerable changes to living conditions. Indeed, the achievement for this objective requires sustainable resource mobilization which otherwise will be a dream to realize as argued by Gupta (2007). In light of this, the Ethiopian government has introduced various foreign exchange reforms aimed at improving foreign exchange availability (WB, 2016; Legese, 2019). However, despite the reforms the country is undertaking, the foreign reserve of Ethiopia is showing major slowdown (NBE, 2021).

Therefore, the reason for undertaking this study in the context of Ethiopia is threefold. First, the issue of improving foreign reserve comes at the forefront of all crucial issues in the context of increasing recognition of the role of foreign exchange availability for sustainable financial and social advancement of nations (IMF, 2020). However, regardless of the remarkable economic growth, the slowdown in the foreign reserve suggests the growth in foreign earning doesn't commensurate with the economic growth perhaps indicating a significant unearned resources. Thus, this requires an empirical examination to identify the significant structural economic determinants of foreign reserves.

Second, empirical study to investigate possible factors of foreign reserve in Ethiopia is not adequate (Gelaw, 2022). Regarding this, a review of some published articles on foreign reserves in Ethiopia (Gereziher & Nuru, 2021; Legese, 2019) indicates that the studies cover only few economic and finance variables, and thus, other relevant variables such as the debt servicing, the imbalance in trade finance, stability in exchange rate and etc. we're not included. Besides, the studies mentioned so far came up with conflicting results that requires further investigation on the factors that influence foreign reserves.

Third, from methodological view, prior works to quantitatively determine the factors that affect the availability of foreign currency use ‘traditional’ regression approach, in which standard ordinary least squares (OLS) to regressions of foreign exchange availability on a range of potential determinants. However, this usual model provides biased results due to correlation in the observation of time series variable. However, recent research works have begun to move beyond a previous focus on linear regression to the application of ARDL (Autoregressive Distributed Lag) model, which more satisfactorily captures the assumption underpinning the time series regression (Bentzen & Engsted, 2001; Nkoro and Uko, 2016).

1.3 Research Objective

The primary goal of this investigation is to study the factors that influence foreign exchange reserve in Ethiopia.

Besides, the study has the following **specific objectives**:

- To see the foreign exchange reserve movements (trends) in Ethiopia since 1987
- To shows the effect of debt servicing on foreign exchange reserve;
- To show the effect of other variables such as private credit, current account balance, inflation, exchange rate and economic growth on foreign exchange reserve and finally,
- To clearly identify significant variables determining foreign exchange reserve in Ethiopia

1.4 Research Question

The following questions is served as a guide to the current investigation:

1. How do Ethiopia's foreign exchange reserve fluctuations look like in general?
2. How will debt payment impact foreign exchange reserves?
3. What impact will private credit have on foreign exchange reserves?
4. What will happen to the foreign currency holding due to the current account balance?
5. What impact will be the effect of exchange rate on the foreign exchange reserve?
6. How will inflation and economic expansion affect foreign exchange reserves?

1.5 Significance of the Study

Investigating factors influencing foreign exchange reserve using time series regression analysis in the context of developing countries, particularly in Ethiopia, the current study will have multiple benefits both for the existing literature and for policy makers. Specifically, with relation to Ethiopia, the study will help to fill the research gap in the area because a review of some published articles on foreign exchange reserve determinants indicates that none of them had reached on conclusion. Therefore, the study is providing inputs for policy makers and practitioners thereby adding empirical knowledge to the available literature. Besides, the study is also serving as an inspiration and reference for further research in the area in Ethiopia in particular and in relation to developing nations generally.

1.6 Scope of the Study

Conceptually, the current study was limited to examination of determinants of foreign exchange reserves in Ethiopia in the last thirty-six years. It will investigate the influence of seven explanatory variables on foreign exchange reserve using data during the course of 1987 to 2022.

The main reason for the ceiling of sample to the year after 2004 is stark. It is because of the fact that VAT revenue collection started since 2003. The study is adopting time series data on regression analysis for determinants of VAT revenue since the data is aggregated at annual series.

1.7 Limitation of the Study

Despite the hypothetical and practical implications of this investigation, the interpretation of its findings has a number of limitations, given the variety of econometric issues that will be faced in the methodology. First, there is an inevitable wide range of omitted variables due to absence of complete data for the investigation period. Second, the conceptual issues associated with the application of time series regression on aggregated data at the country level will have no practical interpretation for individual specific. Third, the study variables may also suffer from collinearity effect that might in turn bias estimates of the determinants.

1.8 Organization of the Study

This thesis is divided into five chapters. The first part covers the introduction section, which comprises the study's background, problem statement, research aims, significance, scope, and limitation. The assessment of associated theoretical and empirical literature on the notions of foreign currency reserve and its determinant factors is covered in the second chapter. The study design and estimating methods, variable specification, and data sources are all covered in the third chapter, which is devoted to the description of the research methodology. The outcome and discussion are explained in the fourth chapter. Finally conclusion and policy suggestions were presented in the fifth chapter.

CHAPTER TWO

2. LITERATURE REVIEW

This section highlights existing scholarship on foreign exchange reserve and its determinants, as well as concepts, opinions, and ideas previously investigated by other researchers, authors, and experts about the same or related topics.

2.1 Theoretical Literature

The conventional identification of three fairly distinct motives behind individuals' holding of money balances the transactions, precautionary and portfolio motives can be applied, albeit with some caution, to central bank holdings of foreign currency. This may be accomplished through wealth diversification, intervention needs, or transaction needs.

2.1.1 Importance of Foreign exchange Reserves

2.1.1.1 Transactions needs

Reserves may be kept in order to finance the public or private sector's easily foreseen foreign exchange needs. For industrialized economies with easy access to international capital markets, this use of reserves is typically regarded as being of relatively modest importance, but it might be substantial for emerging nations. Many of these are unable to borrow money from outside sources, and their earnings or expenditures in foreign currency are notably seasonal. In such cases, borrowing to finance current account deficits may be more costly than drawing on reserves. When strict exchange controls force a large share of a nation's foreign currency transactions to go via the central bank, the transactions motivation may be especially crucial.

2.1.1.2 Intervention Needs

Additionally, reserves are kept in order to participate in market operation for currency. Insofar as the timing and magnitude of such intervention is essentially uncertain, this source of demand corresponds to the precautionary demand for money. For most countries, the most significant source of demand for reserves is thought to be the intervention motive, especially for those nations where the cornerstone of monetary policy is a stable exchange rate and/or extremely open capital and goods markets. Within the intervention needs, it is often useful to distinguish between two somewhat different sub-motives:

One is the management of very short-term currency rates. Central banks in most developed countries would probably identify this as the most important reason for holding and using reserves. Such interventions often aim to counteract short-term speculative capital movements' impacts that appear to be unrelated to underlying economic trends and sterilization is used to avoid leakage of exchange market turbulence into domestic financial markets., so as to prevent or correct speculative "bubbles" and reduce undesirable exchange rate volatility over the short term. Alternatively, and perhaps of particular importance for countries with exchange rate commitments, intervention may be undertaken simply in order to "buy time" while the authorities consider or employ alternative policy measures, like modifying domestic interest rates.

Second, the management of the medium-term currency rate. In addition to very short-term exchange rate management, unsterilized exchange market intervention can also be employed with an eye toward medium-term macroeconomic stabilization policy goals for output and prices. There is now an extensive literature suggesting that, from a stabilization policy perspective, it will usually be appropriate for monetary authorities to allow domestic interest rates and the money supply to react to exchange rate movements or pressures. In some cases, the optimal policy response will be to adjust domestic interest rates so as to strongly counter exchange rate movements." In some other cases, the optimal policy may be to reinforce exchange rate movements.' Free-floating exchange rate policies which involve no monetary policy response to exchange rate movements will lie somewhere in between.

2.1.1.3 Wealth Diversification

Although wealth or portfolio considerations, the risk/return characteristics of different financial and non-financial assets, may be important in motivating individuals' holdings of foreign currency assets, wealth considerations are not generally thought of as greatly influencing the size of the central bank's foreign exchange reserves. Rather, they are thought to be relevant mainly for decisions regarding the composition of reserves.

