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THE EFFECT OF FOREIGN TRADE LIBERALIZATION ON THE BALANCE OF PAYMENTS- THE CASE OF ALGERIA- AN ANALYTICAL AND ECONOMETRIC STUDY FROM 1989 TO 2020

By

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ABSTRACT

This study aims to examine the effect of foreign trade liberalization on Algeria's balance of payments over the period from 1989 to 2020. We used an Autoregressive Distributed lag model, the ordinary least squares estimation technique, the Box-Jenkins approach and the Cox proportional hazards model.

The results of this study indicate that Algeria's current account is unsustainable. Trade openness is the main factor negatively affecting export diversification. Counter-intuitive relationship between economic risk and export diversification, in which an increase in Algeria's economic risk index (i.e., a decrease in economic risk) will result in a decline in export diversification. A little positive impact of financial risk on export diversification. Algeria's political risk index does not affect export diversification. Continued deterioration of Algeria's trade balance (excluding hydrocarbon exports) within the association agreement between Algeria and the European Union. Furthermore, that agreement did not improve the industrial competitiveness performance of Algeria. Trade openness has no impact on Algeria's accession to the World Trade Organization (WTO).

Keywords: Foreign Trade Liberalization, Balance of Payments, Export diversification, current account sustainability, Country Risk, Algeria.

ملخص

تهدف هذه الدراسة إلى دراسة أثر تحرير التجارة الخارجية على ميزان مدفوعات الجزائر خلال الفترة من 1989 إلى 2020. استخدمنا نموذج الانحدار الذاتي للفجوات الزمنية الموزعة، طريقة المربعات الصغرى العادية، منهجية بوكس– جنكينز، ونموذج كوكس للمخاطر النسبية.

تشير نتائج هذه الدراسة إلى أن الحساب الجاري للجزائر غير مستدام. يعد الانفتاح التجاري العامل الرئيس الذي يؤثر سلبا على تنويع الصادرات. علاقة غير بديهية بين المخاطر الاقتصادية وتنويع الصادرات، حيث تؤدي الزيادة في مؤشر المخاطر الاقتصادية في الجزائر (أي انخفاض المخاطر الاقتصادية) إلى تراجع تنويع الصادرات. تأثير إيجابي طفيف للمخاطر المالية على تنويع الصادرات. مؤشر المخاطر السياسية في الجزائر لا يؤثر على تنويع الصادرات. استمرار تدهور الميزان التجاري الجزائري (باستثناء صادرات المحروقات) ضمن اتفاقية الشراكة بين الجزائر والاتحاد الأوروبي. إضافة إلى ذلك، فإن هذا الاتفاق لم يحسن أداء القدرة التنافسية الصناعية للجزائر. ليس للانفتاح التجاري أي تأثير على انضمام الجزائر إلى منظمة التجارة العالمية.

الكلمات المفتاحية: تحرير التجارة الخارجية، ميزان المدفوعات، تنويع الصادرات، استدامة الحساب الجاري، مخاطر الدولة، الجزائر.

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Introduction

During the 1970s and early 1980s, Algeria has built an industrial fabric based primarily on capital-intensive production technology; those industrial investments have been financed by its foreign exchange reserve and external borrowing, yet, over time the public industrial sector lost gradually its competitiveness; Algeria's industrial production regressed by half spinning the period from 1986 to 1996 as a result of poor performance, however public enterprises have remained to rely on government subsidies, yielding more erosion of Algeria's foreign exchange reserve (Ruppert, 1999) . The free fall of oil prices in 1986 has yielded considerable difficulties for the Algerian economy, deficits in the current account, falling in foreign exchange reserves, greater public debt and rising unemployment (Almenar-Llongo, Prat, & Orero-Blat, 2021). Motivated by payments balance pressure induced by the free drop of oil prices on the world energy market, the Algerian authorities have adopted a broad program for achieving stabilization and structural reform in 1994 (Ruppert, 1999). The structural adjustment plan was based upon four major objectives: (i) enhancing strong economic growth, (ii) ensuring an acceptable inflation rate closer to that in industrial countries, (iii) mitigating the transitional effects of such a plan on the most disadvantaged segments of the populations, (iv) improving balance of payments situation (Abbas, 2012). As a result of the 1986 oil crisis, Algeria has embarked on deep economic reforms, of which liberalization of foreign trade to attract foreign direct investment, which is deemed as a catalyst factor for prompting the competitiveness of Algerian manufacturing products, therefore, enhancing export diversification, reducing imports, hence rebuilding the foreign exchange reserve as well as achieving economic and financial equilibriums. Algeria has submitted its application for accession to GATT in 1987 to achieve three desirable goals: (i) trade diversification, in which foreign trade liberalization is the main condition of this diversification on the medium-long term of production and so of exportations, (ii) the upgrade of the general level of industrial competitiveness to face the potential adverse effects of internationally competitive, and (iii) the control of the imports of food products (Abbas, 2012). Although its application for accession to GATT was submitted in 1987, its memorandum was produced in 1996 (Michalopoulos, 2000). Besides, Algeria has endorsed some trade agreements, of which the Algeria-European Union association agreement on April 22, 2002, in Valencia, Spain, which was entered into force in September 2005, (Aghrout, 2007; ITC, 2023). We have chosen this topic for our research because the world is geared toward more globalization, notably economic globalization, where the magnitude of international trade across countries has been growing, such that many economists have called to remove/reduce the trade restrictiveness, to reap more gains than autarky. From the above, we can formulate the following problem: what are the implications of foreign trade liberalization on Algeria's balance of payments?

To address this question the following sub-questions were developed:

- Is Algeria's current account sustainable amid trade openness?
- Is export diversification positively associated with trade openness at a 5% significance level?
- Is export diversification negatively related to country risk subcomponents at a 5% significance level?

- Has the association agreement between Algeria and the European Union improved the competitive industrial performance of Algeria?
- Does trade openness have a crucial role in Algeria's accession to the World Trade Organization (WTO)?

Depending upon previous sub-questions, we draw up the following hypotheses:
- Algeria's current account is sustainable within trade openness.
- Export diversification is positively associated with trade openness at a 5% significance level.
- Export diversification is negatively related to country risk subcomponents at a 5% significance level.
- The association agreement between Algeria and the European Union has improved the competitive industrial performance of Algeria.
- Trade openness has a crucial role in Algeria's accession to the World Trade Organization (WTO).

Our research is grounded upon the following main approaches:
- Theoretical approach: we used this approach to review the main theoretical economic literatures about foreign trade liberalization and the balance of payments.
- Descriptive approach: we used this approach to demonstrate the evolution of study variables, such as exports, imports, trade openness index, and foreign direct investment inflows.
- Econometric approach: we employed this approach to determine the parameters of independent variables, and so quantify their effects on dependent variables.

There are several studies have addressed the effect of trade liberalization on the balance of payments, of which:

Study of Fankem and Feyom (2023) entitled "Is trade openness a barrier to industrialization? Evidence from Sub-Saharan Africa". They examined the effect of trade openness on industrialization in 27 Sub-Saharan African countries over the period 1985-2014. To this end, They used the trade openness index of Squalli and Wilson, and three indicators of industrialization (index of the industrial competitiveness, the share of manufacturing value-added out of GDP, and the share of manufacturing employment out of total employment). A two-step system generalized method of moments (GMM) is employed to test this effect. They denoted that trade openness has a negative impact on industrialization only when the levels of FDI and human capital are very low. Thus, this result supports the repercussions of the infant industry argument.

Study of Meressa (2022) entitled " Determinants of foreign direct investment inflows to COMESA member countries: an integration of institutional and socio-economic factors". He investigated the determinants of FDI inflows to 17 COMESA (Common Market for Eastern and Southern Africa) member countries over the period 2002-2016, employing panel data estimators. The results indicated that trade openness, financial development, government effectiveness, control over corruption, infrastructure, human capital, political stability and economic growth have a significant and positive impact on FDI inflows. While regulatory quality, external debt and inflation have no effect on those inflows.

Study of Gounder et al.,(2019) entitled " The Effects of Preferential Trade Agreements on Foreign Direct Investment: Evidence from the African Caribbean Pacific Region". They

investigated the role of PTAs (Preferential Trading Arrangements) in attracting FDI, using panel data on bilateral FDI stocks from 34 OECD countries into 45 ACP (African Caribbean Pacific) countries during the period 2000-2017. They have found that natural resource rent has an insignificant impact in attracting FDI; double tax treaty has a significant and positive effect on FDI; based on the type of FDI, trade can be a substitute or complement for FDI; a negative and significant impact of PTAs (both with and without investment provisions) on FDI in Africa, implying that firms of source country prefer to trade instead to invest in the presence of PTAs; in the Caribbean countries, PTAs without investment provisions significantly prompt FDI, while in Pacific countries, the effect of PTA on FDI is insignificant. However, a combination of BIT (bilateral investment treaty) with PTA (without investment provisions) will encourage FDI into Africa.

Study of Navarrete and Tatlonghari (2018) entitled "An empirical assessment of the effects of the Japan–Philippine Economic Partnership Agreement (JPEPA) on Philippine exports to Japan: a gravity model approach", over the period from the first quarter of 2001 to the fourth quarter of 2014, a multiple regression analysis was applied by using ordinary least squares (OLS) procedure. They found a negative relationship between eliminating restrictions to trade, measured by weighted average tariff rates imposed by Japan to exports of Philippine and Japan's imports from Philippine, in which, a decrease in those tariff rates will lead to increased Philippine exports to Japan, after one (1) period lag.

Study of Cestepe et al.,(2015) entitled "The Impact of Trade Liberalization on the Export of MENA Countries to OECD Trade Partners". They examined the effect of trade liberalization via both free trade agreements and WTO membership on exports of 13 MENA (Middle East and North Africa) countries to 30 OECD (Organization for Economic Co-operation and Development) trading partners, during the period 2000-2009, using a panel gravity model. They concluded that exports react positively with free trade agreements, and negatively with WTO membership.

The main contribution of our study is to examine the effect of trade liberalization on the balance of payments through the combination of country risk subcomponents (political risk, economic risk and financial risk) and Squalli and Wilson's index of trade openness, and their impacts on export diversification.

This study is split into four chapters as follows:

Chapter 1 reviews the concept of trade liberalization and its most prominent indicators of measurement; International trade theories; and Tariffs and Non-tariffs measures.

Chapter 2 reviews the sixth edition of the balance of payments and international positions manual (BPM6); Sudden stop economies, the current account sustainability, Optimal level of foreign reserves ,balance of payments crisis; external and internal imbalances, relative prices and the pace of economic growth.

Chapter 3 reviews a general equilibrium analysis of the impact of tariffs on the payments balance; the nexus between the degree of deep RTAs and the FDI trend; trade agreements, dissimilarity, FDI, intensive margin, extensive margin; the role of unilateral preferences in prompting developing countries exports; and a two-period intertemporal trade model.

Chapter 4 tests whether Algeria's current account is sustainable or not amid trade openness, using an Autoregressive Distributed lag (ARDL) model, the effect of Squalli and Wilson's

index of trade openness and country risk subcomponents (political risk, economic risk and financial risk) on export diversification, using the ordinary least squares (OLS) estimation technique, the implications of Algeria-European Union association agreement on Algeria's balance of payments, the impact of trade openness on Algeria accession to WTO using the Cox proportional hazards model.

Chapter 1. Foreign trade liberalization: an overview

1. Foreign trade liberalization: an overview

1.1. Trade liberalization, the concept and indicators:

1.1.1 Trade liberalization:

Trade liberalization entails the reduction or elimination of trade barriers, the spreading of technology, liberalized external capital flows and international labor migration (Adegboye et al., 2020).

Oladipo (2011) argues that trade liberalization is referred to as any change that triggers a country's trade system towards neutrality. Oladipo (2011) indicated that neutrality in trade policy takes place if incentives for reaping a unit of foreign exchange via exports and incentives for saving a unit of foreign exchange via import substitution are equal. Obeng et al. (2011) state that trade liberalization involves lowering tariff rates on imports and quantitative restrictions removal.

1.1.2 Trade liberalization indicators:

Trade liberalization measures are divided into (i) de-jure measures and (ii) de-facto measures based on the sources used in establishing the trade openness measures. The former is drawn on a country's regulatory environment, typically tariff rates and non-tariff barriers to trade, whereas the latter is based on aggregate economic statistics (Gräbner et al., 2021).

1.1.2.1 Trade freedom score:

Trade freedom is a composite measure of the extent of tariff and non-tariff barriers which affect both imports and exports of goods and services. The trade freedom score is assigned on two inputs: • The trade-weighted average tariff rate and

• Non tariff barriers (NTBs) (Heritage, 2014).

The base trade freedom score equation is given as follows:

$$\text{Trade Freedom}_i = (((\text{Tariff}_{max} - \text{Tariff}_i)/(\text{Tariff}_{max} - \text{Tariff}_{min}))*100) - \text{NTB}_i$$

Where: Trade Freedom_i is the trade freedom in country i. Tariff_{max} is the upper bounds for tariff rates (%). Tariff_{min} is the lower bounds for tariff rates (%). Tariff_i is the weighted average tariff rate (%) in country i. NTBs comprise price restrictions, investment restrictions, quantity restrictions, regulatory restrictions, direct government interventions and customs restrictions (The Heritage Foundation, 2022; Gnangnon, 2018).

