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Current Account Dynamics in Iran: An Intertemporal Approach

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ABSTRACT

We aim to highlight the asymmetric relationship between the current account balance and variables of fundamental macroeconomic and macroeconomic stability in the nonlinear boundary test approach in Iran for the period 1978-2020. The main focus of this research is on the intertemporal approach to the current account views the current account as the difference between domestic saving and domestic investment and focused on macroeconomic factors that determine these two variables. The primary purpose of this research is to assist in the formulation of appropriate economic policies to minimize any negative effects of the current account deficit on the economy. The nonlinear boundary test approach method is used in this article due to the possibility of long-term nonlinear relationships between the current account deficit and financial balance, inflation rate, KOF index, net foreign assets, real effective exchange rate, total investment, terms of trade and GDP per capita growth. According to the analysis findings, there is a long-term cointegration relationship between variables. It is seen that while there exists long-term asymmetry between the current account deficit, net foreign assets, and financial balance the coefficients themselves are not statistically significant. However, the effect of the real effective exchange rate and the Terms of Trade on the current deficit is statistically significant and substantial. The asymmetric cointegration result confirms, between the current account deficit and the inflation rate, KOF index, total investment, terms of trade, and GDP per capita growth a long-run integration exists.

1. Introduction

The field of international macroeconomics has devoted great attention to concerns that arise when the current account is in persistent disequilibrium

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and has focused on its existence. Macroeconomic crises in developing countries have underscored the need to clearly identify factors determining a country's current account balance (CAB). While previous theories of the current account emphasized the study of the specific determinants of trade and financial flows, the modern view (the Intertemporal Current Account (ICA) approach) highlights the role of saving-investment decisions made by a forward-looking representative agent. This view emphasizes the macroeconomic factors that determine these two variables. In the first generation of intertemporal models, a country's current account surplus equaled the present value of expected future declines in output, minus the investment and government purchases. The intertemporal approach is founded on utility-maximizing decisions by economic agents. Second-generation factors highlighted by the intertemporal approach to the current account explain the long-run dynamics of the external sector (Moccero, 2008). Iran though has been facing turbulent current account dynamics over the past four decades, they have not been the subject of many empirical studies despite the fact that the position of the current account is typically used as one of the main leading indicators for the future behavior of an economy. A striking feature of the CAB in Iran is the unsustainable recurrent deficits without oil exports. These prolonged deficits, crowd out domestic savings or lead to economic instability. An understanding of the current account deficit determinants will, therefore, aid better policy prescriptions and the main determinants which affect the size of the current account balance. Persistent current account deficit, such as the one experienced by Iran, raised a very important question of which variables play a role in the determination of the current account balance. An understanding of the determinants of the current account balance deficits is important in analyzing the sustainability of the country's external position. Empirical studies on the determinants of the current account balance in Iran are inadequate. Of course, the focus of studies in Iran was not on testing the effect of macroeconomic variables on the balance of payments and only a limited number of determinants have been addressed in a scattered manner. Several

studies have examined the determinants of current account unbalances until now. A group of studies has worked on the response to current account imbalances to shocks in just one specific determinant. In this empirical analysis, for the first time the factors considered to determine the current account deficit, in the long -run, include a macroeconomic stability variable and fundamental macroeconomic variables. Based on this, this paper estimates the long-run relationship between the current account deficit and its key determinants in Iran using the Nonlinear Autoregressive Distributed Lag (NARDL) model for the period 1978-2020.

The rest of the paper is organized as follows: section 2 provides an overview of the theoretical background of the current account balance. Section 3 includes a review of the empirical reviews. Modeling current account determinants for Iran is delineated in 4 sections. Section 5 is the empirical estimation and interpretation of results. The conclusions and policy implications are provided in section 6.

2. Theoretical Background

2.1. The Approaches about Current Account Balance

The current account deficit (CAD) defined as the sum of net exports of goods and services and unrequited transfer balances can be derived via the national income accounts, as well. The latter shows the main relationship between current account balance and capital flows and can be calculated with the help of the difference between private savings minus private investments and government spending minus tax revenues (Nihat and Kilinç, 2017). The extensive theoretical and empirical literature has examined the relationship between current account deficits and other specified macroeconomic variables (Chowdhury and Saleh, 2007). Within the theoretical literature there exist some robust analyses and models that try to explain the determinants of current account dynamics. The current account balance has dual identities: (1) the sum of the trade balance and net international investment income; and (2) the difference between income and

absorption; or equivalently, the difference between savings and investment. This approach is a macroeconomics-oriented approach. Because each identity can be derived from the other in the framework of the national income and product accounts, they do not pose a theoretical conflict with each other. Nevertheless, some economists tend to invoke the first identity the elasticity approach to emphasize the role of the exchange rate in the current account adjustment, while others tend to cling to the second identity the absorption approach to emphasize that the exchange rate is unimportant in the current account adjustment (Hung and Bronowski, 2002).