Wealth considerations may, however, have significance for reserve levels in certain circumstances. The most notable example is where the management of the net foreign currency exposure is partially the central bank's job. of the public sector or, perhaps, of the country as a whole. An alternative source of wealth or portfolio effects on reserve levels can arise from exchange controls or other measures which effectively replace private sector acquisition of foreign exchange assets with public sector acquisition. However, such wealth effects are less an

explicit motive for holding reserves than a consequence of measures aimed at preventing an export boom or capital inflow from boosting consumption, inflation and imports. The range of purposes for holding funds, as well as the variety of factors likely to influence the relative importance of each motive, suggests that determining a "desired" or "optimal" level of foreign currency for any given nation is likely to be a complex calculation. It also suggests that appropriate reserve levels will vary widely across countries, undermining the usefulness of very simple yardsticks for assessing reserve adequacy, such as the reserves-to- imports ratio.

2.1.2 Factors affecting Foreign Reserves

The principal factors likely to affect the assessment of reserve needs are discussed below. The structure of the currency rate system, the external exposure of the economy, the flexibility of the economy, and/or the restrictions on trade and capital movements may have an impact on a country's actual reserves at any one time.

2.1.2.1 The Nature of the Exchange Rate Regime

It was predicted that as the Bretton Woods system broke apart in the first 1970s, the requirement for reserves in countries switching to a floating rate regime would decline. The basic reasoning for this expectation was that a floating exchange rate would tend to protect the economy from outside shocks, automatically correct payments imbalances, and essentially eradicate speculative capital movements related to fixed rates, all of which would undercut the rationale for intervention and the holding of reserves. Some evidence to support this conclusion is provided by Lizondo and Mathieson (1987), who estimate that the shift to generalized floating after 1972 may have reduced industrial countries' demand for reserves by about 30%. In contrast, developing countries, who by and large continued to peg their exchange rates even after 1972, are estimated to have experienced a decline in reserve demand of only 7%.

What is surprising, however, is not that the demand for reserves may have declined, but that it did not decline by more. A number of reasons may be suggested for this. First, a shift of exchange rate regimes, such as occurred in the early 1970s, may be more apparent than real. For example, a switch from a formally pegged, but frequently realigned, exchange rate to a formally floating, but heavily managed, exchange rate may not involve much greater exchange rate flexibility in practice. Second, even though most industrial countries, as least, may have become more tolerant of exchange rate movements later the Bretton Woods system, reserve demand for the purpose of very short-term exchange rate management was likely to have been boosted by the marked increase in the short-term instability of nominal currency rates in the post-1972 period. An additional factor that may obscure any systematic relationship on deciding on an exchange rate system and the requirement for reserves is the effect on single currency peggers of

exchange rate movements between the major currencies. After 1972, for example, many developing countries continued to peg their currencies against the US dollar or the French franc. Given the large subsequent movements between the dollar and the other major currencies, the single currency peggers experienced substantially greater volatility in their effective exchange rates than previously. As a result, their reserve needs may have increased even without any formal change in their exchange rate regimes.

2.1.2.1 The External Exposure of the Economy

There is a fairly broad consensus on the proposition that the greater the exposure of an economy to balance-of-payments disturbances, whether of domestic or foreign origin, the higher reserves will need to be. Perhaps the most important caveat to this is that exchange rate arrangements may vary systematically with the degree of exposure in such a way as to undermine the linkage between external exposure and reserve needs. For example, if more exposed economies tend to have more flexible exchange rate regimes, it would be quite possible to find an inverse relationship between reserve holdings and balance-of-payments exposure. In practice, however, this does not appear to be the general rule. Where there is somewhat less consensus is on the issue of what is the most meaningful measure of exposure. The scale of a country's trade is commonly used, though the variability of its current account or short-term capital account is argued to be a better measure (though also probably more difficult to project into the future). A simple and traditional measure of the openness of an economy and, by implication its exposure to external disturbances, is given by the average propensity to trade. In principle, a high degree of openness might be expected to be associated with higher reserve holdings, at least in relation to GDP.

2.1.2.3 The Flexibility of the Economy

The term "flexibility" is used here, loosely, to describe the responsiveness of the economy and the balance of payments to exogenous developments and policy actions, including exchange market intervention. Although practically every economic parameter should affect the level of intervention and, consequently, reserve requirements (relative to GDP or, maybe, money supply), according to the research on optimal intervention, a few may be particularly significant.

Traditionally, the marginal propensity to import has been identified as a key parameter. The literature suggests that the higher this propensity, the lower the need to intervene or hold reserves (at least relative to trade or the variability of the current account). The underlying argument runs as follows: the alternatives to official reserve financing of a balance-of-payments shortfall are either to induce external financing through private capital (loans, or to close the gap by reducing net import demand. The latter can be achieved by expenditure-switching, through exchange rate adjustment (depreciation in this case), or by expenditure-changing (reduction in this example), brought about by monetary and fiscal measures. If the marginal propensity to import is high, expenditure-changing measures will be quite effective because a small reduction in income and expenditure will generate a relatively large compression of imports. Eliminating a financing gap and the need to finance it from reserves consequently has much less impact on the stability of domestic output and spending than when the marginal propensity to import is low. These means of filling or eliminating a financing gap point to other key variables. Expenditure-

switching, for example, is most efficient when the exchange rate elasticity of net exports is high. In this case, even limited exchange rate flexibility will be quite effective in eliminating external payments imbalances and therefore reduce the incentive to hold and use reserves.

2.1.2.4 Constraints on Trade and Capital Flows

In an event of trade restrictions, countries with fairly liberal trade regimes are likely to require higher levels of precautionary reserves than those with extensive controls over imports and exports, for two reasons. The first is that trade liberalisation, especially when involving reduced tariff and quota restrictions, is almost invariably associated with an expansion of the levels of imports and exports relative to national income and, consequently, an increase in the scale of potential trade imbalances to finance. The second is that trade liberalisation eliminates the possibility of directly tailoring import spending to exports receipts, so that larger external trade imbalances may emerge.

In terms of capital flow restrictions, an alternative to official financing of external payments imbalances is private financing. Capital account liberalization and a high degree of international capital mobility therefore offer scope for substantial reductions in reserves held mainly for financing of current account imbalances. Capital account liberalization can, in effect, lead to a shifting of precautionary holdings of foreign exchange off the books of the central bank. At the same time, however, liberalized capital flows may expose the economy to destabilizing speculative flows, the requirement for reserves to regulate the exchange rate in the very near future increasing. Such needs will increase the greater the central bank aversion to exchange rate movements (whether or not there is a formal commitment to a stable exchange

rate). In this regard, it is important to take into account the fact (usually neglected in theoretical models) that capital mobility or, more precisely, asset substitutability can vary significantly between different currency areas.

2.2 Empirical Literature

Numerous empirical investigations have tried to pinpoint the factors that determine foreign exchange reserves have been discovered in both advanced and emerging nations. The general level of growth is one of them (reflected in economic growth, private credit, etc.), the macroeconomic stability (inflation, exchange rate) current account balance, external debt servicing, plus other factors. Due to the different characteristics of nations and the time, the samples of most of the previous researches were mixed and less focused on the effect of different factors specifically on foreign exchange reserves (Gosselin, & Parent, 2005; Cheung & Ito, 2009; Kashif & Thiyagarajan, 2017; Sooriyan, 2017; Olomola, & Ajayi, 2018; Sanusi & Hassan, 2019; Andriyani et al., 2020; Oyeniran & Alamu, 2020; Bosnjak, & Kordic, 2020).