Based on the extent of using NTBs, a penalty is subtracted from the standard score (Gräbner et al., 2021). The trade freedom index is divided into five sub- categories: from 0 to 49.9 point repressed, from 50 to 59.9 point mostly unfree, from 60 to 69.9 point moderately free, from 70 to 79.9 point mostly free and from 80 to 100 point free (The Heritage Foundation, 2022).

1.1.2.2 Squalli and Wilson index:

Squalli and Wilson. (2011) have defined an open economy as one that exhibits two dimensions: (i) a relatively high portion of trade relative to aggregate economic activity, and (ii) a significant interconnectedness and interaction with the rest of the world. They have constructed a composite trade share index that captures these two dimensions (Squalli & Wilson, 2011; Akyuz et al., 2022). The most common and predominant indicator which has been used to assess the trade openness of a country or region is trade share (TS):

$$TS = (X + M)i / GDP$$

Where: X, M and GDP refer to the total exports, total imports, and gross domestic product of the country i (Bouët et al., 2017; Squalli & Wilson, 2011).

Squalli and Wilson. (2011) have asserted that this measure is imperfect to cross-countries comparisons of the degree of trade openness, in which they found a country such as the United States of America is a closed economy according to TS, despite it being the dominant trading country of the world. In the same vein, we have investigated this paradoxical result by comparing TS of 4 differential countries as shown in table 1.1

Table 1.1. TS and its components for four selected countries in 2020

Country	Exports of goods and services (US Billion $)	Imports of goods and services (US Billion $)	GDP (US Billion $)	TS (%)
United states	2123.41	2774.60	20953.03	23.38
Qatar	70.93	59.06	144.41	90.01
Algeria	26.10	40.37	145.01	45.84
Singapore	599.22	490.69	340.00	320.56

Source: The World Bank, 2022

As illustrated in table 1.1, United States's TS represents roughly 25.97%, 51% and 7.29% of Qatar's TS, Algeria's TS, and Singapore's TS respectively, although Qatar, Algeria, and Singapore total trade represent roughly 2.65%, 1.36%, and 22.25% of the total trade of the United States, respectively. Hence, these inconsistent results assert Squalli and Wilson insight. The straightforward explanation of these results is that TS captures only the domestic dimension (the relative position of trade performance of a country relative to its domestic economy) (Squalli & Wilson, 2011; Tee et al, 2018). Squalli and Wilson (2011) indicated that TS is associated inversely with the economic size of a country. Kuznets (1964) argues that the trade openness index (measured as exports plus imports over GDP) will lead to biased results of a country's trade openness degree relative to other countries. To illustrate his insight, Kuznets (1964) presented the following example: there are two countries i (the larger country) and j (the smaller country), the exports from country i (X_i) to country j (M_j) are equal, and vice versa. Hence, if GDP_i equals 10 times GDP_j , the trade openness index of country i will be equal to one-tenth of the country j's trade openness index.

The second dimension is captured by world trade share (WTS). This index sheds light on the contribution of an economy to world trade (Squalli & Wilson, 2011). It captures only the global dimensions (Tee et al., 2018). Its formula is given as:

$$WTS = (X + M)i/\sum_{j=1}^{n}(X + M)_j$$

Where: n refers to the number of countries in the world, j indicates a set of countries (i.e., j = {1,2,…,n}, in which country i ∈ j (Squalli & Wilson, 2011; Akyuz et al., 2022).

To tackle the anomaly observed by Squalli and Wilson. (2011), they established a new measure of trade openness is labelled the composite trade share (CTS), which is written as:

$$CTS_i = \frac{(X + M)_i}{\frac{1}{n}\sum_{j=1}^{n}(X + M)_j}\frac{(X + M)_i}{GDP_i}$$

1.1.2.3 Nash's measure of trade liberalization:

This index is considered an inclusive measure of trade liberalization. It clarifies the change in the tariff equivalent of all trade restrictions. The Nash measure is derived from the import demand function, which in turn relies on three variables: prices, income and exchange rates. The import demand function is expressed as follows:

$$M = a + bY + c[P_M E(1+t)]$$

Where: M and Y suggest imports and income in real terms respectively, P_M refers to the import price measured in dollars, E represents the real exchange rate and $(1+t)$ indicates the tariff equivalent of all trade barriers. Thereafter, by introducing natural logarithms on all variables of the above formula and then applying differentiation to that equation, the trade liberalization intensity indicator is given as:

$$\%\Delta(1+t) = \frac{1}{c}[\%\Delta M - b\%\Delta Y - c(\%\Delta P_M + \%\Delta E)]$$

Where: %Δ refers to a variable's percentage change, b and c represent the import demand elasticities with respect to income and price, respectively (Ancharaz, 2000).

1.2 International trade theories:

1.2.1 Mercantilist theory:

The Mercantilism age prevailed almost from the year 1650 to 1780 (Rassekh, 2009). Mercantilism stipulates that import liberalization is a "concession" (Tomiura et al., 2021). Mercantilist doctrine is grounded on the notion that excess balance in international trade is preferable (Medlock III et al., 2021). This economic doctrine argues that the state's power is confined to its stock of valuable metals, particularly gold and silver; it states that foreign trade plays a crucial role in the economic development of a state, by increasing its balance of gold and silver (Uzunidis & Laperche, 2011).

1.2.1.1 The Viner model of Mercantilism:

This model is developed by Jacob Viner. There are two main basic elements on which the model is based in building the utility function of the representative nation: foreign asset accumulation (the current account's accumulated surplus) and consumption, where possession of wealth (precious metals) enables a nation to derive its power with direct shape in the international community, Viner states that mercantilism objective is attained their utility function to capture power vs plenty. The formula of utility function for a nation is given as follows:

$$\int_0^\infty U(c_h, c_f, b)\, e^{-\rho t}\, dt = \int_0^\infty [\mu(c_h, c_f) + \beta w(b)]\, e^{-\rho t}\, dt,$$

Where: c_h denotes domestic goods' per capita consumption, c_f indicates foreign goods' per capita consumption, b refers to foreign asset holdings per capita or it can be defined as treasure, wealth and riches, in terms of a negative b represents foreign borrowing, and β ($\beta > 0$) measures whether the sentiments of mercantilist according to Cunningham, or the mentality of mercantilist according to Heckscher. $\beta w(b)$ suggests an increasing function of the wealth of a nation, it can be considered as a nation's power to possess and enjoy. $\mu(c_h, c_f)$ can be explained as the consumption utility or as a measure of plenty and opulence according to Viner. In the case of a small open economy, the foreign asset accumulation dynamic formula is expressed as:

$$\dot{b} = \frac{y}{\rho} + rb - \frac{c_h}{\rho} - (1+\tau)c_f + \frac{x}{\rho}$$

Where: y indicates endowment income per capita, r refers to the exogenous returns of interest on holdings of foreign asset, ρ points out the domestic goods' exogenous world relative price, in terms of the foreign goods. T suggests the tariff on the imported consumption good, and x denotes government transfer per capita. Mercantilism objective function can be interpreted as

maximizing $\int_0^{\infty} \beta w\,(b)\, e^{-\rho t}\, dt$ subject to the dynamic constraint represented in formula $\dot{b}$ (Zou, 1997).

1.2.1.2 Trade protection indices:

1.2.1.2.1 The Trade Restrictiveness Index:

As reported by Anderson and Neary, the TRI is defined as a uniform tariff that provides the same welfare as the tariff's original differentiated structure (Fusacchia et al., 2021). The TRI recapitulates the distortion has been forced by the trade policies of each country (Kee et al., 2009). Broadly, TRI has been applied to the entire- economy, since it depends on the trade balance approach; however, it was applied effectively for both developed and developing countries in multi-market situations and partial equilibrium (beghin et al., 2015). According to Kee et al. (2009) the TRI can be defined (implicitly) as:

$$TRI: \sum_n W_{n,c}\,(TRI_c) = \sum_n W_{n,c}\,(T_{n,c}) = W_c^0$$

Where : $W_{n,c}$ denotes the welfare related to good n's imports for country c, and W_c^0 refers to the existing level of the country c's whole welfare considering its protection structure. As noted by Irwin (2010) the TRI's equation can be expressed as:

$$\text{TRI} = \left[\sum_n s_n\, \varepsilon_n\, \tau_n^2 \,/\, \sum_n s_n\, \varepsilon_n\right]^{1/2}$$

Where : s_n indicates the ratio of imports of good n to GDP, ε_n represents good n's imports demand elasticity and τ_n suggests the import tariff imposed on good n.

As well as the TRI can be decomposed into three components as follow:

$$\text{TRI} = \sqrt{(\bar{t}^2 + \sigma^2 + \rho)}$$

Where: $\bar{t}$ denotes the import-weighted average tariff, such that $\bar{t} = \sum_n s_n\, \tau_n$, σ^2 is the import-weighted variance of the tariff rate, such that $\sigma^2 = \sum_n (\tau_n - \bar{t})^2$, and ρ refers the covariance between the product n's import demand elasticity and its tariff square, $\rho \equiv \text{cov}\,(\tilde{\varepsilon}_n\,,\, \tau_n^2)$, such that $\tilde{\varepsilon}_n \equiv \frac{\varepsilon_n}{\bar{\varepsilon}_c} > 0$, $\bar{\varepsilon}_c \equiv \sum_n s_n\, \varepsilon_n$, where: $\tilde{\varepsilon}_n$ is the import demand elasticity of good n and $\bar{\varepsilon}_c$ is country c's import-weighted average elasticities (Mix, 2019; Kee et al., 2008).

1.2.1.2.2 The Mercantilist Trade Restrictiveness Index:

The MTRI is defined as the uniform tariff that maintains the volume of imports at the same level as the extant set of tariffs (Irwin, 2010). The MTRI can be expressed as:

$$\tau^{\mu}: M[(1+\tau^{\mu})p^*\,, B^0] = M^0(p^0,\, p^*,\, B^0),\ with\ p^0 \equiv p^*(1+\tau)$$

Where: τ^{μ} denotes the uniform tariff, M is the import demand function, B^0 indicates the trade balance function at a constant level, p^* refers to world prices' vector (p_k^*) of N goods k = (1, …, N), M^0 represents imports' overall value at world prices in the reference period, τ is the actual tariff rates and p^0 is the vector of initial distorted price (Antimiani et al, 2008). The MTRI is also called the overall TRI (OTRI) (Beghin et al., 2015). The OTRI can be expressed as (Federico & Vasta, 2015):

$$OTRI = \sum_n s_n\, \varepsilon_n\, \tau_n \,/\, \sum_n s_n\, \varepsilon_n$$

The MTRI is meaningful for bilateral negotiations, so the practical trade policymakers have taken the trade volume as a reference to evaluate the trade restrictiveness, such as negotiations in auto parts and in semiconductors under U.S Japanese bilateral trade volumes (Anderson & Neary, 2003)

1.2.1.2.3 The Effective Rates of Protection:

Its formula takes the following shape:

$$ERP = \frac{VAD_d - VAD_w}{VAD_w}$$

Where: VAD_d refers to domestic value added and VAD_w indicates world value added as the difference between output' value and inputs' value in world/border prices, in the absence of CIF prices, the tradable border prices are expressed by: $P_{world} = (P_{domestic}/(1 + t_e))$

So that, t_e is the effective tariff rate which comprises the customs duties, value added tax, advanced income tax, supplementary duties and import charges (Ali, 2006). Yoon (2006) has derived the ERP formula based on the Input-Output table, he assumed that trade barriers were represented only by tariffs, although existing non-tariff barriers, so the ERP of industry j can be governed as follows:

$$ERP_j = \frac{VA_j - VA_{Fj}}{VA_{Fj}}$$

Where: VA_j denotes the value added in the presence of tariffs (protected situation) and VA_{Fj} refers to value added which happens without tariffs (free trade situation), such that the initial attention of domestic producers is value added protection instead of the tariffs on the output. To get VA_{Fj}, we should be deflating observed input coefficients (a_{ij}) and the coefficients of value added (1-a_{ij}) by the tariffs on inputs (t_i) and the final goods (t_j).