This approach states that if an economic absorption exceeds income, it must import from other countries for its excess consumption and spending, this economy thus runs a current account deficit. On the other hand, if this economic income exceeds absorption, it runs a current account surplus. The intertemporal approach, which is derived from the absorption approach, also considers the current account balance from a saving-investment perspective. This approach suggests that an economy runs a current account surplus if the national income is temporarily high or investment temporarily low. However, the intertemporal approach is a microeconomic-based analysis, while the absorption approach is a macroeconomic-based analysis. The intertemporal approach, recognizes the current account balance as the result of the optimization decisions of economic agents. Collective optimization behavior is based on the expected values of various macroeconomic factors under the intertemporal budget constraint. This approach to current-account analysis extends the absorption approach through its recognition that private saving and investment decisions, and sometimes even government decisions, result from forward-looking calculations based on the expectations of future productivity growth, government spending demands, real interest rates, and so on (Obstfeld and Rogoff 1995). Analyzing current account dynamics from an intertemporal saving-investment perspective has become the dominant approach in modern empirical literature which is now arguably the ‘workhorse’ model of modern international macroeconomics. This view

achieves a synthesis between the trade and financial flow perspectives by recognizing how macroeconomic factors influence future relative prices and how relative prices affect saving. The main insight offered by this approach is that intertemporal utility maximization of a representative household or profit-maximizing firm, infinitely lived agents lead to smooth consumption paths, where the current account via the savings rate acts as a buffer against temporary income shocks. A direct implication of the model is that current account deficits are likely whenever investment is high or income is temporarily low (Chuku et al., 2017).

2.2. The Theoretical Framework of Current Account Dynamics

In international economics since the early 1980s, the theory and experimental work of the intertemporal approach have been developed and studied. Although the approach had explicit precursors in work on trade and growth by Bardhan (1967), Bruno (1970), Hamada (1969), Buiter (1981) and Sachs (1981a and 1981b), Obstfeld (1982), Greenwood (1983), and Svensson and Razin (1983) have developed intertemporal models to provide a coherent foundation for open-economy policy analysis (Obstfeld and Rogoff, 1995). Obstfeld and Rogoff (1995), separate the intertemporal current account models into two broad groups deterministic and stochastic. Deterministic models operate under the assumption of perfect foresight of relevant variables and complete information. The basic model postulates that a representative consumer maximizes a time separable utility function in equation 1:

$$U = \sum_{t=0}^{\infty} \beta u(C_t) \quad (1)$$

The consumer is discounting the value of future utility ($0 < \beta < 1$), and the marginal utility of private consumption at the end of period $t - C_t$ is always positive ($U'(C_t) > 0$), but decreasing ($U''(C_t) < 0$). The next step involves specifying the resource constraint for the economy. On the viewpoint that emphasizes that the current account is the difference between saving and investment, the intertemporal approach to the current account

recognizes that saving and investment decisions result from forward-looking calculations based on the expected values of various macroeconomic factors. It achieves a synthesis between the trade and financial flow perspectives by recognizing how macroeconomic factors influence future relative prices and how relative prices affect saving and investment decisions. The next step involves specifying the resource constraint for the economy. To clarify the concept of the current account (CA), refer to the article by Obstfeld and Rogoff (1995), in which B (t+1) shows the net foreign assets of the economy at the end of a period t. The current account for balance over period t is defined as equation 2:

$$CA_t = B_{t+1} - B_t \quad (2)$$

In general, the date t, the current account for a country that does not have a capital account or government espending is calculated according to equation 3:

$$CA_t = B_{t+1} - B_t = Y_t + r_t B_t - C_t \quad (3)$$

Where r_t B_t is interest earned on foreign assets acquired previously, Y_t denotes gross domestic product (GDP), and C_t consumption. Equation 2 shows that the current account is the difference between its total income and its consumption. The national income of an economy is also called gross national product (GNP) and is measured as the sum of two components: the value of the final output produced within its borders (GDP) and net international factor payments (r_t B_t).In terms of national accounts these net savings of the open economy correspond to the sum of net income (returns on net foreign assets) $r_t B_t$ and net output $NO_t = Y_t - I_t - G_t$ minus aggregate consumption in equation 4. (Bussière et al. 2004):

$$CA_t = r_t B_t + NO_t - C_t \quad (4)$$

Rearranging equation 4, one can write:

$$CA_t = B_{t+1} - B_t = r_t B_t + Y_t - G_t - C_t - I_t \quad (5)$$

or

$$(1 + r_t)B_t = B_{t+1} + (C_t + G_t + I_t - Y_t) \quad (6)$$

Real interest rates are rarely constant for very long. An extended model

that incorporates changing interest rates brings the economy's intertemporal prices to center stage. Let r_t denote the real interest rate of the market and define R(t,k) as the market discount factor for date k consumption on date t≤k, that is, as the relative price of date k consumption in terms of date t consumption in equation 7:

$$R_{t,k} = \frac{1}{\prod_{i=t+1}^{k}(1+r_i)} \quad (7)$$

The intertemporal approach expresses the current account deviations from permanent levels of the relationship between the market and consumer's discount rates defined as equation 8:

$$\widehat{(\frac{\beta}{R})^{\alpha}} = \frac{\sum_{k=t}^{\beta} R_{t,k}(\frac{\beta^{k-t}}{R_{t,k}})^{\alpha}}{\sum_{k=t}^{\infty} R_{t,k}} \quad (8)$$

After repeated substitution for B_{t+1}, in equation 6 , one can express it as:

$$(1 + r_t)A_t = \lim_{k\to\infty} R_{t,k}\, A_k + \sum_{k=t}^{\infty} R_{t,k}(C_k + G_K + I_k - Y_K) \quad (9)$$

In equation 9 the term $\lim_{k\to\infty} R_{t,k}\, A_k$ represents the present value of foreign assets into the infinite future. Since, according to equation 1, agents only derive utility from consumption, no country would be willing to accumulate foreign assets indefinitely. Therefore, $\lim_{k\to\infty} R_{t,k}\, A_k = 0$, and the resource constraint facing the economy is:

$$\sum_{k=t}^{\infty} R_{t,k}(C_k + G_K + I_k) = (1 + r_t)A_t + \sum_{k=t}^{\infty} R_{t,k}\, Y_K \quad (10)$$