Gosselin & Parent (2005) mentioned in their study that, over the past few years, Asian central banks have made it easier for the USA to finance its trade deficit by purchasing USA security. As a result of this practice, Asian central banks have amassed substantial amounts of foreign exchange reserves in dollars. Then they looked at the distance that the present reserves deviate after what the traditional macroeconomic factors indicated. The authors estimated a panel of eight Asian countries. They found that a slowdown in the rate of reserve buildup is probable as long as historical relationships persist. The further explained that the risks of a sharp depreciation of the currency are nevertheless reduced by the significant capital losses that they would suffer if they radically changed reserve strategy.

Cheung & Ito (2009) employed information from more than 100 economies for the years 1975 to 2004, and perform a thorough empirical investigation on what influence the holdings of reserves. In their investigations, four categories of determinants were taken into account they then discovered that there are differences between established and emerging economies' relationships among reserves and its influencing factors. Their findings showed that wealthy economies often hold less in the way of foreign reserves than developing ones, especially in more recent times. Furthermore, there is little proof that the economies of East Asia, particularly China and Japan, are stockpiling excessive amounts of foreign reserves.

Kashif & Thiyagarajan (2017) studied the factor affecting international reserve holdings in India. They believed that the accumulation of international reserves around the world has accelerated recently and that the top 10 big holders are primarily from Asia. Developing nations, in particular, are competitive enough to hoard these assets. There are several factors that influence the holdings of international reserves, and developing nations, like India, are prone to stockpiling foreign currency. They discovered that there were long-term relationships between the factors. They discovered a negative relationship between trade openness (TRDOP) and reserve holdings using the error correction mechanism (ECM), which may have resulted from the Indian balance of payments' ongoing trade deficits. Economic progress and relationship are both in the affirmative.

Sooriyan (2017) aimed to determine the factors that influenced emerging economies' foreign exchange reserves between 1983 and 2014. The researcher's interest in how countries choose their ideal level of reserves and what factors are responsible for reserve holdings in their respective countries was piqued by his claim that emerging economies hold more than 40% of the total currency holdings in foreign exchange reserves. Similarly, Olomola, & Ajayi (2018)

investigated, for the years 2005 to 2014, the association between reserve and its influencing factors in West African States. The study's estimation method, the Panel ARDL technique, was based on the buffer stock model. With the exception of imports and nominal effective exchange, all variables have a positive effect on international reserves. Long-term import, export, and nominal effective exchange (NEER) do not statistically correlate with the growth of international reserves.

Sanusi & Hassan (2019) aimed to research the factors influencing the countries of Southern Africa's foreign exchange reserves. They used the annual data sets gathered over a 26-year period, from 1990 to 2015, to apply the ARDL methodology within a panel econometric framework. The model included variables for foreign reserves, capital inflows, exports, inflation, exchange rate, and imports. Their results demonstrate the cointegration of the variables under study. With the exception of import demand, they discovered that exports, inflation, currency rates, and imports are all important long-term predictors of foreign reserve holdings. On the other hand, it was found that capital inflow had no long-term influence on the amount of reserves held. The short-run study demonstrated that, other from exchange rate, none of the independent factors significantly affect reserve holdings. According to the study, "fear of floating"—rather than "fear of capital"—is a crucial element affecting or deciding foreign exchange reserves in Southern African countries.

Andriyani et al. (2020) attempted to identify and examine the elements influencing Indonesia's foreign exchange reserves. In their ARDL approach to monthly data spanning from 2016 to 2018, they took into account variables like exchange rate, inflation, exports, and foreign debt. They discovered that simultaneous fluctuations in foreign currency holding had a major effect on exports, foreign debt, exchange rates, inflation, and inflation rates. Foreign debt was discovered

to have a considerable and advantageous impact on foreign exchange reserves.

Oyeniran & Alamu (2020) have used the "buffer stock model," developed by Frenkel and Jovanovic (1981), to estimate the ideal level of foreign reserves for Nigeria. The ideal foreign reserve's function was estimated using the ARDL approach. The findings demonstrated that Nigeria's ideal level of foreign reserves responds to adjustment costs associated with holding reserves and currency rate volatility, and that import and opportunity costs associated with maintaining reserves have little bearing on Nigeria's ideal level of foreign reserves. The buffer stock model's short- and long-term estimations provide credence to the idea that Nigeria's holdings of foreign reserves are more sensitive to precautionary than to mercantilist reasons for maintaining reserves. They also suggested that the Central Bank of Nigeria (CBN) develop rules for managing foreign reserves that accounts for the volatility of the foreign currency, the price of oil, and macroeconomic imbalances.

Bosnjak & Kordic (2020) used a quantile regression to investigate the causes and characteristics of foreign currency holding abroad in Serbia and North Macedonia at different levels of foreign currency rates. Their analysis included quarterly data from 2005Q1 through 2019Q1. They showed that, when comparing the two countries, quantile-dependent determinants of foreign exchange reserves have demonstrated common movement between monetary variables and other volatility.

2.3 Research Gaps

Generally speaking, on the basis of summary of the aforementioned theoretical and empirical literature, the following can be taken as research gaps that could in turn justify as to how the

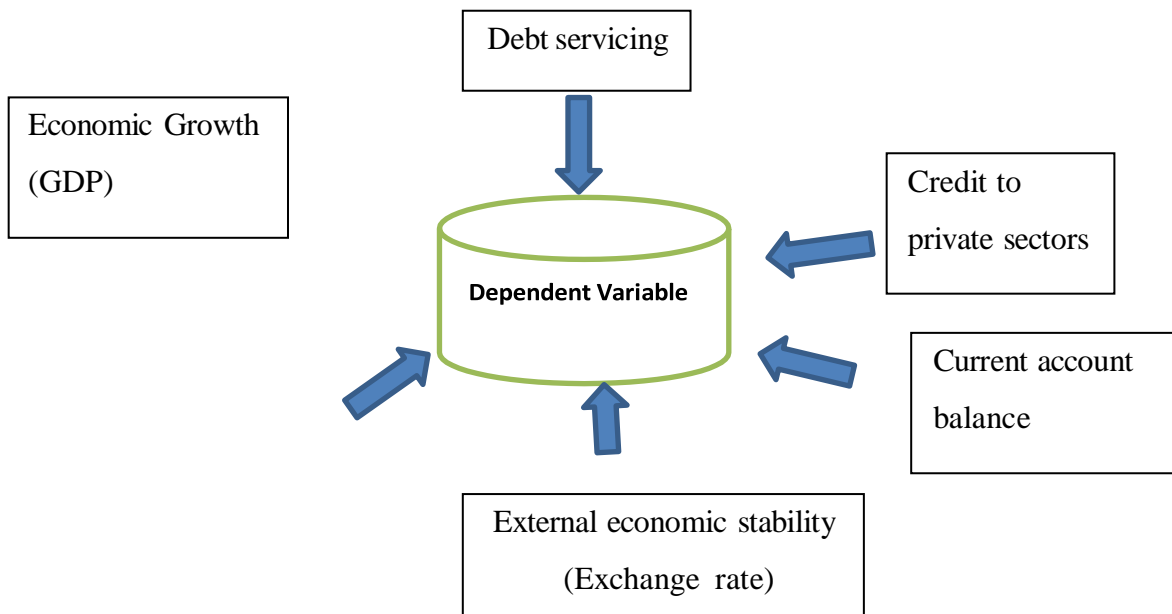
current study on hand is worth doing. First, from theoretical point of view, efforts to quantitatively estimate the determinants of foreign reserve holdings are very limited. More recent research analyzed the

determinants of foreign reserves (Cheung & Ito, 2009; Kashif & Thiyagarajan, 2017; Sooriyan, 2017; Olomola, & Ajayi, 2018; Sanusi & Hassan, 2019; Andriyani et al., 2020; Bosnjak & Kordic, 2020). There were also limited empirical literature focused on the estimating the optimal amount of foreign reserve needed for the economy specifically (Oyeniran & Alamu, 2020; Gosselin & Parent, 2005). While their findings are encouraging, the disparity in the data they have used, the method they have employed and the variables they have included were resulted in the determinants of foreign reserves unsettled. The studies so far were covered only few economic and finance variables thus, other relevant variables such as the debt servicing, the imbalance in trade finance, stability in exchange rate and etc., were not included. Besides, the studies mentioned so far came up with conflicting results that requires further investigation on what factors determine foreign reserves. The current study is aimed to provide the factors that determine Ethiopia's foreign exchange reserves.