Free trade input coefficients (a_{Fij}) can be governed by the following formula:

$$a_{Fij} = \frac{a_{ij}\,(1+t_j)}{(1+t_i)}$$

On the other side, value added per unit can be expressed as:

$$VA_{Fij} = \frac{P_{Fj}\,Q_{Fj} - \sum_i P_{Fi}Q_{Fij}}{Q_{Fj}} = P_{FJ}\left(1 - \sum_i \frac{P_{Fi}Q_{Fij}}{P_{Fj}Q_{Fj}}\right) = P_{FJ}\left(1 - \sum_i a_{Fij}\right)$$

$$VA_{ij} = \frac{P_j\,Q_j - \sum_i P_iQ_{ij}}{Q_j} = P_J\left(1 - \sum_i \frac{P_iQ_{ij}}{P_jQ_j}\right) = P_J\left(1 - \sum_i a_{ij}\right)$$

Such that, P_F , Q_F denote price and quantities domestically produced under free trade, and P, Q indicate price and quantities domestically produced under protection. In addition, we assume that trade taxes and subsidies are only the sole option for the government to apply its policy instruments; this policy provides a wedge between domestic and international prices, namely: P = P_F (1+ t_i), where VA_{ij} formula can be rewritten as:

$$VA_{ij} = P_{Fj}\left(1 + t_j - \sum_i a_{Fij}\,(1 + t_i)\right)$$

Employing, VA_{Fij} and last VA_{ij} formulas, ERP_j can be expressed as:

$$ERP_j = \frac{P_{Fj}\left(1 + t_j - \sum_i a_{Fij}\,(1 + t_i)\right)}{P_{Fj}\left(1 - \sum_i a_{Fij}\right)} - 1 = \frac{\left(t_j - \sum_i a_{Fij}\,t_i\right)}{\left(1 - \sum_i a_{Fij}\right)}$$

Using the last equation of ERP_j requires dividing it into two goods categories, tradable and non-tradable goods, thus:

$$ERP_j = \frac{1 - \sum_t a_{tj} - \sum_{nt} a_{tj}}{\left(\frac{1}{1 + t_j}\right) - \left(\frac{\sum_t a_{tj}}{1 + t_t}\right) - \left(\frac{\sum_{nt} ii_t a_{ntj}}{1 + t_t}\right) - \sum_{nt} va_{nt} a_{ntj}} - 1$$

$$= \frac{CT_j - \sum_t II_{tj} - \sum_{nt} II_{tj}}{\left(\frac{CT_j}{1 + t_j}\right) - \left(\frac{\sum_t II_{tj}}{1 + t_t}\right) - \left(\frac{\sum_{nt} ii_t II_{ntj}}{1 + t_t}\right) - \sum_{nt} va_{nt} II_{ntj}} - 1$$

Where: a_t and a_{nt} represent tradable and non-tradable goods input coefficients, CT_j refers to good j's output, II_{tj} and II_{ntj} denote tradable goods' intermediate inputs and non-tradable goods' intermediate inputs in the production of good j, ii_t and va_{nt} indicate the ratios of intermediate input t and value added to output of non-tradable goods.
According to Junior (2005), the ERP_j can be defined as:

$$ERP_j = \left(t_j - \sum a_{ij}^{lc} \,.\, a_{ij}^{lc}\right) / \left(1 - \sum a_{ij}^{lc}\right)$$

Where: $a_{ij}^{lc} = a_{ij}^{d}.\left(1 + t_j\right)/(1 + t_i)$ denotes the technical coefficient of free trade that measures at international price the participation degree of input i in the final price of industry j, a_{ij}^{d} indicates the distortionary technical coefficient, which measures at domestic price the participation degree of input i in the final price of industry j. t_i , t_j are input i nominal tariff and the nominal tariff in industry j respectively. a_{ij}^{d} was obtained from the input-output tables and tariffs have been calculated by taking the simple average of whole tariffs forced on given industry products.

1.2.1.3 Trade protection and welfare:

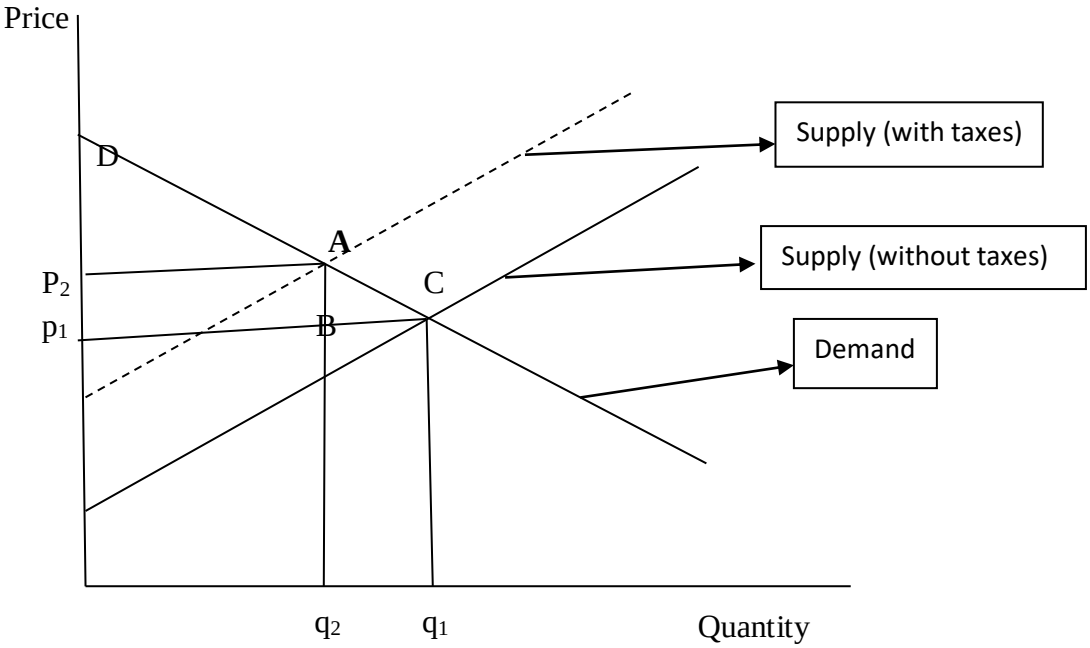
As is well known, the rise of tariff protection will commonly influence negatively both quantities supplied and imported into the market. By substituting TRI to NT in the formula of Harberger triangles, they have come up with the following formula to estimate deadweight loss (DWL) related to protection as follow:

$$\frac{DWL}{GDP} = \frac{1}{2}\, TRI^{2*} \sum_n S_n\, \varepsilon_n$$

It is worth noting that $\frac{DWL}{GDP}$ provides the loss that is evaluated for a given year or a given period (Federico & Vasta, 2015). Where NT (nominal protection), it can be defined as the ratio of the total customs revenue to the value of imports, its equation takes the following formula: $NT = \sum(Q_i\, D_i)/\sum(Q_i\, P_i)$, where Q_i refers to the ith good' the quantity of imports, P_i and D_i indicate the world price and specific duty of good i respectively (Federico & Tena, 1998). The Harberger triangle is used to provide a straightforward picture of deadweight loss

induced by market restrictions such as monopoly practices, price ceilings and quantity restrictions (Colander et al., 2010).

Figure 1.1. The Harberger triangle



Source: Hines, Jr, 1999: 169

As shown in the figure1.1, the triangle ABC indicates the excess burden or deadweight loss related to applying excise tax, where Jules Dupuit is commonly the first one that has attempted to explain the welfare effects created by price changes, so as relying on demand schedules. Dupuit has defined excess burden as: *"the utility lost both to the taxpayers and the fisc [the public sector]"* (Jr, 1999). Harberger has tried to estimate the deadweight loss induced by the monopoly state, through a simplified mathematical formula based on triangle's surface (area) that takes the following formula (Ryan & O'sullivan, 19??):

$$S = \frac{1}{2}\Delta p\ \Delta q = \frac{1}{2}\Delta p\ dq/dp\ \Delta p$$

$$= \frac{1}{2}[(\Delta p)^2/p].[dq/dp.p/q].q$$

$$= \frac{1}{2}[(\Delta p)^2/p].\varepsilon.pq/p$$

$$= \frac{1}{2}[(\Delta p/p)^2].\varepsilon.pq$$

Dupult-Marsball-Harberger have illustrated that the excess burden is a decrease of consumer surplus resulting in the tax payment, where triangle area DCP_1 is the consumer surplus before applying the tax, the trapezoid P_2ACP_1 refers to the reduction of the consumer surplus induced by the tax imposed, where the quantity demanded declined from q_1 to q_2 (Shome, 1995). Irwin (2010) has indicated the formula of DWL as a share of GDP as follow:

$$\frac{DWL}{GDP} = \frac{1}{2}\sum_n S_n\ \varepsilon_n\ \tau_n^2$$

Furthermore, Kee et al. (2008) have indicated that the DWL formula, with the existing tariff structure, can be governed as:

$$DWL = \frac{1}{2}\bar{t}_c^2 GDP_c\bar{\varepsilon}_c + \frac{1}{2}\sigma_c^2 GDP_c\bar{\varepsilon}_c + \frac{1}{2}\rho_c GDP_c\bar{\varepsilon}_c$$

Where: $\bar{t}_c^2 GDP_c\bar{\varepsilon}_c$ refers tariff average, $\sigma_c^2 GDP_c\bar{\varepsilon}_c$ denotes tariff variance, $\rho_c GDP_c\bar{\varepsilon}_c$ points out tariff-elasticity covariance and c suggests country c.

1.2.2 Absolute advantage:

Adam Smith argues that two countries can gain from international trade, if each one specializes in producing a commodity in which it has an absolute advantage, and thus trade would be mutually beneficial (Zhang, 2008). Largely free trade can yield greater total output and wealth than can largely protectionist trade, is the main basic proposition of this theory (Vambery, 2018). Smith contends that each country should specialize in producing only the good (s) that it can produce by the fewest resources, commonly those resources are exclusively confined to the labour quantity required to produce each unit of good(s), thus a given country has an absolute advantage over another country in producing a unit of a commodity, if the former produce that commodity with less labour (Langdana & Murphy, 2014; Machado & Trigg, 2021). To explain Smith' absolute advantage theory, Langdana and Murphy (2014) provided the following example: there are two countries A and B, each one employs 100 workers to produce two products (coffee and tea), so that those labour forces are identical in the two countries, other factors such that labour skills, transportation costs and infrastructure quality have had negligible effects, the needed requirements to produce one unit of each good in the two countries as follow:

Table 1.2 Number of workers required to produce 1 unit of each product in A and B

	Units of labours	
	Country A	Country B
Tea	5 workers	4 workers
Coffee	2 workers	3 workers

Source: Langdana & Murphy, 2014

The results of table 1.2 reveal that country A has an absolute advantage in producing coffee, since it produces that product with fewer workers than country B $(2 < 3)$, in the same context, country B has an absolute advantage in producing Tea, as it produces that product with fewer workers than country A $(4 < 5)$. To exhibit the benefits from specialization for each country, they compared two statuses, the first, each country devotes only 50% of their workers to producing both goods, the second, each country devotes 100% of their laborers in producing only good that it had an absolute advantage.

Table 1.3. Number of units produced of each product in A and B (50% of laborers)

	Produced Units	
	Country A	Country B
Tea	10 units	12.5 units
Coffee	25 units	16.67 units

Source: Langdana & Murphy, 2014

As shown in table 1.3 global units of each product are 22.5 units of tea and 41.67 units of coffee, where: the global output of tea = 10+12.5, and global output of coffee = 25+16.67.

Table 1.4. Number of units produced of each product in A and B (100% of laborers)

	Produced Units	
	Country A	Country B
Tea	0 units	25 units
Coffee	50 units	0 units

Source: Langdana & Murphy, 2014

As shown in table 1.4 global units of each product are 25 units of tea and 50 units of coffee.
By comparing the global output of two cases (50% and 100%), it appears clearly that specialization induces both countries to maximize global output, then by free trading, consumers of each country would get more quantities of both goods than before (Langdana & Murphy, 2014).

1.2.2.1 The vertically integrated sector:

The pioneering paper of Pasinetti entitled 'the notion of vertical integration in economic analysis' is the starting analysis for the concept of a vertically integrated sector (VIS). He defines VIS as a final good, and that's for the production of a physical unit of a commodity, whereby the vertically integrated labour coefficient and a unit of vertically integrated productive capacity are the composites of that final good (Schilirò, 2012).

1.2.2.2 Vertically integrated labour:

The prominent advantage of this approach resides in dealing with both direct and indirect relations of production. Meaning the possibility to measure the direct and indirect effects on industries. The direct effects mean the losses in an activity of a given industry which are subject to analysis, whereas the indirect impacts concern the industries that supply intermediate inputs to a given industry, and the industries which offer intermediate goods to the intermediate inputs industries, etc (Villani & Fana, 2021).

1.2.2.3 Relative vertically integrated unit labour costs (RVIULCs):

From the standpoints of classical political economists, the forces of supply and demand are the affecting factors of market prices, whereby those prices are constantly gravitating towards natural prices due to profitability. Tentatively the price of any commodity or the production prices can be written as follows:

$$P = wL + \pi + M \qquad (1)$$

Where: w denotes the wage rate, L points out the necessary labour for each unit output, wL indicates unit labour costs, π refers to profit per unit output, and M comprises unit materials and depreciation.