According to the 10 equation, the present value of the economy's expenditures must equal its initial net foreign wealth plus the present value of domestic production. In equation 9, the present value of the government expenditure, investment, and consumption equals the present value of output and the current income on net foreign assets. Maximizing equation 1 subject to 9 leads to the following optimality condition shown by the Euler equation:

$$\acute{u}(C_t) = \beta(1 + r_{t+1})\acute{u}(C_{t+1}) \quad (11)$$

At the optimal point consumers, will be indifferent, between saving and consumption. The Euler equation model for consumption and saving is a very important ingredient in most modern macroeconomic models. By

leaving aside discrepancies between β and $1/(1+r_{t+1})$, optimized consumption will follow a smooth, constant, path. A convenient closed form description of the current account is obtained by specializing further to the case in which $U(C)$ takes the isoelastic form given by under the equation:

$$U(C_t) = \frac{C_t^{1-\frac{1}{\sigma}}-1}{1-\frac{1}{\sigma}} \quad (12)$$

In this case, 11 implies that optimal consumption growth obeys:

$$C_{t+1} = \beta^{\sigma}(1+r_{t+1})^{\sigma}C_t \quad (13)$$

This consumption path satisfies the economy's intertemporal constraint. Using 10, it can be shown that the economy's date t consumption will be:

$$C_t = \frac{(1+r_t)A_t+\sum_{k=t}^{\infty}R_{t,k}(Y_k-G_k-I_k)}{\sum_{k=t}^{\infty}R_{t,k}(\frac{\beta^{k-t}}{R_{t,k}})^{\sigma}} \quad (14)$$

Equation 14 leads to an illuminating general characterization of the current account (for k=t). By placing the consumption function in Equation 5, we rewrite this equation as follows:

$$CA_t = r_tA_t + Y_t - \frac{(1+r_t)A_t+\sum_{k=t}^{\infty}R_{t,k}(Y_k-G_k-I_k)}{\sum_{k=t}^{\infty}R_{t,k}\left(\frac{\beta^{k-t}}{R_{t,k}}\right)^{\sigma}} - G_t - I_t$$

$$CA_t = \left(r_t - \frac{1+r_t}{\sum_{k=t}^{\infty}R_{t,k}\left(\frac{\beta^{k-t}}{R_{t,k}}\right)^{\sigma}}\right)A_t + \left(Y_t - \frac{\sum_{k=t}^{\infty}R_{t,k}Y_k}{\sum_{k=t}^{\infty}R_{t,k}\left(\frac{\beta^{k-t}}{R_{t,k}}\right)^{\sigma}}\right) -$$

$$\left(C_t - \frac{\sum_{k=t}^{\infty}R_{t,k}C_k}{\sum_{k=t}^{\infty}R_{t,k}\left(\frac{\beta^{k-t}}{R_{t,k}}\right)^{\sigma}}\right) - \left(C_t - \frac{\sum_{k=t}^{\infty}R_{t,k}C_k}{\sum_{k=t}^{\infty}R_{t,k}\left(\frac{\beta^{k-t}}{R_{t,k}}\right)^{\sigma}}\right) \quad (15)$$

The final step in the derivation is adding and subtracting the permanent levels of variables and multiplying and dividing the fractional terms in the equation $\sum_{k=t}^{\infty}R_{t,k}$ by use of the fact that:

$$\sum_{k=t+1}^{\infty}R_{t,k}r_k = 1 \quad (16)$$

We also consider a less general version of this equation presented by Sachs (1982) and Obstfeld and Rogo (1996) that:

$$\frac{1+r_t}{\sum_{k=t}^{\infty} R_{t,k}} = \frac{r_t+\sum_{k=t+1}^{\infty} R_{t,k} r_k}{\sum_{k=t}^{\infty} R_{t,k}} = \frac{\sum_{k=t}^{\infty} R_{t,k} r_k}{\sum_{k=t}^{\infty} R_{t,k}} = \tilde{r}_t \quad (17)$$

After many steps and concentration on deviations from permanent levels of variables according to equation 8, about express intertemporal approach, we can write the current account equation as:

$$CA_t = (r_t - \tilde{r}_t)A_t + \left(Y_t - \tilde{Y}_t\right) - \left(I_t - \tilde{I}_t\right) - \left(G_t - \tilde{G}_t\right) + (1 - \frac{1}{\left(\frac{\beta}{R}\right)^{\alpha}})(\tilde{r}_t A_t + \tilde{Y}_t - \tilde{I}_t - \widetilde{IG}_t) \quad (18)$$

3. The Empirical Review

3.1. Baseline specification: macroeconomic determinants

Evidence from the use of macroeconomic determinants and macroeconomic stability determinants in studies that determine the current account balance is presented in this section.

GDP growth per capita: The determinants of current account balances can be related to a factor such as GDP growth. A rise in growth rate, generates larger current account deficits. High-growth countries or emerging countries may attract foreign capital flows or import more intermediate goods and investment machinery, which leads to an increase in the current account deficit. Of course, for industrialized countries, growth has an inverse effect on the current account balance compared to other groups. Several studies find that a rise in domestic output growth has a positive significant effect on the current account deficit (Calderon et al. (2002); Altayligil and Çetrez (2020) and Calderon et al. (2000)).