2.4 Conceptual Framework

The current study has created the following graphic depiction of the conceptual framework, which is similar to the previous study as examined above. The theoretical framework explains the connection of foreign exchange reserves with factors determining it such as debt servicing (interest payment on loan received from creditors such as World Bank and the IMF, or from nations with which Ethiopia has diplomatic relations; balance of your current account (As defined by the OECD, a country's account of its foreign dealings with the rest of the world is kept in the current account balance of payments. It comprises any businesses between resident and non-resident entities that entail economic values (apart from those involving financial items); the lending of money by domestic lenders to the private sector is domestic credit to private sectors;

financial institutions, such as through loans, the acquisition of securities with no ownership rights, accounts receivable such as trade credits and other accounts with a claim to payback; external economic stability (measured by exchange rate), internal economic stability (measured by inflation) and economic growth (measured by GDP).



Source: Own creation based on several literature sources, 2023

CHAPTER THREE

3. RESEARCH METHODOLOGY

This section deals with methods considerations of the study and describes the research approach or design, types and sources of data and the variables under consideration. Moreover, this section explores the methods of data analysis as well as model specification and ethical consideration.

3.1 Research Design

A study design, according to Creswell (2003), is a strategy, outline, or scheme used to come up with solutions to research challenges. He points out that a research (study) design is the framework of the study that acts as a binding agent for every component of a research endeavor. This indicates that it systematizes the research and provides direction because it entails a method that the researcher will adhere to throughout the entire investigation. To determine the scope and type of cause-and-effect linkages, the study uses an explanatory research design. This is judged suitable since the research aids the researcher by examining in-depth the variables that affect Ethiopia's foreign currency reserves to assess the current state of the connection between approximately six explanatory variables and the dependent variable foreign reserves.

3.2 Research Approach

There are three types of approaches; namely, quantitative, qualitative and mixed (Saunders, Lewis, & Thornhill, 2007). If the researcher seeks to measure the disparity in a phenomenon, problem, or matter, data is developed chiefly by means of quantifiable variables, and the investigation is planned to govern the size of the disparity, the study is categorized as quantitative. The fundamental purpose of statistics is to serve as a check to see if the researcher's findings,

which were formed based on their interpretation of the studied data, are correct or incorrect. Among other things, statistics aid the researcher in quantifying the strength of a connection or link, showing how confident the researcher can be in the results, and aiding in the separation of the effects of various variables. Therefore, as the study on hand is meant for determining the effects of the below mentioned six explanatory variables on foreign reserves in Ethiopia at different points in time, it employs quantitative research approach for its purpose.

3.3 Sources of Data

This study makes used annual time series data covering the years 1987 to 2022 and collected from NBE and the Ethiopian Ministry of Planning.

3.4 Variables

The response variable of this investigation is foreign reserves that is approached by net foreign assets, and a broad range of explanatory variables that might feasibly influence foreign reserves (net foreign assets) are going to be investigated, which is guided by the theoretical and empirical literature; accordingly, the following six core explanatory variables will be examined in this research. The following Table 3.1 mentioned variables and their expected sign.

Table 3.1: Summary of variables to be tested, explanation and measurement and expected signs

No.	Variables	Explanation	Anticipated sign of the coefficients
1	FER	Foreign exchange reserves - Dependent Variable	Dependent V.
2	RGDP	Real gross domestic product	(-)
3	DS	Debt services (interest payment on loan)	(-)
4	CA	Current account balance of payments	(+)
5	INF	Inflation (a proxy variable to internal economic stability)	(-)
6	RER	Exchange rate (a proxy variable to external economic stability)	(-)
7	CPS	Credit to private sectors	(+)

Source: Author's compilation, 2023

3.5 Methods of Data Analysis

The ARDL, which has advantages compared to other cointegration methods, was taken into consideration to complete the study. It fixes the issue of data with variable integration orders and is reasonably effective for data from small sample sizes. ARDL model uses standard least square estimation and it includes lag of the dependent and independent variables. ARDL is denoted by ARDL (p, q₁, q₂, ...q_k) where p is the response (dependent) variable's lag and q_i is the lag of the ith factors (independent) variable. The ARDL model's fundamental form is provided as follows.

$$Y_t = \beta_0 + \sum_{i=1}^p \beta_i Y_{t-i} + \sum_{j=1}^k \sum_{i=0}^{q_j} X_{j,t-i} \alpha_{j,i} + \epsilon_t$$

X_j and α_{j,i} are a vector of explanatory variables and vector coefficients respectively. X_j may have lag terms or may not and if it has lag terms it is called **dynamic regressor** and if it hasn't it is called **fixed term regressor**.

3.5.1 Stationary Test

It is imperative to evaluate the stability of time series data before doing an ARDL model analysis. Using the ADF test, it is possible to determine whether the data are stationary or whether a unit root exists. The Augmented Dickey Fuller (ADF) incorporates more lags than DF, which is used to correct for serial correlation or stationarity.

However, if it is not stationary up to second order, the time series data is not economically acceptable and it is advised to rewrite the data. If the time series data are not level-stationary, the researcher makes it stationary by differencing up to second order. However, if the non-stationarity was brought on by the existence of a trend, the data could be made stationary by detrending (including the time period) (Gujarati, 2004). The following details the ADF test:

$$\Delta Y_t = \alpha_0 + \gamma t + \theta Y_{t-1} + \sum_{i=1}^p \Delta Y_{t-i} + \epsilon_t$$

3.5.2 ARDL Lag selection

Again, it takes both science and art to select the right number of lags for ARDL. The analyst has a lot of techniques at their disposal to choose optimum lag length unless it is predetermined by theory. One possibility is to specify the highest number of lags for the dependent variable, let's say p , and the highest numbers of lags for each of the regressor variables, let's say q_i , and then run regressions with all the possible lag combinations. The best mixture is then determined by minimization of the Akaike information criteria (AIC), Schwarz information criteria (BIC), or Hannan Quinn (HQ).

3.5.3 Diagnostics test

The idea of a diagnostic test is crucial when choosing a model. To claim that the accurate model was chosen based on the principles, the chosen ARDL model must pass diagnostic tests such the serial correlation, hetroschadasticity, and normality test.

Serial Correlation test: the chosen model in time series analysis should meet the requirement that there is no serial correlation, unless lags or other variables are added to eliminate this kind of correlation. The LM test was taken into consideration to examine whether serial correlation existed in the ARDL model. The research hypothesis explain that there is serial correlation, while the null hypothesis explain that there is no serial correlation. The null hypothesis of shouldn't be discarded in order to praise the model's performance.

Heteroskedasticity test: the Heteroskedasticity Test, another diagnostic method, examines the homoscedasticity of the model's residuals. In contrast to the alternative, which said that the residuals are heteroskedastic, the null hypothesis indicated that the residuals are homoscedastic.

Normality test: For the model to be considered good, it must be regularly distributed. to evaluate normalcy The Jarque-Bera test was taken into account, and the null hypothesis indicated that either the residuals are normally distributed or they are not.

Stability test: after models is selected and have satisfied the above test the final test should be considered is stability test. This is done using cumulative sum graph produced from the results

of estimated model. If the model is stable it is used to estimate parameters to meet the researcher's objective.

3.5.4 Bounds testing (cointegration test)

Pesaran, Shin, and Smith (2001) propose a way for determining whether the ARDL model contains a long-term connection exists between the regressors and the dependent variable. using the ARDL model of Equation above. The ARDL bounds testing strategy, which is primarily depend on the joint Wald-test (F-statistic) is used in the cointegration procedure. The hypothesis stated as follows

- H_0 : long run coefficients = 0 No Cointegration
- H_1 : long run coefficients $\neq 0$ There is cointegration

The cointegration test of ARDL is fundamentally based on two sets of crucial values. If the F statistics is lower than the lower critical bound value, the H_0 is not rejected and suggests that there is no cointegration. H_0 is rejected if the F statistics are higher than the upper critical value due to cointegration. The first is the lower critical bound, which is based on the idea that cointegration cannot exist because all the variables are assumed to be I (0). The second is the upper critical bound, which presupposes cointegration and assumes all the variables are I(1). F is inconclusive if it lies between the upper and lower bound. ARDL model is applicable if there is cointegration unless considering another model or including other variable is important.