According to Smith, wages and profits are exclusively the components of a commodity's natural price. By decomposing M into profits, unit labour costs, and the unit input costs of the original input bundle, equation (1) can be formulated as follows:

$$P = wL + \pi + wL^{(1)} + \pi^{(1)} + M^{(1)} = wL + \pi + wL^{(1)} + \pi^{(1)} + wL^{(2)} + \pi^{(2)} + M^{(2)} + \cdots$$
$$= wL + wL^{(1)} + wL^{(2)} + wL^{(3)} \ldots \pi + \pi^{(1)} + \pi^{(2)} + \pi^{(3)} \ldots \qquad (2)$$

Drawing on the concept of vertically integrated sectors by Pasinetti, the vertically integrated unit labour costs (vr), and the vertically integrated unit profits ($v\pi$), can be derived from equation (2) as follows:

$$vr = wL + wL^{(1)} + wL^{(2)} + wL^{(3)} \ldots \quad ; \quad v\pi = \pi + \pi^{(1)} + \pi^{(2)} + \pi^{(3)} \ldots$$

Where: vr represents the sum of direct and indirect unit labour costs and $v\pi$ refers to the sum of direct and indirect unit profits.
Equation (1) may be rewritten as follow:

$$P = vr + v\pi = a_n(I - A)^{-1}W \cdot (1 + \sigma_{PW})$$

Where: σ_{PW} indicates the vertically integrated profit-wage ratio, namely $\sigma_{PW} = v\pi/vr$, W denotes a diagonal matrix which takes real wages on the main diagonal and zeros elsewhere. a_n points out the row vector of the n direct labour coefficients, which is expressed as the ratio of necessary direct labour measured in total hours worked by employees and gross output of i-th sector. $(I - A)^{-1}$ indicates the inverse matrix of the necessary total inputs to produce commodities, which comprises intermediate inputs consumption and fixed capital consumption, so as for per unit of gross output. $a_n(I - A)^{-1}$ refers to the amounts of direct and indirect labour required to produce commodities, in another word, it indicates the vertically integrated labour coefficients. $a_n(I - A)^{-1}W$ suggests the vertically integrated unit labour costs. Each i-th column of $(I - A)^{-1}$ denotes the direct and indirect commodities consumed to produce the commodities of the i-th sector as final goods.
The RVIULCs of regulating capitals as a proxy of absolute cost advantage has determined the long-term real exchange rates, namely the country with the lowest relative wages and the best general technical conditions of production will have in some sectors an absolute cost advantage, and that's in case of preferential trade agreements . $REER_{i,t}$ can be written as:

$$REER_{i,t} \equiv e_t \cdot \frac{P^*_{i,t}}{P_{i,t}} \cong RVIULC_{it} \equiv \frac{vr^*_{i,t}}{vr_{i,t}} \equiv \frac{a^*_{n,t}(I - A)^{-1*}W^*_{i,t}}{a_{n,t}(I - A)^{-1}W_{i,t}}$$

Where: $REER_{i,t}$ refers the real effective exchange rates of i-th manufacturing sector of the country under analysis vis- à-vis those of its respective n-th trading partners at time t, so that the concerned country and its trading partners are members of the same preferential trade agreements, such as the North American free trade agreement (NAFTA) and the European Union (EU), e_t suggests the nominal effective exchange rate, for example, it is calculated as the ratio of concerned country currency over the currency of NAFTA or EU partner, $P^*_{i,t}$ and $P_{i,t}$ refer the price indices of the i-th manufacturing sector, $RVIULC_{it}$ is the RVIULCs, such that asterisk $(*)$ denotes every n-th trading partner. $vr^*_{i,t}$ and $vr_{i,t}$ represent the sum of the RVIULCs's column vector corresponding to the i-th manufacturing sector, $a^*_{n,t}$ and $a_{n,t}$ represent the direct labour coefficients' row vectors, $(I - A)^{-1}$ and $(I - A)^{-1*}$ refer to the domestic and foreign Leontief inverse matrices, respectively. Determining the base year is very important to measure RVIULCs (Boundi-Chraki & Perrotini-Hernández, 2021).

1.2.3 Comparative advantage:

This theory has been discovered by David Ricardo. He stipulates that a country has a comparative advantage in a given good compared to other countries, if it can produce that

good with relatively lower cost relative to other countries. Ricardo argues that specialization enables a given country to reap gains if that country exports a good in which it has a comparative advantage, and imports a good in which it has a comparative disadvantage (Pariyaprasert, 2005). The cost is measured in relative terms, not in absolute terms (Dorobăt, 2015)

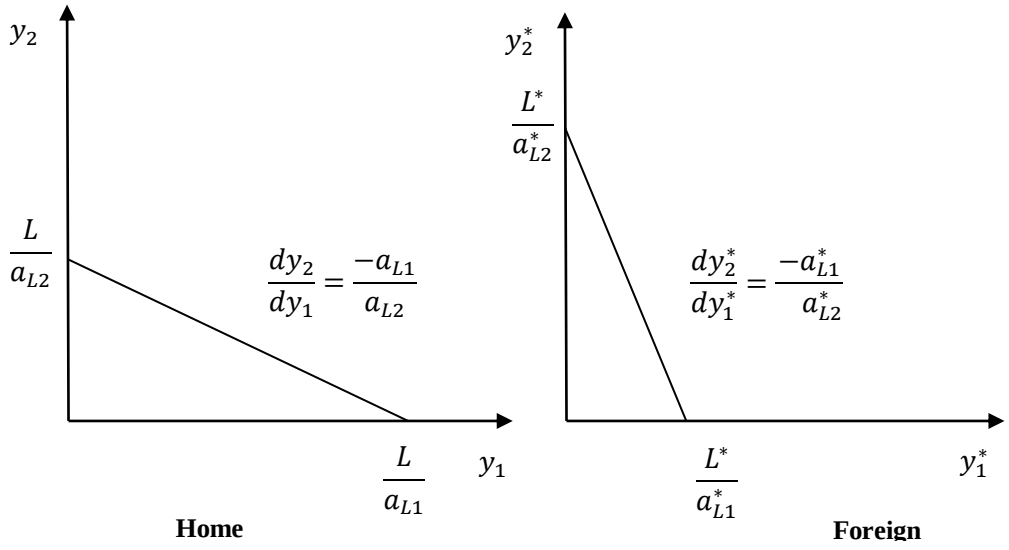
1.2.3.1 The standard Ricardian model:

It is based on some assumptions as follows: two countries home and foreign (denoting by the subscripts 1 and 2) respectively, two goods 1 and 2, each country is endowed with a fixed labour amount L for home and L^* for foreign, goods 1 and 2 have been produced by using only labour, the factor of production (labour) is perfectly mobile between the two industries, but it is immobile among the two countries. The coefficients for home and foreign have been denoted by a_{Li} and a^*_{Li}. The condition of full employment for the home (in an analogous way for foreign) can reflect the autarky situation, the condition's equation is given as:

$$a_{L1}y_1 + a_{L2}y_2 = L$$
$$a^*_{L1}y^*_1 + a^*_{L2}y^*_2 = L^*$$

Where: y_1 and y_2 represent the output quantities for both goods 1 and 2 that will be produced in the home country, $y^*_1 \; and \; y^*_2$ denote the output quantities for both goods 1 and 2 that will be produced in the foreign country.

Figure 1.2. The Ricardian production possibilities setting



Source: Weder, 2017

As shown in figure 1.2 the shape of the production possibility frontiers (PPF) is linear because of the labour coefficients are constant. In case of complete specialization, the maximum quantities which can be produced of both goods 1 and 2 in the home country are $\frac{L}{a_{L1}} \; and \; \frac{L}{a_{L2}}$, respectively, the PPF slope is given as $\frac{dy_2}{dy_1} = \frac{-a_{L1}}{a_{L2}}$, this ratio sets out how much of good 2 has to be abandoned to allocate sufficient labour to produce another unit of good 1, in another sense, it reflects the opportunity costs of good 1. In an analogous way to a foreign country. In the autarky case relative prices are equal to the opportunity cost, namely:

$$\frac{-\rho_1}{\rho_2} = \frac{-a_{L1}}{a_{L2}}$$

It seems clear, that $\frac{a_{L1}}{a_{L2}} < \frac{a^*_{L1}}{a^*_{L2}}$ which signifies that, the home country has a comparative advantage in the production of good 1, since it can produce good 1 with relatively fewer resources compared to the foreign country. In the case of two countries that open up trade, it has introduced the conditions of competitive profit, for a good understanding of the production processes in the two countries, the formula of these two conditions for the home country is expressed as (in an analogous way in the foreign country):

$$a_{\mathrm{L1}}\mathrm{w} \geq \rho_1 \quad (1) \quad ; \qquad a_{\mathrm{L2}}\mathrm{w} \geq \rho_2 \ (2)$$

Where: $a_{\mathrm{L1}}\mathrm{w}$ and $a_{\mathrm{L2}}\mathrm{w}$ represent the unit cost required to produce one unit of good 1 and 2 respectively. As a result of opening up trade the demand for good 1 would be experienced at a greater level, which drives the home country to increase the production of good 1 and decrease the production of good 2, and vice versa for the foreign country. So if the traditional demand is sufficiently large, ρ_1 would be increased, such that, according to (1) w would be raised in the home country, so that, growing demand for good 1, will drive firms in industry 1, to increase the wage rate, causing pressures on firms in industry 2, so they exit. So the home country would completely specialize in industry 1, similarly, the foreign country would completely specialize in industry 2 (Weder, 2017).

1.2.3.2 Comparative advantage indices:

1.2.3.2.1 Revealed comparative advantage (RCA) index:

RCA index offers proof of the export performance of a given industry or market in a country relative to another country or other competitor countries(Ceylan et al., 2018). This index has been mentioned for the first time by Balassa in 1965 (Kang et al., 2021). Its formula is given as follows:

$$RCA_{ij} = \left[\left(\frac{X_{ij}}{X_{it}}\right) / \left(\frac{X_{nj}}{X_{nt}}\right)\right]$$

Where: RCA_{ij} refers country i's revealed comparative advantage on commodity j, X_{ij} denotes exports of commodity j of country i to the world, X_{it} suggests total exports of country i in a given sector or industry to the world, X_{nj} represents exports of commodity j of country n to the world, X_{nt} points out total exports of country n in a given sector or industry to the world. The index value ranges from 0 to infinity $\left(0 < RCA_{ij} \leq \infty\right)$. If $\left(RCA_{ij} > 1\right)$ this means that country i has a comparative advantage on product j. RCA has been employed on a macro level in various sectors and countries to demonstrate sectoral specialization (Ceylan et al., 2018).

1.2.3.2.2 Lafay's index:

It is known as the international trade specialization index, it is broadly used to evaluate the balance of trade for a given country, as well as indirectly, it shows its international competitiveness. Its equation takes the following formula:

$$\mathrm{LFI}_{\mathrm{ij}}^{\mathrm{K}} = 100 \cdot \left(\frac{\mathrm{X}_{\mathrm{ij}}^{\mathrm{K}} - m_{\mathrm{ij}}^{\mathrm{K}}}{\mathrm{X}_{\mathrm{ij}}^{\mathrm{K}} + m_{\mathrm{ij}}^{\mathrm{K}}} - \frac{\mathrm{X}_{\mathrm{j}}^{\mathrm{K}} - M_{\mathrm{j}}^{\mathrm{K}}}{\mathrm{X}_{\mathrm{j}}^{\mathrm{K}} + M_{\mathrm{j}}^{\mathrm{K}}}\right) \cdot \frac{\mathrm{X}_{\mathrm{ij}}^{\mathrm{K}} + m_{\mathrm{ij}}^{\mathrm{K}}}{\mathrm{X}_{\mathrm{j}}^{\mathrm{K}} + M_{\mathrm{j}}^{\mathrm{K}}}$$

Where: LFI_{ij}^{K} represents Lafay index of country K on goods i compared to another country j, or other countries j, X_{ij}^{K} refers country K's exports of goods i to country j or group of countries j, X_{j}^{K} denotes country K's total exports to country j or group of countries j, m_{ij}^{K} suggests country K's imports of goods i from country j or group of countries j, M_{j}^{K} points out country K's total import from country j or group of countries j, i is category of goods, K is home country, j represents another country or group of countries (rest of the world). In the case of ($LFI_{ij}^{K} > 0$), this signifies that country K has a trade surplus for i, as well as it means that international trade of country k displays comparative advantages on i (Falkowski, 2018).

1.2.3.2.3 Comparative Export Performance (CEP) Index:

CEP is a slightly adjusted fashion of the Balassa index. It measures a country's export specialization for given product groups. Its formula is expressed as follows:

$$CEP = \ln(X_{iB}/X_B) \,/\, (X_{iA}/X_A)$$

Where: X_{iB} represents exports of country B of good i, X_B refers to total exports of country B, X_{iA} indicates the world's total exports of good i, X_A suggests the world's total exports. We suppose two countries D (home country) and F (rival country), country D has had a comparative advantage on good i compared to country F, if $CEP_{iD} > CEP_{iF}$ (Serin & Civan, 2008)

1.2.4 Factor endowments:

Eli Heckscher and Bertil Ohlin (H-O) are credited with formulating the new comparative advantage theory, also called factor proportion theory that emerges from differences in national factor endowments, the H-O theory states that the cost of a factor of production is associated with the level of its abundant, thus the produce and export of goods is depended upon locally abundant factors, so that countries export goods that use intensively locally abundant factors, and import goods that require factor of production but locally scarce (not be locally abundant) (Dibiku, 2017). The contrary to the Ricardian concept that explains the trade pattern between two countries through the difference in their factor productivities , the Heckscher-Ohlin theorem has stipulated that the factor endowments is the prominent factor in explaining the pattern of trade (Khan, 1970). As reported by H-O theory, the abundance of factors of production is relative, not absolute, assuming that there are two countries a and b, two factors of production (labour and capital) as inputs, two sectors (export- and import-competing sectors) and two product c and d, so that country (a) has relatively well endowed of the labour than country (b) (trade partner) that is used intensive to produce product (c), and country (b) has relatively well endowed of the capital than country (a) (trade partner) that is used intensive to produce product (d), so as country (a) produces and exports product (c) to country (b), and imports product (d) from country (b), similarly country (b) produces and exports product (d) to country (a), and imports product (c) from country (a) (Helpman, 1998). H-O theory is based on a set of assumptions as follows: two countries, two factors of production, perfect mobility of production factors in the country and immobility outside the country, transport cost is equal zero, no limitations to international trade, technology and tastes are similar, full employment, identical production function but factor endowment among countries vary, continuity element (production relations' variations would be induced by factor endowments' continuous variation) (Bilas & Bošnjak, 2015; Chipman, 1966). In the early 1940s of the 20th, Stolper and Samuelson presented their theorem which was derived

from the H-O basic model. It clarifies the change that occurs to the factor prices of production (real wages and real returns to capital) when the prices of goods change. The principle of Stolper –Samuelson theorem is grounded in that increasing good prices that use intensively a factor of production would lead to an increase in the prices of that factor and vice versa. In international trade, this theorem is used to explain what occurs when economic agents such as government or businessmen impose tariffs on imported goods, the Stolper –Samuelson theorem asserts that countries will earn more gains with tariff reductions and free trade rather than protection. For example, applying tariffs on imports goods that use intensively labour would lead to an increase in the domestic prices of the import-competing good, as a result, the demand for labour will experience growth, and so the real wages would increase at the cost of real returns to capital (Vasquez Galan, 2006). The Stolper –Samuelson theorem is used to expect the factor's incomes change caused by restriction (Kangas, 1984)