Net foreign assets: In theory, countries that have a large stock of foreign assets relative to their foreign liabilities should have a positive balance on their property income flows, which would tend to pull up their real exchange rate and cause the current account balance to deteriorate. This conclusion in Studies of time series and in the long run is correct. But a cross-section result of countries in a particular year shows a consistent positive correlation between them and net foreign assets. Hence the sign of the equilibrium

relationship between it and net foreign assets is practically ambiguous and the determination of long-run net foreign asset positions is an important question in open macroeconomics for empirical and theoretical reasons (Bleaney and& Tian 2019). Adeleke et al. (2017) in their study implied that African governments, desirous of improving their current account balance, must institute policies aimed at increasing savings and net foreign assets. Yang (2011) paper found that net foreign assets are important in explaining the long-run behaviors of current accounts for eight selected emerging Asian economies over, but have less important roles in interpreting the short-run variations in current accounts in these countries.

Terms of trade: A positive change in the terms of trade leads to an improvement in the current account balance, it increases real income and as the propensity to consume is usually less than one, this is translated into a saving increase and a positive effect on the CAB. But only a temporary improvement in the terms of trade should have an effect on the CAB. (Gossé and Serranito 2014, Ciocyte and Rojas-Romagosa (2015).Terms of trade volatility explain a significant proportion of the variation in the current account balances. Agents in economies that face more volatile terms of trade might save more for precautionary reasons in order to smooth their consumption streams in the face of volatile income flows. However, Aizenman (1994) has argued that multinationals tend to diversify their production base across countries with volatile terms of trade in order to have the flexibility to exploit terms of trade movements that are favorable to them (Brzozowski and Prusty 2013). According to views Obstfeld and Rogoff (1995), in models like the intertemporal approach the current account that the current account balance is the outcome of forward-looking dynamic savings and investment decisions, and the impact of volatile terms of trade depends on the duration of the shock (Santos-Paulino 2007).

Fiscal balance: The relationship between fiscal and current account balances has been proposed in contemporary economic theory and examined widely in empirical literature under the commonly known term twin deficit

hypothesis (Marimuthu and Bangash 2021). A rise in the public deficit can reduce national savings without a Ricardian offset from private savings and may increase current account deficits (Altayligil and Çetrez 2020). According to the Keynesian proposition, the budget deficit has an impact on the current account deficit through the absorption theory. The paper of Alleyne et al. (2011) examines the relationship between the fiscal and current account balances in Caribbean economies. The paper finds that for several countries, the current account deficit causes the fiscal deficit and in others, the relationship was bidirectional and the variables affected each other jointly.

Real effective exchange rate: Some studies assess the effect of the real effective exchange rate on the trade balance. Though fixed exchange rate regimes are sometimes "accused" for the inability to current account adjustment there is no unambiguous empirical evidence that supports this statement. Some studies find no empirical evidence about the difference in the effect of the exchange rate regime on the current account balance (Berka et al., 2012; Chinn and Wei, 2013). Other studies find that exchange rate flexibility significantly affects external adjustment (Herrmann, 2009; Ghosh et al., 2013). Based on these mixed empirical implications, Ghosh et al. (2014) conclude that the profession is far from a consensus on the role of flexible exchange rates in facilitating external adjustment (Begović and Kreso 2017).

Total investment in fixed assets: The intertemporal approach, which is derived from the absorption approach, also considers the current account balance from a saving-investment perspective. This approach suggests that an economy runs a current account surplus if the national income is temporarily high or investment temporarily low. A direct implication of the model is that CA deficits are likely whenever investment is high or income is temporarily low (Chuku et al 2017). According found of Bussière et al. (2004) the standard intertemporal current account (ICA) model represents, an appropriate European Unio tool for analyzing current account balances.

The vast catching-up potential of these countries, as well as their strong investment needs, could justify the great current account deficits observed in the past decade.

KOF index: The degree of openness of an economy is negatively related to its current account position. Countries with more exposure to international trade tend to be relatively more attractive to foreign capital, allowing them to undertake more investment and finance the resulting current account deficits with capital from abroad (Prasad & Chinn 2000). But in this article, we use the Kof index instead of the degree of commercial openness because we believe that this index gives us a broader view of the relationship between the degree of trade openness and the current account balance. The KOF globalization index, a larger measure of globalization, developed by the KOF Swiss Economic Institute is used as a measure of openness (Kouton, 2018). This choice is made because the KOF globalization index is a better proxy for openness (Samimi et al., 2012; Syed, 2012). Indeed, the KOF index, in its construction, is based on three dimensions of globalization: Economic, social, and political (Dreher, 2006; Gygli and Sturm, 2018).

Inflation rate: The inflation rate is an indicator of macroeconomic stability that was first identified by Bernanke (2005) and added to the variables of this study. He suggests that macroeconomic stability in developing countries improves their investment climate. Odedokun (2003) in his study concluded that a stable macroeconomic condition in the form of low inflation is an important determinant of attracting foreign private capital to developing countries for investors in a capital-exporting country. Therefore, in the case of developing countries, it is expected to see a positive relationship between macroeconomic stability and current account balance. The Altayligil and Çetrez (2020) study, which was conducted with the aim of discovering the fundamental macroeconomic, institutional, and financial determinants of the current account balance in developing and developed countries, showed that the determinants of the current account balance are related to macroeconomic stability. They found that an increase in the

inflation rate reduces the current account deficit in developing countries compared to industrialized countries.