3.6 Model Specification

The works review in the preceding chapter outlined the causes that determine Ethiopia's foreign currency accumulation. However, it's increasingly difficult to generalize determinants of foreign reserves because of improvement in the economy, improvement in financial system and other varying factors. To overcome such problem, looking at historical development in the foreign reserves along its determinants has better implication than using single time collected evidence (or a cross sectional data), which may further enhance our understanding of foreign reserves determinants. Following the theories and previous studies such as Roger, 1993; Olomola, & Ajayi, 2018; Sanusi & Hassan, 2019; Andriyani et al., 2020; and Bosnjak & Kordic, 2020, this study defined the model as follows in order to investigate the factors that influence foreign reserves in various nations throughout the world:

$$FER_t = f(DS_t, RGDP_t, REER_t, CPS_t, INF_t, CA_t)$$

Where;

- FER = Foreign exchange reserve (dependent variable)
- DS = Debt Service
- RGDP= Real Gross Domestic Product
- REER= Exchange effective exchange rate
- CPS = Credit to private sector
- INF = Inflation
- CA – Current account
- β_0 = Constant term $\beta_1, 2, 3 \dots 6$ are parameters to be estimated;
- ϵ = is the error, $E[\epsilon_t] = 0$

- t = 1987, 2014, 2015... 2022

The ARDL model for the aforementioned the following function is presented, with references to Peseran and Shin (1999) and Peseran et al (2001):

$$FER_t = \beta_0 + \sum_{i=1}^p \beta_i FER_{t-i} + \sum_{j=1}^k \sum_{i=0}^{q_j} X_{j,t-i} \alpha_{j,i} + \epsilon_t$$

Where X_j are independent factors such as debt service, GDP, exchange rate, credit to private sector, inflation, current account.

3.7 Ethical Considerations

According to Crane (1999) stated that in research considering the issues of ethics is interesting and potentially important. The study will use the sources of secondary data. As previously mentioned, information will be gathered from the Ethiopian Ministry of Planning and the National Bank of Ethiopia (NBE). Additionally, compared to qualitative research, the quantitative approach is less likely to raise ethical issues (Saunders et al., 2009). Data collection, processing, and protection, trust, affiliation, and conflicts of interest are other ethical factors to take into account when doing research (Bryman and Bell, 2007). The study data will only be used for thesis-related purposes, and it will be handled ethically and legally. It will also be acknowledged.

CHAPTER FOUR

4. RESULT AND DISCUSSION

The methodologies for analyzing a long-run foreign exchange reserve were covered in the chapter before. This chapter goes into great detail about the results of the econometric approaches stated in the preceding chapter. This chapter's opening section covers a descriptive analysis.

4.1. Descriptive Statistics

The table below displays the illustrative statistics for the relevant variables. The fact that almost all of the variables' means and medians have values that are close to one another suggests that their distributions are almost symmetrical.

Table 4.1. Summary Statistics

	CA	DS	REER	RGDP	INF	FER
Mean	-57,391.07	13,353.02	150.57	778,613.0	11.53	149,545.8
Median	-10,858.14	1,632.49	140.45	463,414.9	8.45	31,077.76
Maximum	-651.68	105,225.5	344.52	2,248,600.	55.24	862,108.3
Minimum	-304,403.9	480.1	93.78	238,826.2	-10.77	2,186.735
Std. Dev.	81,204.42	24,981.21	52.26	621,958.4	14.07	211,762.2
Skewness	-1.36	2.27	1.83	1.04	1.25	1.62
Kurtosis	3.74	7.42	7.078	2.75	4.73	5.08
Obs (N)	36	36	36	36	36	36

Source: own computation by Eviews-12 software

The results indicate that the foreign exchange reserve and debt service had a mean of 149,545.80 and 13,353.02 with a standard deviation of 21,1762.2 and 24,981.21 over this study periods. Further, the mean of the real effective exchange rate was 150.57, while the standard deviation was 52.26; real GDP had a mean of 778,613.0 with a standard deviation of 621,958.4 while the

inflation rate and current account has a mean of 11.53 and -57,391.07 and with a standard deviation of 14.07 and 81,204.42. Besides, the real effective exchange rate ranges between 93.78 and 344.52. Foreign exchange reserve ranges between 2,186.735 and 862,108.30. Debt service and current account ranges between 480.1 and 304,403.90. The real GDP ranges between 238,826.20 and 2,248,600.0, whereas the inflation rate ranges between -10.8 and 55.2.

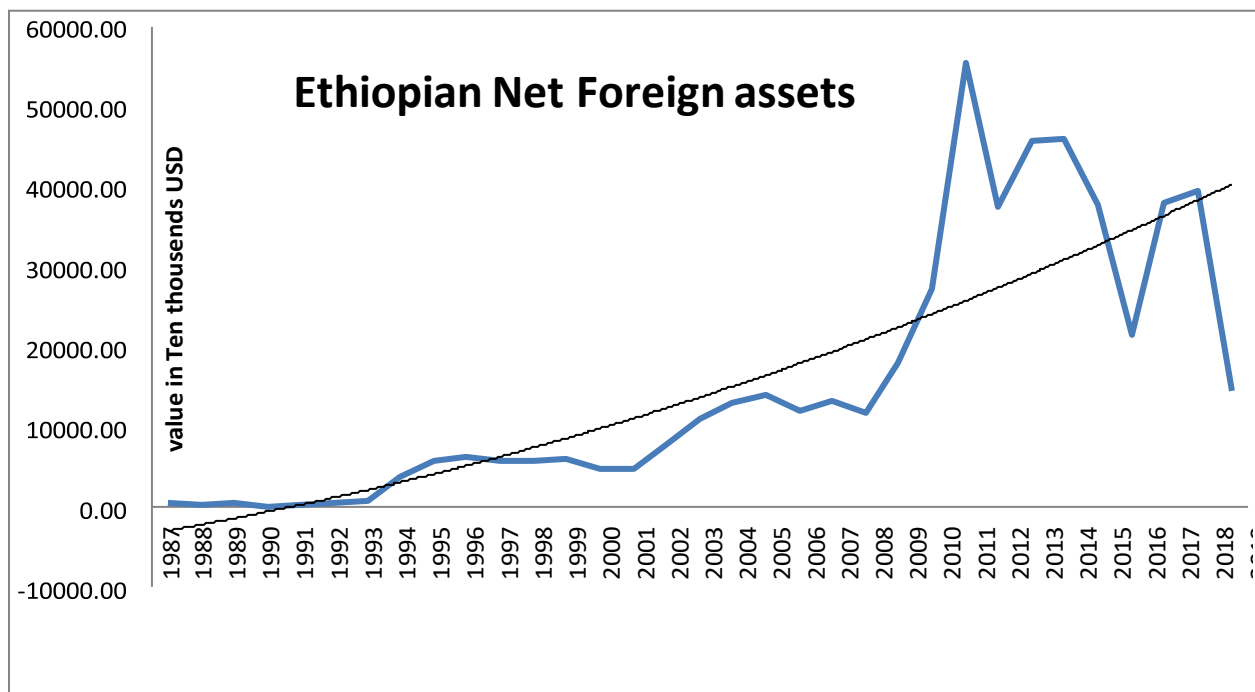


Figure 4.1. Trends of Ethiopian Net Foreign Asset (foreign reserves)

Similarly, as displayed in the following figure, the trend line indicates an increasing Ethiopia net foreign asset on average since 1987. However, there were times where the Ethiopia's net foreign asset was above its potential (or sharply increasing) and again also there were times where it was below its potential (sharply decreasing). For instance, from 1997 to 2010, the Ethiopian net foreign asset was below the potential (the black line) and again, from 2010 to 2016, the

Ethiopian net foreign asset above the trend line or above its potential. And recently, since 2019 the Ethiopian net foreign asset is sharply decreasing. This needs special attention to identify the factors contributing to such variation in the Ethiopian foreign asset or foreign reserves.