1.2.4.1 Stolper -Samuelson Effect:

Stolper –Samuelson theorem depicts the relationship between the factors of production and its prices (Mendoza, 2019). Based on the skill premium that is identified as the wage gap between skilled -and unskilled labour , the Stolper –Samuelson theorem has provided the linkage between trade liberalization (changes in trade costs) and distributional changes in income. According to their model, trade liberalization will be in favor of unskilled workers in developing countries since these countries are substantially abundant endowed with this factor, where reducing trade costs would lead to an increase in the return to unskilled workers induced raising the product prices that is used unskilled- labor intensive in the production. On the contrary, the model predicts that a decline of product prices which is used skilled-labor intensive in the production would lead to a decrease in the return to that factor (Goldberg & Pavcnik, 2007). The skill premium formula can be expressed as the ratio of skilled-labour wages over unskilled-labour wages, more detailed the skill premium combines three main fundamental components: the capital-skill complementarity (CSC) effect, the relative efficiency (RE) effect and the relative quantity (RQ) effect, as shown by Krusell, Ohanian, Rios-Rull and Violante (hereafter KORV) model under perfect competition assumption, this ratio equals to the ratio of their marginal products:

$$\frac{W_{st}}{W_{ut}} = \frac{(1-\mu)(1-\lambda)}{\mu}\left[\lambda\left(\frac{\psi_{et}\check{k}_{et}}{s_t}\right)^{\rho} + (1-\lambda)\right]^{\frac{\sigma-\rho}{\rho}}\left(\frac{n_{ut}h_{ut}}{n_{st}h_{st}}\right)^{1-\sigma}\left(\frac{\psi_{st}}{\psi_{ut}}\right)^{\sigma}$$

Where :

$\left[\lambda\left(\frac{\psi_{et}\check{k}_{et}}{s_t}\right)^{\rho} + (1-\lambda)\right]^{\frac{\sigma-\rho}{\rho}}$ denotes CSC effect, $\left(\frac{n_{ut}h_{ut}}{n_{st}h_{st}}\right)^{1-\sigma}$ represents RQ effect and $\left(\frac{\psi_{st}}{\psi_{ut}}\right)^{\sigma}$ refers to the RE effect. $W_{st}\ and\ W_{ut}$ indicate to skilled-lobour wages and unskilled-labour wages respectively, $n_{ut}\ and\ n_{st}$ suggest the number of unskilled workers and skilled workers respectively, h_{ut} and h_{ut} refer to the hours worked average number for unskilled worker and skilled worker respectively, ψ_{st} , ψ_{ut} and ψ_{et} point to the efficiency of a unit of factor input: skilled labour, unskilled labour and capital equipment, s_t is skilled labour inputs that are defined as: $s_t \equiv \psi_{st} n_{st} h_{st}$. $\check{k}_{et}$ represents the capital equipment stock unadjusted for changes in quality , it is identified as the ratio of capital equipment inputs (k_{et}) over ψ_{et} namely:

$\check{k}_{et} \equiv \frac{k_{et}}{\psi_{et}}$, $\lambda\ and\ \mu$ represent parameters weights of the CES function on unskilled labor and equipment respectively, the elasticity of substitution between k_{et} and s_t equals 1/(1- ρ),

while the elasticity of substitution between k_{et} and u_t is similar to the elasticity of substitution between s_t and u_t that equals 1/(1- σ). capital-skill complementarity hypothesis implies that $\sigma > \rho$.

RQ effect states that when h_{ut} increase at a faster rate than h_{st} , the skill premium will increase, RE effect relies on the substitution parameter (σ) sign, so that, if $\sigma > 0$, it means that the elasticity of substitution between skilled and unskilled labour > 1, so they are substitutes for one another in the production stage. CSC effect says that if $\sigma > \rho$, then an increase in a factor's marginal productivity will happen if the quantity and/or quality of the other factor increases (Lindquist, 2005). The capital-skill complementarity can be expressed as the prominent feature of the technology in the aggregate production function of neoclassic, this implies that the elasticity of substitution between k_{et} and u_t is upper than that between k_{et} and s_t. The major effect of CSC is that an increase of $\check{k}_{et}$ would increase the marginal product of s_t, but decrease unskilled labour's marginal product. λ , μ , ρ and σ were sourced from CES restricted function, which takes the following shape:

$$G(k_{st}, k_{et}, u_{t,} s_t) = k_{st}^{\alpha}\left[\mu u_t^{\sigma} + (1-\mu)\left(\lambda k_{et}^{\rho} + (1-\lambda)s_t^{\rho}\right)^{\sigma/\rho}\right]^{(1-\alpha)/\sigma}$$

Where: G is the production function with constant returns to scale in capital structures(k_{st}), , k_{et}, u_t and s_t . this nested CES function will become a Cobb-Douglas production function if either ρ or ρ is equal to zero (krusell et al., 2000). To demonstrate the Stolper-Samuelson Effect upon skill premium we have based on a model that was constructed by Parro Greco (2011), he has quantified this effect through the difference between the skill premium within free trade (ω_i) and within autarky $(\omega_i)^A$, he have assumed the following assumptions: two countries, home country (i) and the rest of the world, the former is endowed with skilled labour units (S_i) and unskilled labour units (U_i), two tradable sectors, sector K and sector M, so that sector K produces capital goods using both skilled and unskilled labour, while sector M produces other manufacturing goods using skilled labour, unskilled labour and capital goods, trade is balanced, perfectly mobile of labour across sectors, furthermore, by consuming manufacturing goods, households gain utility, which means that capital goods are only used as an intermediate, trade costs equal zero, unskilled wage in the home was normalized to one. To keep the capital-skill complementarity hypothesis, he assumed that the elasticity of substitution between unskilled labour and capital goods equals to $\sigma > 1$, whereas the elasticity of substitution between skilled labour and capital goods equals one. The production function of capital goods produced by sector K is written as:

$$q_{\mathrm{i}}^{\mathrm{K}} = \left(\mathrm{S}_{\mathrm{i}}^{\mathrm{K}}\right)^{\gamma^{\mathrm{S,K}}}\left(\mathrm{U}_{\mathrm{i}}^{\mathrm{K}}\right)^{\gamma^{\mathrm{U,K}}}$$

Where: $q_{\mathrm{i}}^{\mathrm{K}}$ denotes the capital goods quantity produced in the home by sector K. $\mathrm{S}_{\mathrm{i}}^{\mathrm{K}}$ and $\mathrm{U}_{\mathrm{i}}^{\mathrm{K}}$ refer to the quantity of both skilled labour and unskilled labour, respectively, employed in sector K, $\gamma^{\mathrm{S,K}}$ and $\gamma^{\mathrm{U,K}}$ indicate skilled and unskilled labour shares, respectively, in sector K ,with:

$$\gamma^{\mathrm{S,K}} + \gamma^{\mathrm{U,K}} = 1.$$

The production function of manufacturing goods produced by sector M is governed by a combination of two functions Cobb-Douglas of skilled labour and CES function of capital goods and unskilled labour, it can be expressed as:

$$q_{\mathrm{i}}^{\mathrm{M}} = \left(\mathrm{S}_{\mathrm{i}}^{\mathrm{M}}\right)^{\gamma^{\mathrm{S,M}}}\left(\tilde{\mathrm{q}}_{\mathrm{i}}^{\mathrm{M}}\right)^{1-\gamma^{\mathrm{S,M}}}$$

$$q_{\mathrm{i}}^{\mathrm{M}} = \left(\mathrm{S}_{\mathrm{i}}^{\mathrm{M}}\right)^{\gamma^{\mathrm{S,M}}}\left[\mu^{\frac{1}{\sigma}}(U_i^M)^{\sigma-1/\sigma} + (1-\mu)^{1/\sigma}\,(q_i^K)^{\sigma-1/\sigma}\right]^{(1-\gamma^{\mathrm{S,M}})\sigma/\sigma-1}$$

Where: q_i^M suggests the manufacturing goods quantity produced in the home by sector M. S_i^M represents the quantity of skilled labour employed in sector M, $\gamma^{S,M}$ refers to the skilled labour share in sector M. $\tilde{q}_i^M$ indicates the CES function of capital goods and unskilled labour, that take the following formula:

$$\tilde{q}_i^M = \left[\mu^{\frac{1}{\sigma}}(U_i^M)^{\sigma-1/\sigma} + (1-\mu)^{1/\sigma}\,(q_i^K)^{\sigma-1/\sigma}\right]^{\sigma/\sigma-1}$$

Where: U_i^M suggests the quantity of unskilled labour employed in sector M, and $0 < \mu < 1$. If σ equals 1, then q_i^M formula close up to be a Cobb-Douglas production function, meaning without capital-skill complementarity, otherwise the unskilled labour share in sector M ($\tilde{\gamma}_i^{U,M}$) is not constant, it relies upon the capital goods price, namely, it is expressed as:

$$\tilde{\gamma}_i^{U,M} = \Upsilon\,(p_i^K) = (1-\gamma^{S,M})\left[1+\left(\frac{1-\mu}{\mu}\right)\left(\frac{\omega_i^U}{p_i^K}\right)^{\sigma-1}\right]^{-1}$$

Where: ω_i^U refers to the normalized unskilled wage in the home and p_i^K is the capital goods price. So, if the capital goods price declines, the unskilled labour share declines within sector M, but the skilled labour share stays constant. If σ is equal to one, then $\tilde{\gamma}_i^{U,M}$ is a constant, such that, its formula is given as:

$$\tilde{\gamma}_i^{U,M} = \mu\,(1-\gamma^{S,M})$$

To investigate the impact of trade on the skill premium, he has assumed that home opens up to trade, as a result, the capital goods prices would decrease. He used equilibrium conditions to derive an expression ($\omega_i - (\omega_i)^A$), that is described as follow:
The condition of labor market clearing for skilled labor is governed by:

$$\omega_i^S S_i = \gamma^{S,M}\,Y_i^M + \gamma^{S,K}\,Y_i^K \qquad (1)$$

Where: Y_i^M and Y_i^K gross production in sector M and sector K, respectively, measured in U.S. dollars. The conditions of goods market clearing are expressed as:

$$X_i^K = Y_i^K - NX_i^K \qquad (2)$$

$$X_i^M = Y_i^M - NX_i^M \qquad (3)$$

Where: X_i^K and X_i^M represent total expenditures in capital goods and manufacturing goods respectively. NX_i^K and NX_i^M refer to net exports in sector K and sector M respectively. The level of the trade balance (TB) for the country is equal to zero, namely: TB = $NX_i^K + NX_i^M = 0$. Substituting formulas (2) and (3) into formula (1) and using trade balance level:

$$\omega_i^S S_i = \gamma^{S,M}\,(X_i^M + NX_i^M) + \gamma^{S,K}\,(X_i^K + NX_i^K)$$

$$\omega_i^S S_i = \gamma^{S,M}\,(X_i^M - NX_i^K) + \gamma^{S,K}\,(X_i^K + NX_i^K)$$

$$\omega_i^S S_i = \gamma^{S,M} X_i^M - \gamma^{S,M} NX_i^K + \gamma^{S,K}\,X_i^K + \gamma^{S,K} NX_i^K$$

$$\omega_i^S S_i = \gamma^{S,M} X_i^M + \gamma^{S,K}\,X_i^K + (\gamma^{S,K} - \gamma^{S,M})\,NX_i^K \qquad (4)$$

Sector M's total expenditure is written as:

$$X_i^M = \omega_i^S S_i + \omega_i^U U_i \qquad (5)$$

Sector K's total expenditure is written as:

$$X_i^K = \left(1 - \gamma^{S,M} - \Upsilon(p_i^K)\right)\left(\omega_i^S S_i + \omega_i^U U_i - NX_i^K\right) \quad (6)$$

Total expenditure in sector K serves intermediate demand from sector M, while the final demand is served by total expenditure in sector M.