3.2. Evidence from studies conducted on Iran

The evidence from Iranian studies shows that there are contradictory results regarding the same data set of variables that determine the current account balance. This is despite the fact that the major flaw of these studies is the sparse selection of variables and the lack of categorization of these into Macroeconomic determinants, Demographics determinants, Macroeconomic stability determinants, Financial determinants, and Institutional determinants. In this way, we briefly refer to a number of Iranian studies that have used variables close to our research variables. Boroumand and Kahram (2005) find that during the years 1959-2001 budget deficit and the exchange rate had a direct effect and oil revenues had a negative effect on the current account deficit. Taghavi and kehram (2005) have shown that the current account deficit has a significant and positive relationship with the GDP, and it has an inverse and significant relationship with the exchange rate and the terms of trade. The aim of Mahmoudzadeh and Asgharpour (2009) paper is to evaluate the factors, affecting the current account deficit in Iran's economy during 1956-2006. Results indicate that the real exchange rate, oil and gas exports, and terms of trade have a positive impact, while the government budget deficit has a negative impact on the current account balance.

4. Modelling Current Account Determinants for Iran

4.1. Data Description

Table 1. Summarizes the basic information about the variables and explains their sources.

Table 1. Basic Information about the Variables

Variables	Abbreviation	Explanation	unit	Source
Current Account Deficit	CAD	The current account is calculated as the difference between the value of the export of goods and services and the value of the import of goods and services.	%	CBI
GDP Growth Per Capita	GGDP	This variable is GDP growth per capita (annual %).	%	WDI
Net foreign assets	NFA	It is the net amount of foreign assets that a country has.	year	CBI
Terms of Trade	TOT	This is the ratio of export to import prices.	%	WDI
Fiscal Balance	FB	We calculated the financial balance from the difference between savings and national investment.	%	WDI
Real Effective Exchange Rate	REER	The weighted average of a country's currency in relation to an index or basket of other major currencies.	year	CBI
Total Investment in fixed assets	TI	Gross fixed capital formation (GFCF) is considered as a measure of total investment in fixed assets.	%	CBI
KOF Index	KOF	Obtained by measuring the economic, social, and political dimensions of globalization.	year	KSEI
Inflation Rate	IR	The inflation rate is measured by the percentage rise in the Consumer Price Index.	year	CBI

Note: (1) CBI: the Central Bank of the Islamic Republic of Iran, WDI: World Development Indicator, KSEI: KOF Swiss Economic Institute World Development Indicators; (2) Time series data processed by the author via Eviews 10 software.

4.2. Model specification

The ICA generally considers the current account from the saving-investment perspective and features an infinitely lived representative agent who

smoothes consumption over time by lending or borrowing abroad (Bussiere et al, 2004). Economic theory provides an established theoretical framework for analyzing the determinants of current account balances. For interpreting equation 5 current account identity, we label national savings as S_t:

$$S_t \equiv r_t B_t + Y_t - G_t - C_t \quad (19)$$

Equations 19 make it clear that the current account can be expressed as the difference between national saving and investment:

$$CA_t = S_t - I_t \quad (20)$$

4.3. Data

For the assessment equation (20), current account, saving, and investment are inter-temporal as indicated as a function of macroeconomic variables and thus we have:

$$\begin{aligned} &CAD(GGDP,\ NFA, TOT, KOF,\ FB) = S(GGDP, NFA,\ IR, REER, TOT,\ TI) \\ &-I(GGDP, IR, REER, TOT) \end{aligned} \quad (21)$$

Finally, based on the above theoretical model, the general function for current account balances used in this research is specified as follows:

$$CAD = f(GGDP, NFA, TOT, KOF, FB, IR, REER, TI) \quad (22)$$

Many studies that have investigated the determinants of current account deficit have used standard time series techniques of co-accumulation, error correction modeling, and Granger causality. But the ICA approach has received wide application in the recent empirical literature because it emphasizes the special importance of long-term and short-term macroeconomic factors in determining the current account deficit. Our study prefers the ARDL model over other alternatives twofold. In case some variables are I(1) and some I(0), Pesaran et al. (2001) suggest an ARDL method that can estimate both short- and long-run relationships between the series in one step and simultaneously.The method can be used when all the variables are I(0) or I(1) or even if there is a combination of I(0) and I(1) variables. In other words, if each variable is integrated in order below two. The literature on the ICA approach usually relies extensively on event study

analysis and nonlinear econometric methods. While the standard ARDL model enables evaluation of the long-run relations between time-series variables, it only presumes linear or symmetric relations between them. Hence, the standard ARDL model and other techniques that presume symmetric dynamics are not able to capture the potential nonlinearity or asymmetry that lies within the relationship between current account deficit and ITS determinants. In light of this, this study adopts the NARDL approach, which is developed by Shin et al. (2014) as an asymmetric extension to the standard ARDL model. The NARDL model is designed to capture both short-run and long-run asymmetries in a variable of interest while reserving all merits of the standard ARDL approach (Cheah et al. 2017).

5. Empirical Estimation and Interpretation of Results

5.1. Linear and non- Linear Unit Root test

In first step, in order to prevent spurious regression, we analyze variables stationary by Augmented Dickey Fuller (1979) test (ADF). Therefore, unit root test of variables is needed before applying NARDL method (Na et al 2015). The results are in following Table 2. The results show that variables CAD, IR, NFA, TI, and GGDP are I(0), and the other variables are I(1). Therefore, stationarity testing gives us a solid justification to test the presence of con-integration and adopt the non-linear ARDL approach as an estimation technique.