4.1. Econometric Estimation

Although data pretesting is not necessary for ARDL, we choose to set the order of data integration before conducting ARDL. Table 4.2. Show the results of unit root tests for the order of integration of the variables under investigation.

4.1.1. Unit Root Test

The unit root test on the relevant variables is the first stage in time series econometric analysis. The test looks at the stationary or non-stationary nature of the data series. The standard Augmented Dickey-Fuller (ADF) test was used to run the test both with and without a trend.

Table 4.2. Unit Root Test

At level				
Intercept			Trend and Intercept	
Variables	t-statistics	Probability	t-statistics	Probability
FER	0.43	0.98	2.55	1.00
REER	-2.51	0.12	-2.51	0.32
RGDP	2.28	0.99	2.38	1.00
CPS	1.66	0.99	23.81	0.99
DS	10.59	1.00	6.95	1.00
CA	1.78	0.99	-0.28	-0.98
INF	-4.96	0.00***	-5.38	0.00***
At First Difference				
Intercept			Trend and Intercept	
	t-statistics	Probability	t-statistics	Probability
FER	-1.80	0.38**	-5.60	0.00***
REER	-6.25	0.00***	-6.12	0.00***
RGDP	-0.399	0.89	-3.82	0.03**
CPS	4.26	1.00	-6.16	0.00***
DS	0.94	0.99	-8.98	0.00***
CA	-4.31	0.02**	-5.26	0.01**
INF	-7.92	0.00***	-7.83	0.00***

Source: own computation E views 12 software

Notes: 10% significance level for "*" The significance levels for "***" and "****" are 5% and 1%, respectively.

The outcomes of the Augmented Dickey-Fuller (ADF) test statistics show that at levels other than the inflation rate (INF), the real effective exchange rate (REER), the current account (CA), the debt service (DS), the real gross domestic product (RGDP), and the credit to the private sector (CPS) are non-stationary. However, after the first differencing, these variables become stationary. Current account (CA), debt service (DS), real gross domestic product (RGDP), and credit to the private sector (CPS) are all intergraded of order I(1) with the trend and intercept, but net foreign assets (FER) and real effective exchange rate (REER) are stationary at the trend and intercept, indicating that they are stationary at the first differing while inflation rate (INF) is I(0).

4.1.2. Model Selection

Table 4.3. Model Selection

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
FER(-1)	0.208021	0.306250	0.679252	0.5030
CA	1.380970	0.380354	3.630753	0.0012
INF	0.188792	0.073153	2.580788	0.0159
INF(-1)	0.247104	0.057697	4.282822	0.0002
REER	0.267789	0.073078	3.664420	0.0011
RGDP	2.783789	0.707063	3.937118	0.0006
CPS	1.161220	2.736522	5.887837	0.0000
CPS(-1)	-1.278695	3.653595	-4.731491	0.0001
DS	-0.303405	0.735445	-0.412546	0.6833
DS(-1)	1.743303	1.290210	-1.351178	0.1883
C	-0.234266	0.121381	-1.930000	0.0646
R-squared	0.915444	Mean dependent var		0.010541
Adjusted R-squared	0.889427	S.D. dependent var		1.012568
S.E. of regression	0.336705	Akaike info criterion		0.877814
Sum squared resid	2.947623	Schwarz criterion		1.277760
Log likelihood	-6.361741	Hannan-Quinn criter.		1.015875
F-statistic	35.18605	Durbin-Watson stat		2.175350
Prob(F-statistic)	0.000000			

Source: own computation using E views 12 software

The ideal lag length for each variable in the model needs to be determined before estimating the ARDL model. The Akaike information criterion (AIC) is used in our study to establish the ideal lag length for each variable, resulting in the choice of the ARDL (1, 0, 1, 0, 0, 0 and 1) model. And also model is selected by assigning maximum lag one for dependent and maximum lag one for explanatory variables.

4.1.3. Testing for Bounds Test or Co-Integration

In order to ascertain whether a long-term link existed between the variables and test for it, co-integration was used in the model bound co-integration test. Table 4.4 displays the outcomes of the ARDL bounds testing method.

Table 4.4. ARDL Bounds Test for Cointegration

Test Statistic	Value	k
F-statistic	11.92345	5
Critical Value Bounds		
	Lower Bound (I0)	Upper Bound (I1)
1% significance level	3.06	4.68
2.5% significance level	2.96	4.18
5% significance level	2.62	3.79
10% significance level	2.26	3.35

Source: on computation using E views 12 software

The fundamental step in the ARDL model is to determine whether or not there is cointegration among the variables after model selection and diagnostic tests. According to the ARDL limits test below, even at a 1% level of significance, the F-statistics test value of 11.92 is higher than the upper bound critical value, indicating that the null hypothesis that there is no cointegration is rejected. This demonstrates that the variables included in the study have cointegration, demonstrating the suitability of the ARDL model for estimating short-run and long-run

parameters.

4.2. Long Run Estimation ARDL Model

The following step is to estimate the long-run parameters to determine the effect of regressors on the dependent variable because the ARDL bound test indicates that there is common among the variables taken into account in the study. In Table 4.5, the long-term estimates of the ARDL method's optimal foreign reserve's function are shown.

Table 4.5. Long Run ARDL Analysis

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CA	1.743695	0.563674	3.093449	0.0047
INF	0.550388	0.150892	3.647564	0.0012
REER	0.338126	0.105693	3.199146	0.0036
RGDP	3.514978	0.635094	5.534576	0.0000
CPS	-1.174757	1.829222	-0.642217	0.5266
DS	-2.584295	0.292054	-8.848702	0.0000
C	-0.234266	0.121381	-1.930000	0.0646

Source: Computed by authors using E views 12 software

The estimated long run coefficients of the ARDL model based on equation are presented in Table above. The estimates for RGDP is positive and statistically significant, confirming that growth in economy is in general positively associated with the level of foreign reserves in Ethiopia. This matches what a priori theoretical predictions predicted. The positive sign of the RGDP, there was a positive relationship between the RGDP and foreign exchange reserve. This indicates that a 1% rise in the RGDP will lead to a 3.515 percent rise in the foreign exchange reserve in Ethiopia in long run, assuming all other things remain the same. It follows that the null hypothesis of RGDP not having a significant impact on foreign exchange reserve in Ethiopia is rejected and the alternative accepted.

Additionally, the current account (CA) variable's coefficient showed a positive sign and reached statistical significance at the 5% level. The current account and foreign exchange reserve had a positive relationship, which was a sign of the current account's success. This means that, if all other variables stay constant, an increase in the current account of one percent will eventually translate into an increase in Ethiopia's foreign exchange reserve of 1.744 percent. As a factor in determining foreign reserves, take the inflation variable into consideration. The findings demonstrate that inflation affects foreign exchange reserves positively and significantly, with a coefficient value of 0.550 and a probability value of 0.0012. This is consistent with theoretical expectations made beforehand.

The real effective exchange rate (REER) variable's coefficient showed up with the anticipated sign (positive) and was statistically significant at the 5% levels. This indicates that over the time period under consideration, there is a positive correlation between the exchange rate and Ethiopia's foreign exchange reserve. Our findings revealed that the exchange rate's coefficient is 0.338, indicating that an increase in the exchange rate would result in a 0.338 increase in the nation's foreign exchange reserve position. The findings, as anticipated, indicate that an Ethiopian birr depreciation will increase export and make import expensive and will improve Ethiopian foreign exchange reserves.