To get the formula of skill premium within free trade (ω_i), he has substituted formulas (5) and (6) into (4), also by taking $\omega_i^U = 1$ as follows:

$$\omega_i = \frac{\mathrm{U_i}}{\mathrm{S_i}} \frac{(\gamma^{\mathrm{S,M}}\gamma^{\mathrm{U,K}} + \gamma^{\mathrm{S,K}}(1 - \Upsilon\,(p_i^K)))}{1 - (\gamma^{\mathrm{S,M}}\gamma^{\mathrm{U,K}} + \gamma^{\mathrm{S,K}}(1 - \Upsilon\,(p_i^K)))} + NX_i^K \frac{1}{\mathrm{S_i}} \frac{(\gamma^{\mathrm{S,K}}\Upsilon\,(p_i^K) - \gamma^{\mathrm{S,M}}\gamma^{\mathrm{U,K}})}{1 - (\gamma^{\mathrm{S,M}}\gamma^{\mathrm{U,K}} + \gamma^{\mathrm{S,K}}(1 - \Upsilon\,(p_i^K)))}$$

Within autarky ($NX_i^K = 0$) the skill premium is written as:

$$(\omega_i)^A = \frac{\mathrm{U_i}}{\mathrm{S_i}} \frac{(\gamma^{\mathrm{S,M}}\gamma^{\mathrm{U,K}} + \gamma^{\mathrm{S,K}}(1 - \Upsilon\,(p_i^K)))}{1 - (\gamma^{\mathrm{S,M}}\gamma^{\mathrm{U,K}} + \gamma^{\mathrm{S,K}}(1 - \Upsilon\,(p_i^K)))}$$

Then:

$$\omega_i - (\omega_i)^A = \left(\Upsilon\left(p_i^{K^A}\right) - \Upsilon\,(p_i^K)\right)\Omega_i + NX_i^K\Phi_i$$

Where: $\left(\mathrm{Y}\left(p_i^{K^A}\right) - \mathrm{Y}\,(p_i^K)\right)\Omega_i$ represents skill-biased trade effect, $NX_i^K\Phi_i$ is Stolper-Samuelson effect, p_i^K and $p_i^{K^A}$ denote the capital goods price within free trade and under autarky respectively, with $\Omega_i > 0$. If $\sigma = 1$, the unskilled labour share in the manufacturing goods is constant, thus: $\omega_i - (\omega_i)^A = +NX_i^K\Phi_i$, with the assumption that the capital goods are more skilled-labor intensive relatively than manufacturing goods, thus $\Phi_i > 0$. If $NX_i^K < 0$, the home country is a net importer of capital goods, so the skill premium would decline. This is the standard Stolper-Samuelson effect, where Φ_i refers to the demand's change for skilled labour for a unit of capital goods, so that this change is measured in units of the unskilled wage for each unit of export/import.

$$\Phi_i = \frac{1}{\mathrm{S_i}} \frac{\left(\gamma^{\mathrm{S,K}}\Upsilon\left(p_i^{K^A}\right) - \gamma^{\mathrm{S,M}}\gamma^{\mathrm{U,K}}\right)}{1 - \left(\gamma^{\mathrm{S,M}}\gamma^{\mathrm{U,K}} + \gamma^{\mathrm{S,K}}(1 - \Upsilon\left(p_i^{K^A}\right))\right)}$$

1.2.4.2 Relative Endowment Measure:

Spilimbergo et al. (1999) have constructed an indicator to measure the relative factor endowment (relative to the world endowment) for a given country, its formula is given as:

$$RE_{ijt} = \ln \frac{(E_{ijt})}{(E_{jt}^*)}$$

Where: RE_{ijt} is the relative factor endowment of factor j at time t. E_{ijt} indicates the endowment per capita of factor j of country i at time t. E_{jt}^* refers to the effective endowment per capita of the world of factor j at time t, it is weighted by trade openness and population for every country's endowment, and it is measured as:

$$E_{jt}^* \equiv \frac{adjusted\ endowment}{adjusted\ population} = \frac{\sum_i \left(E_{ijt} \times POP_i \times \left(\frac{X+M}{Gdp}\right)_i\right)}{\sum_i \left(POP_i \times \left(\frac{X+M}{Gdp}\right)_i\right)}$$

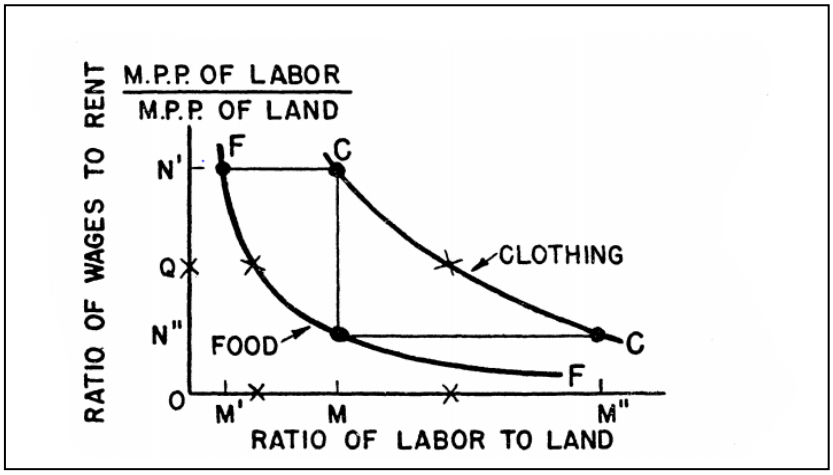
X , M and POP represent exports, imports and the population of country i, respectively. Using the openness degree with weighted fashion in the ratio, to take into consideration that closed

countries endowments do not compete in the world markets with other factors (Gourdon, 2009; Lu & Cai, 2011)(Gourdon, 2009; Lu & Cai, 2011; Spilimbergo et al., 1999)

1.2.4.3 Factor Price Equalization:

The classical doctrine of factor price equalization states that free mobility of production factors across different regions would lead to the equalization of both relative and absolute prices of productive services among them. Professor Bertil Ohlin has developed this classical doctrine, such that has arrived at the main result: in international trade, commodities' free mobility can act as a partial substitute for factor mobility, therefore, this substitute will tend to a partial equalization of both relative and absolute factor prices. As reported by Ohlin and professor Ellsworth free commodities mobility would lead to a partial equalization, chiefly due to that the joint industrial demand for factors of production (labour, capital and land) requires a combination between them, which is determined by the physical conditions and the factor prices, where achieve the complete equalization need adapting the whole industry demand of production factor with the highly varying local supply (Samuelson, 1948). Otherwise, Samuelson (1948) has stipulated that free commodities mobility under some circumstances would lead to a partial equalization. To prove his perspective, Samuelson (1948) relied mainly on the Edgeworth box diagram and then the neo-classical concept of comparative advantage, where he presented the following example:

Figure 1.3. Adjusted Edgeworth box diagram for America and Europe



Source: Samuelson, 1948

As shown in figure 1.3 the horizontal axis indicates the ratio of labour to land, while the vertical axis refers to the ratio of real wages to real rents, in the same thing the labour's marginal physical productivity (M.P.P. of labour) over the land's marginal physical productivity (M.P.P. of land), we have two curves FF for food and CC for clothing due to the varying technological dependence which will occur of this marginal rate of substitution for each commodity, due to constant returns to scale assumption; the ratio of physical substitution in both cases rests only on the factor employed proportions in each use. The distance OM represents the labour's factor endowment relative to the total land in one of the countries. Without more knowledge, if $\frac{labour}{land} > OM$ then will be used in clothing production, while $\frac{labour}{land} < OM$, will be used in food production. Furthermore, OM can be detailed arithmetically as follows: Total land = Food land + Clothing land

Total labour = Food labour + Clothing labour

$$OM = \frac{total\ labour}{total\ land} = w_1 \frac{food\ labour}{food\ land} + w_2 \frac{clothing\ labour}{clothing\ land}$$

Where:

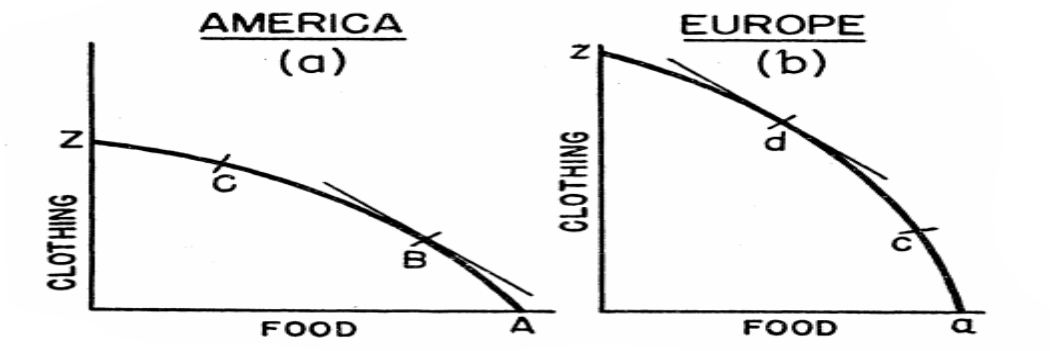
$$w_1 = \frac{food\ land}{total\ land} \text{ and } w_2 = \frac{clothing\ land}{total\ land} = 1 - w_1$$

To know the corresponding labor-land ratios, we just choose any given wage-rent ratios vertically such as the cross at Q, and we move over horizontally to the two curves to read the convenient labour-land ratios whether related to food or clothing, through the corresponding crosses upon the horizontal axis. It is worth noting that M should always fall in between the two lower crosses. It is obvious that possible combinations of factor price ratios which allow the production of various quantities of both products are scaled between N' and N". At N" production of clothing has to halt wholly if there is no unemployment. M and M" indicate corresponding crosses of food and clothing, respectively at N", Samuelson (1948) has presumed that the price ratio will never exceed N' since clothing and food are still being produced, the vertical movement of Q from N" to N' means that gradually increasing in clothing production, versus gradually decreasing in food production, up to N' entirely using all factors to produce clothing. M' and M represent corresponding crosses of food and clothing, respectively at N' . As a result of the non-existent transport costs, free trade drives demand to be perfectly non-localized, *so long as neither country is forced beyond the point of complete specialization*, with each country producing something of food and clothing, the common international price ratio = production possibility curves slopes in both countries. And so:

$$\frac{price\ of\ food}{price\ of\ clothing} = \left(\frac{marginal\ cost\ of\ food}{marginal\ cost\ of\ clothing}\right)_{America} = \left(\frac{marginal\ cost\ of\ food}{marginal\ cost\ of\ clothing}\right)_{Europe}$$

= absolute slope at D = absolute slope at b.

Figure 1.4. domestic production-possibility curves of America and Europe



Source: Samuelson, 1948

Where:

C and c represent the pre-trade points (autarky case) in America and Europe respectively, so that:

$$\left(\frac{price\ of\ food}{price\ of\ clothing}\right)_{America} < \left(\frac{price\ of\ food}{price\ of\ clothing}\right)_{Europe}.$$

B refers to the production shift from the autarky stage to the free trade stage, where America moves toward increasing food production and decreasing clothing production, in Europe d indicates the production shift from the autarky stage to the free trade stage, where Europe moves toward increasing clothing production and decreasing food production (Samuelson, 1948).

1.2.5 Technological gap theory:

In the earliest of 1960s, the Technological gap theory emerged by Posner or Freeman. In their model, they have described the technological transition from the initial exporter to the initial importer, so that, the initial exporter is a leader technological country, which produces and exports a new product (innovative) into markets due to having a technological lead advantage, where the technology is a crucial factor of production. After reaping the necessary knowledge (implies the existence of a lag period), the initial importer country likely can be an exporter country (Brodzicki & Kwiatkowski, 2018).

1.2.5.1 The Innovative comparative advantage indicator:

As far as the measures of technological gap among countries, it should be taken into account the differences among economies in terms of indicators level used to evaluate the innovation development level. These measures are employment in innovative sectors, the magnitude of expenditure on research and development (R&D), the number of patents, etc. The innovative comparative advantage indicator (ICAI) based on the number of patents is governed as follows:

$$\mathrm{ICAI_i} = \frac{\mathrm{P_{ij}}}{\mathrm{P_j}} : \frac{\mathrm{P_i^R}}{\mathrm{P^R}}$$

Where: $\mathrm{P_{ij}}$ is the i-th sector' number of patents in the j-th country, $\mathrm{P_j}$ refers to the j-th country's total number of patents, $\mathrm{P_i^R}$ denotes the i-th sector' number of patents in reference countries, and $\mathrm{P^R}$ points out the reference countries' total number of patents (Salamaga, 2020).