Table 2. Results of the Unit Root Tests

Variable	Augmented Dickey Fuller				Order of integration
	Level		First Difference		
	lag	Trend & Intercept	lag	Trend & Intercept	
CAD	9	-4.19***	-	-	I(0)
IR	7	-7.19***	-	-	I(0)
FB	12	-4.21	1	-4.19***	I(1)
KOF	3	-4.19	3	-4.19***	I(1)
NFA	9	-4.25***	-	-	I(0)
REER	7	-4.19	7	-5.06***	I(1)
TI	9	-3.19*	-	-	I(0)

Variable	Augmented Dickey Fuller				Order of integration
	Level		First Difference		
	lag	Trend & Intercept	lag	Trend & Intercept	
TOT	1	-4.19	1	-4.19***	I(1)
GGDP		-4.19**	-	-	I(0)

Note: (1) Optimal lag order of ADF test is determined by the improved Akaike information criterion; (2) In ADF tests, H0= there is unit root in the series; (3) ***, ** and * denote significance level at 1%, 5% and 10% respectively.

Source: Research findings

But realizing that standard unit root tests, such as ADF, have low power to reject the unit root null hypothesis when the stationary alternative is true under the presence of structural breaks or nonlinearity in the data-generating process casts some doubt on these findings. To advance more reliable results, we tested the nonlinear unit root Lee and Strazicich (2003), which is strong against structural failure. Table 3. presents the results of the Lee and Strazicich (2003) LM unit root test with two breaks in the intercept (Model A) and two breaks in the intercept and trend (Model C). In both cases, the test fails to reject the unit root null only for the case of a variable KOF, implying the rejection of the sustainability hypothesis for this variable.

Table 3. Lee and Strazicich (2003) LM Unit Root Test

Variable	Break in intercept			Break in intercept and trend		
	Test statistic	TB1	TB2	Test statistic	TB1	TB2
CAD	-3.95**	1998	2006	-6.63**	2003	2006
IR	-4.64***	1996	1999	-6.17**	1991	1998
FB	-4.56***	1992	1997	-5.14	1997	2003
KOF	-2.96	1997	2001	-4.81	1989	2009
NFA	-4.61***	2008	2012	-6.90***	2001	2011
REER	-2.49	2005	2012	-8.76***	2000	2011
TI	-3.07	1994	2015	-5.72*	1989	2013
TOT	-3.38*	1989	1996	-5.01	1989	2001
GGDP	-4.80***	2000	2007	-6.59*	1995	2007

Note: (1) ***, ** and * denote significance level at 1%, 5% and 10% respectively, (2) TB1 and TB2 are the dates of the structural breaks.

Source: Research findings

5.2. Optimal lag length

After finding the order of integration, the optimal lag length of VECM for the NARDL model can be determined according to Akaike information criterion (AIC), Schwarz Bayesian information criterion (SBC), final prediction error (FPE), and likelihood ratio (LR).Therefore, an important sector of concern in this regard is the selection of the optimal lag length. The appropriate lag length is a prerequisite to continue the NARDL bounds testing to examine cointegration between the series. The SBC criterion is followed to choose the lag length.Table 4 shows the information criteria. The Schwarz Bayesian Criterion (SBC) is preferred to other model specification criteria as it often has more parsimonious specifications (Pesaran and Smith, 1998). The (SBC) selection criteria indicate one lag as an optimum lag length.

Table 4. Optimal lag length specification criterion

lag	LogL	LR	FPE	AIC	SC	HQ
0	-316.0013	NA	9.23e-05	16.25006	16.63006	16.38746
1	-54.07100	392.8954	1.20e-08	7.203550	11.00353*	8.577502
2	24.81967	82.83520	2.55e-08	7.309017	14.52898	9.919526
3	210.4541	111.3807*	1.31e-09*	2.077293*	12.71723	5.924360*

Notes: * refers to significance at 5% level and and lag order selected by the criterion

Source: Research findings

5.3. F-Bounds Test

Now that has been established that none of the selected series I(2) or beyond and the determination of the optimal order of lag, the presence of the long-run cointegration has been tested using the bounds test (Acar, 2020). The results of the NARDL bound test of cointegration are displayed in Table 5. The F-statistics has a higher value (10.06545) than the upper bound critical value, which is 3.6 (at 1% significance level) hence we have sufficient reasons to reject the null hypothesis of no long-run relationship at 1%, 2.5%, 5%, and 10% significance level and the existence of cointegration (long-run relationship) among the CAD and its determinants. This further buttresses the use of the NARDL modeling approach in this study.

Table 5. Bounds Test (F-version) for Nonlinear Co-integration

Variables	F-statistics	Decision
F(CAD | IR, FB, KOF, NFA, REER, TI, TOT, GGDP)	10.06545***	Cointegration exist
Critical Value Bounds (significance)	Lower Bound (I0)	Upper Bound (I1)
10%	1.06	2.72
5%	1.82	2.99
2.5%	2.02	3.27
1%	2.26	3.6

Note: (1) *** indicates the critical value of significance level 1% in bounding test; (2) K=16
Source: Research findings

5.4. Estimation Long-Run Relationships

Having viewed nonlinear cointegration, the next step is to estimate the long-run error correction coefficients of the NARDL model the results are presented in Table 6. In this model, we focus on the asymmetric relationship between CAD and determinants of CAD. In order to deal with cointegrating variables, it is more suitable to employ a non-linear model focusing on asymmetries. Lately, this model has become one of the best approaches to showing asymmetric effects between variables. In the NARDL model, we focus on the asymmetric relationship between CAD and the determinants of this variable. The results of long-run coefficients nonlinear ARDL are reported in Table 4. Panel A.