Finally, the estimated coefficient of debt service is -2.584. This value is significant at 5 percent meaning that debt service has statistically significant impact on foreign exchange reserve in Ethiopia. A negative coefficient indicates a one percent rising in debt service will

leads to a fall in foreign exchange reserve by a 0.715 point in the long run. When a nation pays its foreign debt, its foreign currency reserves will decline, which has an adverse effect on Ethiopia's foreign exchange reserves. This is theoretically supported by Todaro & Smith (2011).

4.2.1. Diagnostic Test Checking and Model Stability

Heteroscedasticity Test

H0: All model variables are homoscedastic

H1: All model variables are heteroskedastic

Table 4.6. Heteroscedasticity Test

F-statistic	1.540586	Prob. F(8,26)	0.1917
Obs*R-squared	11.25551	Prob. Chi-Square(8)	0.1876
Scaled explained SS	7.552594	Prob. Chi-Square(8)	0.4783

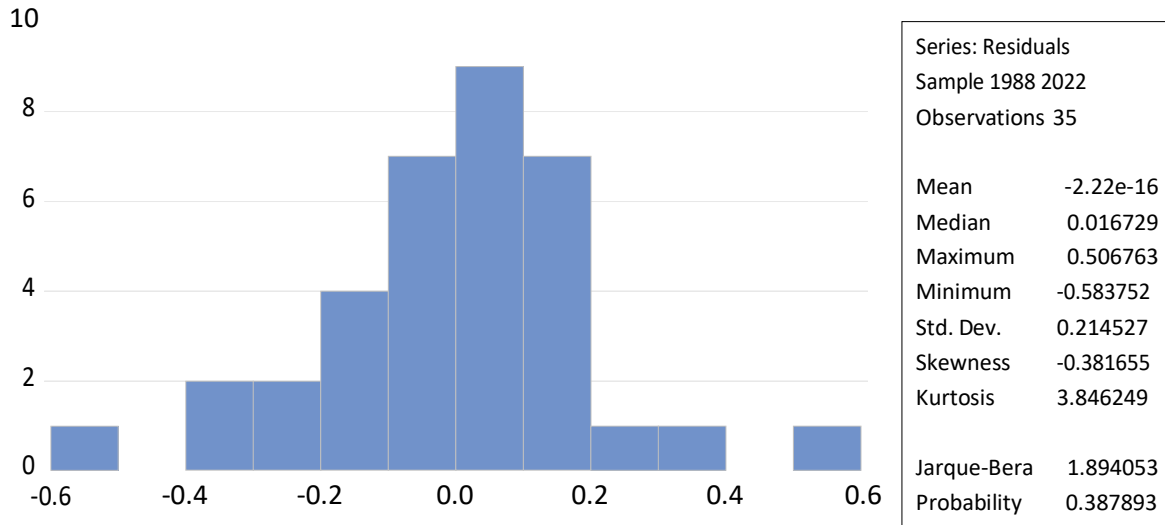
Source: Computed by authors using E views 12 software

Diagnostic testing is necessary before conducting any econometric data analysis in order to verify the accuracy of the estimated model. Before going on to the examination of the model result, a few diagnostic tests, such as the Heteroscedasticity test, Serial correlation test (Brush & Godfray LM test), and Normality test (Jaque-Bera test), were also performed to ensure that the model was stable. As can be shown in Table 4.6, no evidence of heteroscedasticity was found in this particular study according to all iterations of the white test statistic (F-statistic, Chi-Square, and Scaled explained SS). The null hypothesis could not be rejected because the p-values of 0.1917, 0.1876, and 0.4783 for the F-statistic, Chi-Square, and Scaled explained SS, respectively, were more than 0.05.

Normality test

H0: all model variables are normal

H1: all model variables are not normal



Source: Computed by authors using E views 12 software

Figure 4.2. Normality Test

Here, Jarque-Bera's likelihood has a P-value of 0.38789, which is greater than the normality test's 5% level of significance. So, rather than rejecting H_0 , we should accept H_0 and draw the inference that the residuals follow a typical normal distribution.

Serial Correlation Test

All iterations of the Breusch-Godfrey serial correlation LM test statistic (F statistic, Chi-Square) came to the conclusion that autocorrelation was not present in this investigation, as indicated in Table 4.7. The null hypothesis shouldn't be rejected because the p-values of 0.4689 and 0.3428 for the F-statistic and Chi-Square, respectively, are more than 0.05.

H0: There is no serial correlation between model variables

H1: There is a serial correlation between model variables

Table 4.7. Serial Correlation Test

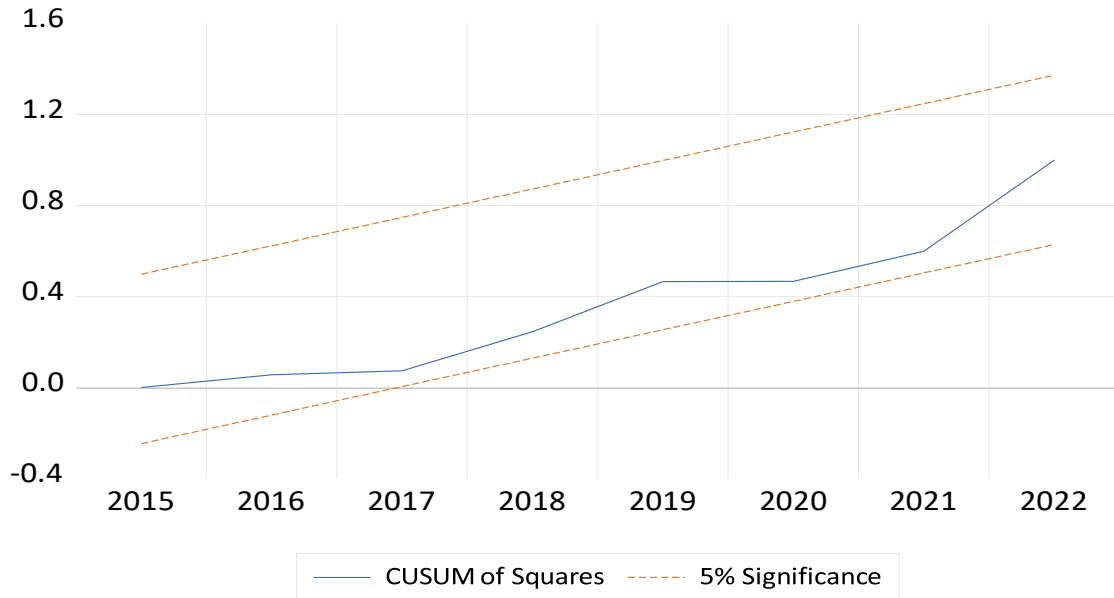
F-statistic	0.781869	Prob. F(2,24)	0.4689
Obs*R-squared	2.140955	Prob. Chi-Square(2)	0.3428

Source: Computed by authors using E views 12 software

Residual diagnostic test for model is carried out through some method tests, which includes normality (Jaque -Bera test), Serial correlation test (Brush & God fray LM test) and heteroskedasticity all tests satisfies the necessary condition. As a result, all diagnostic tests of the residual have passed and the model is adequate.

Stability Test

The CUSUM of squares test, which produces a plot versus t and a pair of 5% critical lines, is used in the paper to test the consistency of the parameter across time. Movement outside the critical lines, as with the CUSUM test, indicates parameter or variance instability. The model's stability test is depicted in the diagram below.



Source: Computed by authors using E views 12 software

Figure 4.2. Stability Test

Because the cumulative sum square does not go outside the area between the two crucial lines, the test finds that the parameter or variance is stable. As a result, the study indicates that the parameters do not change over time, implying that the aforementioned model can be used to forecast or implement additional policy initiatives.

CHAPTER FIVE

5. Conclusion and Recommendation

5.1. Conclusion

The goal of this study was to use time series data from Ethiopia to investigate the factors that influence foreign exchange reserves. We investigated this issue using annual data from the National Bank of Ethiopia that covered the years 1987 through 2022. First, summary statistics and trends were used to analyze the acquired data. Next, an autoregressive distributed lag regression model was used to estimate the model.