1.2.5.2 Technological catch-up measure:

The basic construction of this indicator is based on the superlative index number, so that the technological gap (distance) between developing countries and technological leaders represented in the United States of America (USA) as the advanced countries leader, and China as the developing countries leader is measured by the differences in the total factor of productivity (TFP). The technological catch-up indicator formula is given as:

$$\mathrm{bt} - TFP_{\mathrm{ct\,gap}} = 1 - TFP_{ct}$$

Where: $\mathrm{bt} - TFP_{\mathrm{ct\,gap}}$ indicates the technological distance between developing country c and leader country b (USA and China) at time t. TFP_{ct} represents the productive efficiency of country c relative to country b at time t, in terms of TFP_{ct} equation is expressed as:

$$\frac{TFP_{ct}}{TFP_{bt}} = \left[\left(\frac{RGDP^o_{ct}}{RGDP^o_{bt}}\right)/Q_{cbt}\right]$$

Where: TFP_{bt} refers to the total factor of productivity of country b at time t, you et al. (2020) have supposed that its value is equal 1. $RGDP^o_{ct}$ denotes output-side real GDP of country c at time t, at chained PPPs (purchasing power parity rates), $RGDP^o_{bt}$ points out output-side real

GDP of country b at time t, at chained PPPs. Q_{cbt} suggests the Törnqvist index of the country's factor endowments, using Q_{cbt} here, to measure the gap between observed and efficient output, its equation is written as follows:

$$Q_{cbt} = \frac{1}{2}(LABSH_{ct} + LABSH_{bt})\left(\frac{EMP_{ct}}{EMP_{bt}}\frac{HC_{ct}}{HC_{bt}}\right) + \left[1 - \frac{1}{2}(LABSH_{ct} + LABSH_{bt})\left(\frac{RK_{ct}}{RK_{bt}}\right)\right]$$

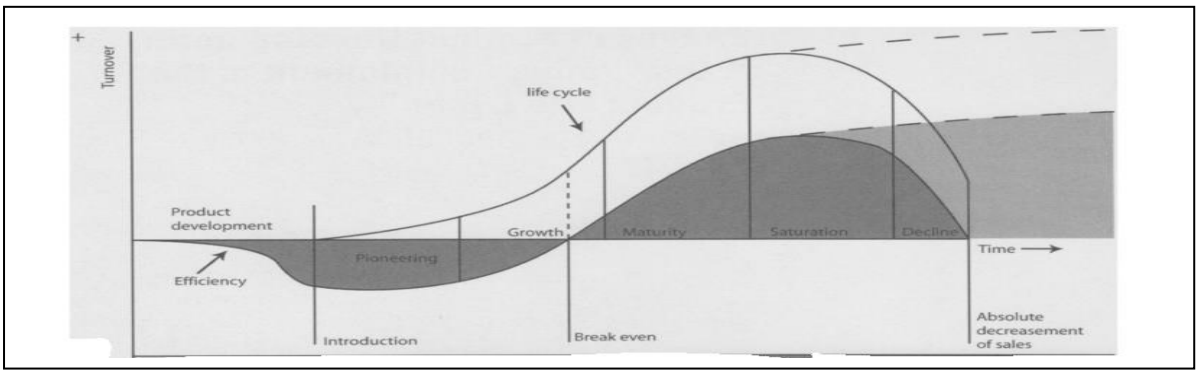
Where: $LABSH_{ct}$ and $LABSH_{bt}$ denote the ratio of labour income of employees and self-employed workers to nominal GDP in country c and b, respectively, at time t. EMP_{ct} and EMP_{bt} refer to persons engaged number in country c and b, respectively, at time t. HC_{ct} and HC_{bt} are the index of human capital of country c and b, respectively, at time t. RK_{ct} and RK_{bt} suggest the capital stock of country c and b, respectively, at time t, at chained PPPs.

bt$-TFP_{\text{ct gap}}$ ranges between 0 and 1, such that when bt$-TFP_{\text{ct gap}}$ close up to 1, means more more technological gap, whereas, when bt$-TFP_{\text{ct gap}}$ close up to 0, refers to less less technological distance among developing countries and leader countries (You et al., 2020).

1.2.6 International Product life cycle:

The international product life cycle theory has been primarily proposed by Vernon. He has shown that this cycle combines three stages: first, the North produces exclusively products for the domestic market; second, the North exports these products to the South, and third, the South imitates and re-exports the same products to the North, where Vernon has introduced its theory essentially relying upon demand, per capita incomes and relative cost advantage (Foellmi et al.,2018).Vernon has denoted that the patterns of trade and comparative advantage shift dynamically between the innovating country and the imitating country, where the former produces a new product, whereas the imitating country re-exports the same product after a period is called an imitation lag (Kang M. , 2003). The product life cycle depicts the product's development from innovation and introduction to the product's disappearance, such that the demand for knowledge and labour skills changes over the life of a product (Karlsson & Nyström, 2003).

Figure 1.5. Product life cycle phases



Source: Eger & Drukker, 2010

As reported by figure 1.5 the product life cycle encompasses six phases over time as follows: product development, pioneering, growth, maturity, saturation and decline respectively. The characteristics of each phase are expressed as:

Product development: this phase demonstrates primarily the research and development (R&D) costs earlier its introduction. Pioneering: it begins right away after launching the new product on the market. Growth: the emergence of this phase is associated with the acceptance of the new product, where the turnover would be experienced gradually increasing, in addition, the competitors' emergence through imitating the product that was launched. Maturity: declining the growth rates of the sold products. Saturation: the product's turnover attains its peak; thereafter the sold products would decrease in absolute terms, because of the appearance of substitute products. Decline: due to the emergence of substitute products, the sold products would decline in absolute terms, thus the innovative product would disappear gradually (Eger & Drukker, 2010).

The formula of the Product life cycle (PLC) index is given as follows:

$$PLCI_{i,t} = \left(\sum_{j} R_j e_j \right)_{i,t}$$

Where: $PLCI_{i,t}$ is the product life cycle index of a particular developing country i to developed countries at time t, j refers to an industry or product. R_j Indicates research & development (R&D) index on industry-wide j, it is defined as the ratio of R&D spending over gross sales revenue (SALES). It is given as:

$$R_j = average \left(\frac{R\&D}{SALES} \right)_j$$

Based on the maturity phase of the product life cycle which is stipulated that industry/product-wide $R\&D$ spending will decrease, we can use R_j as a proxy for the average life cycle stage of industry/product j. $e_{j,t}$ denotes industry j's export shares in aggregate manufacturing goods' exports. It is governed as:

$$e_{j,t} = \left(\frac{EXP_{j,t}}{\sum_j EXP_{j,t}} \right)$$

When the PLC index is higher, it implies that the export content of a particular developing country is more younger, namely non-standardized products, and vice versa (An, 2003).

1.2.7 New trade theory:

The differences in relative factor endowments (inter-industry trade) have remained the main engine for international trade among countries (Arnold, 2013). However, by incorporating three eminent elements: increasing returns to scale, differentiated goods and imperfect competition, Paul Krugman has contended that countries with identical factor endowments can engage in trade with each other (Krugman, 1980; Dhamodharan, Devadoss, & Luckstead, 2016). The emergence of new trade theory was driven by the increasing relative importance of similar-similar trade among advanced economies (Krugman, 2009). Krugman has stressed that the patterns of trade were driven by the increasing returns to scale and network effects that happen in the key firms labeled the market first movers, where cost advantage confers them the first mover advantages. Krugman contends that product differentiation (many varieties of products) for consumers generates gains from trade. Increasing production of each type of product leads to a rise in real income, thus price reduction as a result of increasing competition and market size (Verter, 2015). Drawing on the source of increasing returns to

scale, we can distinguish two sorts: internal and external. The latter comes from the total output of the industry level, which drives the cost of firms to drop, whereas the former (internal) comes from spreading the fixed cost of production (Zhou, 2007).

1.2.8 New new trade theory:

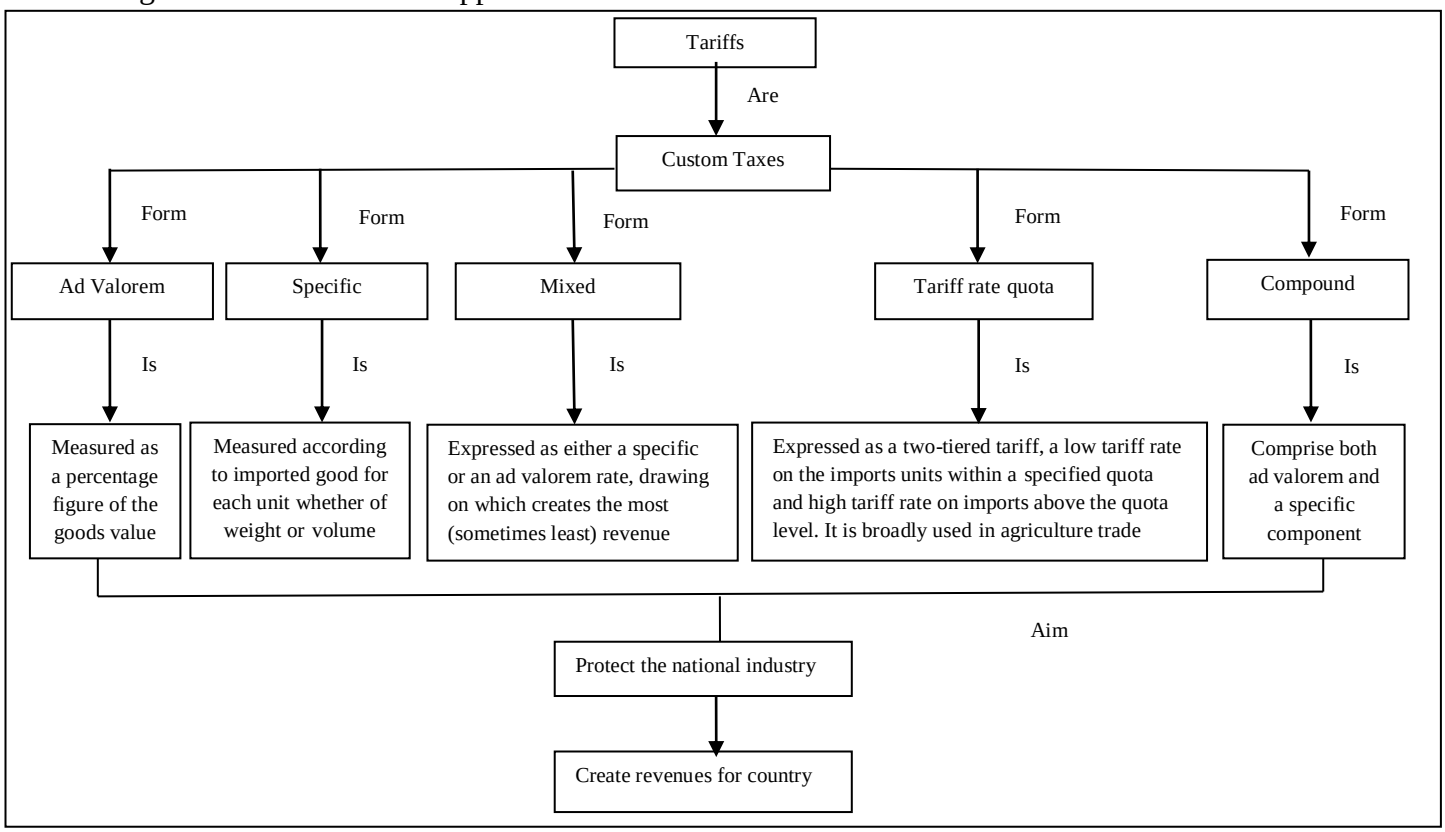
New new trade theory or the heterogeneous-firms trade models has emerged as a result of new trade theories shortcomings in the case of heterogeneous firms. These models were developed by Melitz, where the productivity of each firm in an industry is mixed. It opines that only the more productive and larger firms would export, as they have the ability to exceed the needed cost for entry into a foreign market (Kamal & Zaki, 2018).

1.3 Tariffs and Non-tariffs measures:

1.3.1 Tariffs measures:

As is well known, ad-valorem tariff is the most familiar form of tariff barriers to restrain trade flow. Non-tariff measures have been still the main predominant of international trade flows. According to The World Integrated Trade Solution (WITS), tariff forms are divided into ad valorem tariffs and non ad valorem tariffs as shown in the following figure.

Figure 1.6. Tariffs forms applied in international trade



Source: (López & Rojas, 2019; Nagurney, Besik, & Nagurney, 2019; Muchopa, Bahta, & Ogundeji, 2021; The World Integrated Trade Solution (WITS))

Generally, there are three categories or types of tariffs: most favored nation (MFN), bound and preferential tariffs. The hierarchy of these types is as follows (Nasir, 2020):

$$preferential < MFN < Bound$$

The difference (gap) between MFN and bound tariffs is labeled binding overhang (Nasir, 2020; Kuenzel, 2020)

1.3.1.1 Most favored nation (MFN) tariffs:

The MFN principle is the prominent pillar of the General Agreement on Tariffs and Trade (GATT). This principle requires that a member WTO country treats all other WTO members by the same tariff rates without discrimination, the so-called MFN applied tariff. More simply, the MFN principle signifies 'favour one, favour all' (Lake, Nken, & Yildiz, 2020; Saggi, 2009; Nasir, 2020). Kuenzel & Sharma (2021) have attempted to derive the optimal MFN tariff amid the existence of a preferential trade agreement (PTA), using a canonical partial equilibrium trade model, where a country's import composition with respect to its trading partner is a main key determinant of its MFN tariff, as follows:

They have assumed a model of three countries A, B and C. A is an importing country , B and C are exporting countries, whereby A imports strictly positive quantities from C and B.

C is subject to MFN tariffs, A is in a PTA with B. The indirect utility function of the representative household governs the welfare of country A as:

$$V[p, \Pi + t_B X_B(p - t_B) + t_C X_C(p - t_C)]$$

Where : p refers to the price in A , Π denotes the surplus of domestic producer, t_B and t_C point out the specific tariff levied on countries B and C, respectively. $X_B(p - t_B)$ and $X_C(p - t_C)$ indicate the import of country A from countries B and C, respectively.