The results show that the estimation of FB coefficients with positive and negative shocks does not have a significant effect on CAD. This is contrary to the research result of Marimuthu and& Bangash (2021). Therefore, the hypothesis of twin deficiency in Iran is not accepted. According to the Bahmani-Oskooee and Fariditavana (2015) method to calculate the long-term coefficient, we divide the negative of each coefficient by the first lag coefficient of the dependent variable. After a lag of one period, a long-run coefficient of negative [-(-0.005715/ -1.288404)= - 0.00444] of the inflation Rate can be calculated and it is found that the effect of negative components

after a lag of one period is negative, and its effect on CAD is asymmetric. This analysis is opposite to that of Odedokun (2003) because, in the case of developing countries, it is expected that there is a positive relationship between macroeconomic stability and current account balance. After a lag of one period, the effect of a long-run coefficient of negative [-(-0.022668/ -1.288404)= -0.01759] the KOF Index is negative. Although the KOF Index reduction has a negative and significant effect on CAD in long term, the KOF Index increase has no significant effect on CAD long term. This proves the asymmetric effect of the KOF Index. Turning to our main topic, we look at the long-run relationship between net foreign assets and CAD, while increases and decreases in net foreign assets have no effect on CAD. This result is similar to the analysis Bleaney and Tian (2019) regarding the vagueness of this relationship.

The Real Effective Exchange Rate reduction has a positive and significant effect on CAD in long-term. After a lag of one period, the effect of a long-run coefficient of negative the Real Effective Exchange rate is positive. A low real exchange rate or an undervalued exchange rate makes domestic exports relatively cheaper and improves the current account balance. On the other hand, the increase in the Real Effective Exchange Rate does not statistically affect the CAD, which indicates the condition of asymmetric this variable in the long run. An increase in the total Investment by 1% results in a deterioration in CAD by [-(-1.660118/ -1.288404)=-1.28] at a 5% significance level. This result follows the inter-temporal approach in which if investment increases, according to the study by Chuko et al. (2017), the economy will face a current account deficit.

It can be seen that weak terms of trade improve the trade deficit. The terms of trade, like other model variables, have an asymmetric effect on the current account deficit. The unlike the analysis by Gossé & Serranito (2014), the negative change in terms of trade has affected CAD. It is visible from this result that while significant partly impressions on CAD performance can be discovered for KOF Index and Inflation Rate, for GDP per capita growth

at negative changes, the same conclusion can be made. From this result, there is discernable evidence for the presence of an asymmetric impact on the GDP per capita growth in the long run. A low GDP per capita growth generates lower current account deficits. This result is consistent with the finding of Altayligil and Çetrez (2020). After the confirmation of the long-run relationship, the next step is to estimate the error correction term (ECM), which must be smaller than the unity in absolute terms and should be negative and statistically significant. The short-run dynamics error correction term is reported in panel B of Table 6. The error correction term as a velocity adjustment coefficient in the NARDL model has a negative sign and is significant at the level of 1%, with a coefficient value of -0.62, which means that if there is a discrepancy between the desired results and the actual disturbance, it is corrected immediately and quickly, towards long-term equilibrium adjusted. Panel C of Table 6 shows the NARDL diagnostics which indicate the absence of autocorrelation, Heteroskedasticity, normality test, and Ramsey REST test for a model correct specification. The results reveal that the model has achieved desired econometric properties and has the best goodness of fit and is valid for reliable interpretation.

Table 6. Long run and short run, NARDL (1, 0, 1, 0, 1, 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 1)

Variable	Coefficient	t-Statistic	Prob
Panel A: long run dynamics			
CAD(-1)	-1.288404	-1.288404	0.0000 ***
FB_POS	0.149751	0.149751	0.7485
FB_NEG(-1)	0.128200	0.128200	0.7807
IR_POS(-1)	-0.001565	-0.001565	0.1431
IR_NEG(-1)	-0.005715	-0.005715	0.0022 **
KOF_POS(-1)	-0.004531	-0.004531	0.3837
KOF_NEG(-1)	-0.022668	-0.022668	0.0389 *
NFA_POS(-1)	-2.36E-08	-2.36E-08	0.5891
NFA_NEG(-1)	5.13E-08	5.13E-08	0.0755
REER_POS	-593.5994	-593.5994	0.8071
REER_NEG	6502219.	6502219.	0.0000 ***

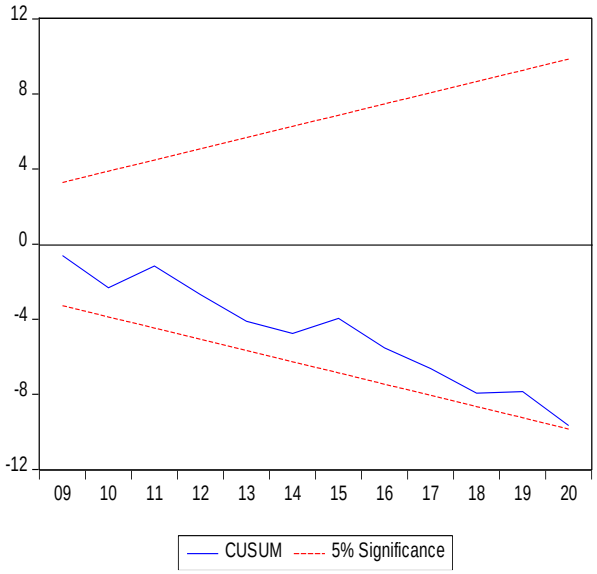
Variable	Coefficient	t-Statistic	Prob
Panel A: long run dynamics			
TI_POS(-1)	-1.660118	-1.660118	0.0014 **
TI_NEG(-1)	-0.387572	-0.387572	0.4528
TOT_POS(-1)	0.318839	0.318839	0.1047
TOT_NEG(-1)	0.399479	0.399479	0.0358 *
GDP (%)_POS(-1)	-0.001037	-0.001037	0.3947
GDP(%)_NEG(-1)	-0.004711	-2.814602	0.0168 *
Panel B: short run ECM			
CointEq(-1)	-0.620868	-13.59137	0.0000***
Panel C: NARDL diagnostics			
Diagnostic test		**F-statistics**	**P-values**
LM test for autocorrelation		2.788538	0.1142
Heteroskedasticity ARCH [1]		0.040508	0.8416
Heteroskedasticity ARCH [2]		0.016012	0.9841
Jarque–Bera for normality		0.088729	0.956605
Ramsey RESET test for model specification		0.896723	0.3660