The two primary things we found are: firstly, having improved economic growth, having appreciated Ethiopian birr, and having stable inflation significantly improves the foreign exchange reserves in Ethiopia. Secondly, the debt service or interest payment on external loan is statistically significantly lowering the Ethiopian net foreign asset of foreign reserves. Whatever it is, debt service is reducing Ethiopian foreign exchange reserves.

It is important to consider whether these findings are limited to the situation in Ethiopia or if they have larger implications. We hope that the context under investigation is characteristic of the majority of the developing countries. The bulk of emerging nations encounter problems with their foreign exchange reserves. Whatsoever, different factors are positively and negatively contributing to Ethiopian foreign exchange reserve. Therefore, this research topic might be used as an example of how foreign exchange reserves are determined.

The drawback in this study is lack of long time data in Ethiopia context and observational nature of this study. This study used a data of only thirty six years. To determine the best strategies, it would be advantageous to conduct more research in Ethiopia; there is still much to learn about the factors that influence foreign exchange reserves in-depth utilizing survey data. It would be openly advised to use more full data to further analyze the factors that influence foreign exchange reserves.

5.2. Recommendations

The findings clearly show that having improved economic growth, having appreciated Ethiopian birr, and having stable inflation significantly improves the foreign exchange reserves in Ethiopia. Again the debt service or interest payment on external loan is statistically significantly lowering the Ethiopian net foreign asset of foreign reserves. Hence, this analysis suggests that the Ethiopian government should continue minimizing their external loan to reduce debt services and improve domestic economic growth, appreciating Ethiopian birr, improving exports to improve current account balance in order to improve foreign exchange reserve.

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Appendix

Null Hypothesis: FER has a unit root
 Exogenous: Constant
 Lag Length: 1 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	0.429112	0.9814
Test critical values: 1% level	-3.639407	
5% level	-2.951125	
10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: FER has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 1 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	2.548932	1.0000
Test critical values: 1% level	-4.252879	
5% level	-3.548490	
10% level	-3.207094	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(FER) has a unit root
 Exogenous: Constant
 Lag Length: 1 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.800629	0.3737
Test critical values: 1% level	-3.646342	
5% level	-2.954021	
10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(FER) has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 0 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.598954	0.0003
Test critical values: 1% level	-4.252879	
5% level	-3.548490	
10% level	-3.207094	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: REER has a unit root
 Exogenous: Constant
 Lag Length: 0 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.507211	0.1224
Test critical values: 1% level	-3.632900	
5% level	-2.948404	
10% level	-2.612874	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: REER has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 0 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.505765	0.3236
Test critical values: 1% level	-4.243644	
5% level	-3.544284	
10% level	-3.204699	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(REER) has a unit root
 Exogenous: Constant
 Lag Length: 0 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.246403	0.0000
Test critical values: 1% level	-3.639407	
5% level	-2.951125	
10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(REER) has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 0 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.123771	0.0001
Test critical values: 1% level	-4.252879	
5% level	-3.548490	
10% level	-3.207094	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: RGDP has a unit root
 Exogenous: Constant
 Lag Length: 1 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
<u>Augmented Dickey-Fuller test statistic</u>	2.198432	0.9999
Test critical values: 1% level	-3.639407	
5% level	-2.951125	
10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: RGDP has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 0 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
<u>Augmented Dickey-Fuller test statistic</u>	2.384828	1.0000
Test critical values: 1% level	-4.243644	
5% level	-3.544284	
10% level	-3.204699	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(RGDP) has a unit root
 Exogenous: Constant
 Lag Length: 1 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
<u>Augmented Dickey-Fuller test statistic</u>	-0.399354	0.8980
Test critical values: 1% level	-3.646342	
5% level	-2.954021	
10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(RGDP) has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 0 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
<u>Augmented Dickey-Fuller test statistic</u>	-3.819527	0.0276
Test critical values: 1% level	-4.252879	
5% level	-3.548490	
10% level	-3.207094	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: CPS has a unit root
 Exogenous: Constant
 Lag Length: 1 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
<u>Augmented Dickey-Fuller test statistic</u>	1.657431	0.9994
Test critical values: 1% level	-3.639407	
5% level	-2.951125	
10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: CPS has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 0 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
<u>Augmented Dickey-Fuller test statistic</u>	23.80769	0.9999
Test critical values: 1% level	-4.243644	
5% level	-3.544284	
10% level	-3.204699	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(CPS) has a unit root
 Exogenous: Constant
 Lag Length: 0 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
<u>Augmented Dickey-Fuller test statistic</u>	4.257091	1.0000
Test critical values: 1% level	-3.639407	
5% level	-2.951125	
10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(CPS,2) has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 0 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
<u>Augmented Dickey-Fuller test statistic</u>	-6.160561	0.0001
Test critical values: 1% level	-4.262735	
5% level	-3.552973	
10% level	-3.209642	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: DS has a unit root
 Exogenous: Constant
 Lag Length: 0 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
<u>Augmented Dickey-Fuller test statistic</u>	10.59741	1.0000
Test critical values: 1% level	-3.632900	
5% level	-2.948404	
10% level	-2.612874	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: DS has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 0 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
<u>Augmented Dickey-Fuller test statistic</u>	6.947965	1.0000
Test critical values: 1% level	-4.243644	
5% level	-3.544284	
10% level	-3.204699	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(DS) has a unit root
 Exogenous: Constant
 Lag Length: 0 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
<u>Augmented Dickey-Fuller test statistic</u>	0.943597	0.9949
Test critical values: 1% level	-3.639407	
5% level	-2.951125	
10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(DS) has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 0 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
<u>Augmented Dickey-Fuller test statistic</u>	-0.471679	0.9801
Test critical values: 1% level	-4.252879	
5% level	-3.548490	
10% level	-3.207094	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(DS,2) has a unit root
 Exogenous: Constant
 Lag Length: 1 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
<u>Augmented Dickey-Fuller test statistic</u>	-8.984304	0.0000
Test critical values: 1% level	-3.653730	
5% level	-2.957110	
10% level	-2.617434	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: CA has a unit root
 Exogenous: Constant
 Lag Length: 0 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
<u>Augmented Dickey-Fuller test statistic</u>	1.780478	0.9996
Test critical values: 1% level	-3.632900	
5% level	-2.948404	
10% level	-2.612874	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: CA has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 0 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
<u>Augmented Dickey-Fuller test statistic</u>	-0.287882	0.9879
Test critical values: 1% level	-4.243644	
5% level	-3.544284	
10% level	-3.204699	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(CA) has a unit root
 Exogenous: Constant
 Lag Length: 0 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
<u>Augmented Dickey-Fuller test statistic</u>	-4.313745	0.0017
Test critical values: 1% level	-3.639407	
5% level	-2.951125	
10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(CA) has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 0 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
<u>Augmented Dickey-Fuller test statistic</u>	-5.258862	0.0008
Test critical values: 1% level	-4.252879	
5% level	-3.548490	
10% level	-3.207094	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: INF has a unit root
 Exogenous: Constant
 Lag Length: 0 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
<u>Augmented Dickey-Fuller test statistic</u>	-4.955934	0.0003
Test critical values: 1% level	-3.632900	
5% level	-2.948404	
10% level	-2.612874	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: INF has a unit root
 Exogenous: Constant, Linear Trend
 Lag Length: 0 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
<u>Augmented Dickey-Fuller test statistic</u>	-5.375120	0.0005
Test critical values: 1% level	-4.243644	
5% level	-3.544284	
10% level	-3.204699	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(INF) has a unit root
 Exogenous: Constant
 Lag Length: 1 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
<u>Augmented Dickey-Fuller test statistic</u>	-7.921117	0.0000
Test critical values: 1% level	-3.646342	
5% level	-2.954021	
10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(INF) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=1)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-7.827138	0.0000
Test critical values: 1% level	-4.262735	
5% level	-3.552973	
10% level	-3.209642	

*MacKinnon (1996) one-sided p-values.