Note:(1) *, **, and *** indicate significant at the 10% level, 5% level, and 1% level, respectively., (2) 'POS' and 'NEG' denote posetive and negative partial sums.

Source: Research findings

5.5. Structural stability test

Finally, we have examined the stability of the long-run parameters together with the short-run movements for the equations. To do so, we follow the path taken by Pesaran and Pesaran (1997) and implement the CUSUM and cumulative sum square (CUSUMQ) tests, as suggested by Brown et al. (1975). The plots in Figure 1 show that the parameter estimates are stable in the NARDL framework.



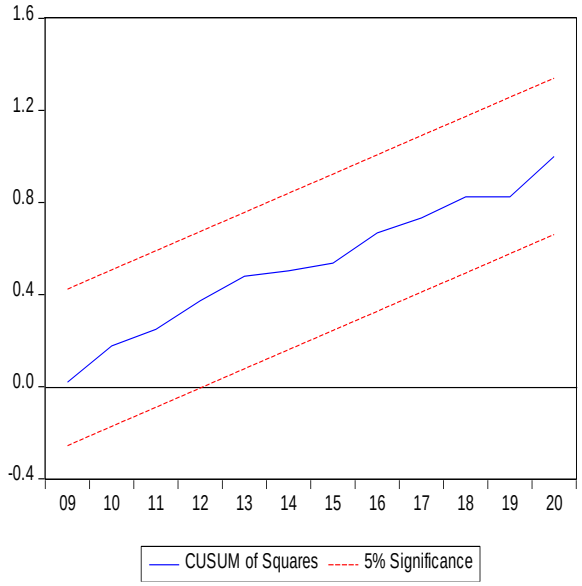


Fig 1. Plot of CUSUMSQ and CUSUM

Source: Research findings

6. Conclusions and Policy Implications

Little work has focused on building a model of the current account from the Intertemporal Current Account (ICA) approach that the current account balance is the difference between domestic savings and investment.We analyze Iran's economy because unusual policy changes caused by factors such as war and international sanctions occurred in the country's economy during the research period and led to many structural failures in macroeconomic variables and the stability of the current account deficit This paper has investigated the asymmetric effect of fundamental macroeconomic and macroeconomic stability determinants of current account deficit by using the nonlinear autoregressive distributed lag (NARDL) approach. The study uses annual data from Iran in period 1978 to 2020. To meet our goal, we used the NARDL estimator to detect the impact of positive and negative changes in the variables. The results reveal that there is a nonlinear relationship among the variables in the long-run relationship as the evidence of cointegration was found in the model. The result of the Non-linear ARDL approach indicates statistically significant asymmetrical effects of Inflation Rate, KOF Index, Real Effective Exchange Rate, Total Investment, Terms of Trade, and GDP per capita growth on the current account deficit. None of the studies conducted regarding Iran consider macroeconomic stability and the KOF index as determining factors of the current account balance. The study has reached the suitable decision to say that the Fiscal Balance and, Net Foreign Assets is invalid in determining the current account deficit. We found strong evidence that the Twin deficit hypothesis is invalid in Iran. A positive shock to the Total Investment will have a negative impact on the current account deficit. This indicates that more intermediate goods and machinery investment imports will cause higher current deficits. Further, despite the unresponsive impact of positive shocks, negative shocks to the Inflation (representing macroeconomic stability), KOF index, Terms of Trade, and GDP per capita growth contributed to the increase of the current account deficit. None of the studies considers macroeconomic stability as one of the determinants of the current account balances. Seems to be maintaining a

stable period of reduced inflation will lower the risk of unanticipated price increases and hence increase the consumption of long-term in Iran and current account deficits get higher. While both positive and negative shocks to Terms of Trade are important determinants, only negative shock is capable of driving changes in the current account deficit. Also, the long-term asymmetric effect of the GDP per capita growth in the direct determination of the current account deficit was determined, but the role of this variable in its effect on the current account deficit is not very important. The decrease in the Real Effective Exchange Rate showed the highest level of impact on the creation of the current account balance among the macroeconomic series and it is considered a key variable for the current account balance. A low real effective exchange rate generates lower current account deficits. On the basis of these outcomes, the recommendation from this study encourages continuous government practices towards reduced and stable exchange rate that makes the country's in the long term, can be concluded that reducing the budget deficit and encouraging domestic savings, Along with, a low and stable rate of inflation would help to solve the current account deficits. Thus, an improvement in the budget balance and the saving-investment balance would positively affect the current account balance currency stronger. This study recommends that policymakers should raise GDP per capita growth and fixed capital accumulation, KOF Index, and lastly maintain a low rate of interest. The decrease in the Real Effective Exchange Rate and improvement in terms of trade (TOT) make it better the current account deficits.

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All authors had contribution in preparing this paper.

Conflicts of interest

The authors declare no conflict of interest

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