The government of country A seeks to maximize welfare by choosing t_C, taking t_B as predetermined. the first-order condition for the government's optimal MFN tariff rate is:

$$\frac{dV}{dt_C} = -D\frac{dp}{dt_C} + X_A\frac{dp}{dt_C} + t_B\frac{dX_B}{dp}\frac{dp}{dt_C} + t_C\frac{dX_C}{dp}\left(\frac{dp}{dt_C} - 1\right) + X_C = 0$$

Where: D and X_A refer to the consumption and domestic output in country A, respectively. The ad valorem equivalent MFN tariff from country C is :

$$\frac{t_C}{p - t_C} = \frac{1}{\sigma_C} - \frac{\sigma_B}{\sigma_C}\frac{X_B}{X_C}\left(\frac{dp/dt_C}{1 - dp/dt_C}\right)\left(\frac{1}{\sigma_B} - \frac{t_B}{p - t_B}\right)$$

Where : σ_B and σ_C indicate the export supply elasticity for countries B and C, respectively. Furthermore, they have supposed that $\sigma_B = \sigma_C = \sigma_C$, namely the same foreign export supply elasticities for countries B and C. So:

$$\frac{t_C}{p - t_C} = \frac{M}{X_C}\frac{dp}{dt_C}\left[\frac{t_C}{p - t_C}\frac{X_C}{M} + \frac{t_B}{p - t_B}\frac{X_B}{M} - \frac{1}{\sigma}\right] + \frac{1}{\sigma} \qquad (1)$$

Where: M indicates A's total imports of goods. X_C/M and X_B/M represent the weights, namely the share of countries B and C in the total imports of the goods of country A.

To offer more illustration about the effect of the PTA import share, they have isolated the MFN tariff rate expression in equation (1), $t_C/(p - t_C)$, on the left-hand side. Drawing on the assumption of zero preferential tariff between A and B , namely $t_B = 0$, the optimal MFN tariff mentioned in equation (1) can be rewritten as :

$$\frac{t_C}{p - t_C} = \frac{1}{\sigma}\left[1 - \frac{X_B}{X_C}\left(\frac{dp/dt_C}{1 - dp/dt_C}\right)\right] \qquad (2)$$

As shown in equation (2) there is clear evidence that the optimal MFN tariff relies on country A's imports composition. Overall trade would occur with country C , if X_B = 0 . Increase the exports share of country B (preferential trading partner) to country A, i.e., an increase in X_B/X_C would lead to reduced tariff rate set on C. Means that the too depend of country A on preferential trading partner translates into a lower optimal MFN tariff.

From the above model explanation, the trade diversion generated by the PTA is the prominent mechanism which drives the inverse relationship between the optimal MFN tariff and the share of import from PTA partners. Commonly, the existence of a PTA between countries A and B would lead to two conflicting impacts on country A welfare. First, cutting tariffs rate for B will reduce A's domestic prices, increase imports and increase the surplus of domestic consumers.This process is indicated as the channel of trade creation for the preferential trade agreements (PTAs). Second, preferential tariff treatment for country B would cause diversion of the import of country A from country C (non-PTA member) to country B. This trade diversion leads to record losses in tariff revenue by the government of country A. Equation (2) demonstrates how can country A mitigate the detrimental effects of trade diversion subsequent to the PTA, by reducing its MFN tariff. Based on equation (1) they have derived the optimal MFN tariff in the case of $t_B > 0$ as follows:

$$\frac{t_C}{p - t_C} = \frac{1}{\sigma} - \frac{X_B}{X_C}\left(\frac{dp/dt_C}{1 - dp/dt_C}\right)\left(\frac{1}{\sigma} - \frac{t_B}{p - t_B}\right) \qquad (3)$$

Country A will reduce its MFN tariff set on country C, after its accession to a PTA with B, so as to minimize the losses in the tariff revenue created by trade diversion. This cutting in MFN tariff rate drives the reversion of trade diversion from B, in which is indicated by $-dX_B/dt_C$. As well,this reduction in MFN tariff drives the total increase in export from country C to country A , whereby:

$$\text{Total increase } (dX_C/dt_C) = (-dX_B/dt_C) + \text{trade creation}$$

The ratio $(-dX_B/dt_C)/(dX_C/dt_C)$ denotes the significance of the reversal of trade diversion relative to the entire trade effect. Calculation this ratio and rearranging , they have gotten:

$$\frac{X_B}{X_C}\left(\frac{dp/dt_C}{1 - dp/dt_C}\right) = \left(-\frac{dX_B/dt_C}{dX_C/dt_C}\right)\left(\frac{p - t_C}{p - t_B}\right) \qquad (4)$$

They have gotten the optimal MFN tariff for country A, with respect to the relative trade diversion reversal, by combining equations (3) and (4).

$$\frac{t_C}{p - t_C} = \frac{1}{\sigma} - \left(-\frac{dX_B/dt_C}{dX_C/dt_C}\right)\left[\frac{p - t_B}{(p - t_C)\sigma} - \frac{t_B}{p - t_C}\right] \qquad (5)$$

Thus, in response to a PTA the motivation for country A to cut the MFN tariff is closely related to the magnitude of the trade diversion reversal magnitude which can be realized .

1.3.1.2 Bound tariffs:

Bound tariffs are indicated as specific commitments, namely the maximum tariff rates propounded by individual WTO members while negotiating entry to WTO.

1.3.1.3 Preferential tariffs:

It has emerged as a result of article XXIV of GATT, which confers an exception to the MFN principle in the form of preferential trade agreements (PTAs). So that PTAs member countries commit to grant lower tariffs than MFN rate for their products while trading with each other (Nasir, 2020). Since the Rome treaty in 1958, which is considered the first modern agreement, preferential trade agreements have become the gist part of the trade policy agenda (Medvedev, 2010). Nowadays, PTAs are used as among the main instruments of international economic policy (Limão, 2007). Interestingly, the largest trading powers such as the United States of America (USA) and the European Union (EU), despite being the most eminent WTO members, have increasingly tended toward preferential trade agreements, which are referred to as arrangements in which liberalization is confined for participating countries. There are two developments in which, are considered as main prominent reasons for enhancing the shift of the major high-income countries toward more PTA_S away from the WTO, the first is, the steady rise of the large emerging economies' share of international trade, of which China, Brazil and India, particularly China, which has been recording the biggest share among them, since the late 1990s. The second is related to the properties of the trade policy agenda, such that it has become more complex, with respect to reducing or removing tariffs and other traditional policy instruments (Hoekman, 2015).

1.3.2 Non-tariffs measures (NTM_S):

Broadly, non-tariffs measures can be defined as policy measures except for ordinary customs tariffs which likely affect international trade movement in goods, through influencing quantities or prices, or both (UNCTAD, 2019a). The distortion of trade caused by NTM_S also is known as non-tariffs barriers (NTB) if those measures were imposed distinctly to protect domestic industry by limiting imports, where a distortion occurs when the domestic price varies from the border price (Carrère & Melo, 2011). Under the auspices of the United Nations Conference on Trade and Development (UNCTAD), a support team of multiagency has distinguished NTM_S into two categories measures, technical and non-technical. This classification is advantageous and comprehensive, but several technical measures are not technical, indeed rather prominently political (Asche, 2021). These measures have been organized into 16 groups; so groups from A to O are considered as import measures, whereas group P is considered as an export measure (Asche, 2021; Laget, 2019).

Drawing on their design and/or scope, those measures are divided into groups or chapters, moreover, each chapter is divided into many subgroups designed as a tree/branch structure. Most chapters have two digits, while a few chapters have reached three digits. This disaggregation follows the same logic of the Harmonized System (HS) nomenclature for product classifications (UNCTAD, 2019a). Chapter P comprises measures imposed by an exporting country on its exports such as export prohibitions, export quotas or export taxes (UNCTAD, 2021).

Table 1.5. UNCTAD classification of non-tariff measures

Measures	Groups	Describe
Technical	A	Sanitary and phytosanitary
	B	Technical barriers to trade
	C	Pre-shipment inspection and other formalities
Non technical	D	Contingent trade protective measures
	E	Non-automatic licensing and quantity control
	F	Price control including additional taxes and charges
	G	Finance measures
	H	Measures affecting competition
	I	Trade-related investment
	J	Distribution restrictions
	K	Restriction on post-sales services
	L	Subsidies
	M	Government procurement restrictions
	N	Intellectual property
	O	Rules of origin
Export	P	Measures related with export

Source: Laget, 2019

1.3.2.1 The similarity of NTM structure in bilateral trade:

$$\eta_{gij} = 1 - \frac{\sum_{m=1}^{Mg}\left(h_{mgi} - h_{mgj}\right)^2}{M_g} \text{ for all } g, i, j$$

Where: η_{gij} refers to the similarity index of NTM structure by industry g among two countries i and j, g indicates industry at the HS 2 digit level (g=1, 2,…., 99). M_g denotes industry's M HS code 6 level tariff lines, m suggests the tariff line, h_{mgi} and h_{mgj} belong to the same tariff line m.

$$h_{mgi} \text{ or } \left(h_{mgj}\right) = \begin{cases} 1 & \text{if m has NTM}_s \\ 0 & \text{otherwhise} \end{cases}$$

The value of η_{gij} ranges between o and 1, so that η_{gij} value close up to 1, signifies a more similar NTM structure of the industry among countries, and vice versa (Cho et al., 2020).

1.3.2.2 Average Tariff Equivalents (AVE_S):

In order to measure AVE_S, Péridy and Ghoneim. (2013) argue that there are two sorts of methods, the first can be applied especially for the trade of goods, namely when data on NTM_S are available, and the second can be implemented particularly for the trade of services when data on NTM_S are unavailable, the former method usually denoted as Kee, Nicita and Olarreaga (KNO) methodology, while the second method depends on the border effect or the fixed-effects approach.

1.3.2.2.1 Measuring AVE_S for the trade of goods:

As with advalorem tariffs, inserting the price variable is very necessary, as the calculation of NTMs effects have to be on prices not on quantities. To derive the price effects of NTMs on

imports, it is recommended as a first step, to estimate the quantity effects of NTMs on imports, and then translate these effects into price effects as a second step.

1.3.2.2.1.1 The quantity impact of NTMs on imports:

The equation below indicates the primary formula to be estimated:

$$\log(m_{n,c}) = \alpha_n + \sum_k \alpha_{n,k} C_c^k + \beta_{n,c}^{ntb} ntm_{n,c} + \varepsilon_{n,c} \log(1 + t_{n,c}) + \mu_{n,c} \quad (1)$$

Where: $m_{n,c}$ refers to the import value of country c from good n, C_c^k indicates a control variables vector characterizing a country. One of these variables is GDP as a proxy of economic size, relative factor endowment and average distance to the world market. $ntm_{n,c}$ denotes a dummy variable that reflects a core NTM existence. $t_{n,c}$ suggests the tariff imposed by country c on good n and $\varepsilon_{n,c}$ points out the import demand elasticity.

Applying some modification on equation(1), the final estimated equation becomes:

$$\log(m_{n,c}) - \varepsilon_{n,c} \log(1 + t_{n,c}) = \alpha_n + \sum_k \alpha_{n,k} C_c^k + \left[-e^{\beta_{n,c}^{ntb} + \sum_k \beta_{n,c}^{ntb} C_c^k}\right] ntm_{n,+c} + \kappa_{n,c} \quad (2)$$

As soon as tariffs are applied by a country, the import value is reflected by the left-hand side of equation (2). NTMs, the characteristics of a country and domestic support are the main affecting factors on the import value.

1.3.2.2.1.2 The price impact of NTMs on imports:

This effect appears after translating quantity impact derived from equation (2) into price-equivalents, AVE is written as:

$$AVE = \frac{\partial \log P^d}{\partial NTM}$$

Where: P^d indicates the domestic price**.**

Differentiating equation (1), the AVE formula is expressed as follows:

$$\mathrm{AVE}_{\mathrm{n,c}}^{\mathrm{ntb}} = \frac{\mathrm{e}^{\beta_{\mathrm{n,c}}^{\mathrm{ntb}}} - 1}{\varepsilon_{\mathrm{n,c}}}$$

1.3.2.2.2 Measuring AVE_S for the trade of services:

As far as assessing and computing AVE_S for the trade of services, using an indirect approach is preferable by taking the difference between actual trade in services relative to the benchmark (Fontagné et al., 2011). The coefficients of fixed effects in gravity models are the basic factors for estimating AVE_S in the case of services (Péridy & Ghoneim, 2013).

The basic gravity framework was introduced by Anderson and Wincoop. (2003). It has been widely employed to investigate the border effects. Their model relies on Armington's assumption which stipulates the existence of differentiated goods produced by countries and that the love of variety by consumers is a key factor in driving trade. Their gravity equation is given as:

$$X_{ij} = \frac{y_i y_j}{y^w} \left(\frac{t_{ij}}{\prod_i P_j}\right)^{1-\sigma}$$

Where: X_{ij} refers to exports from region /country i to region /country j. y_i and y_j indicate the output (GDP) of country i and country j respectively, y^w suggests world output. t_{ij} is the

bilateral trade cost, such that, $t_{ij} = (1 + tariff\ equivalent)$. $\prod_i is$ the resistance term of outward multilateral. P_j indicates the resistance term of inward multilateral. σ refers the elasticity of substitution , so that $\sigma > 0$ (Coughlin & Novy, 2013; Anderson & Wincoop, 2003; Park, 2002).

$$\Pi_i \equiv \left(\sum_j \left(t_{ij}/P_j\right)^{1-\sigma} \theta_j\right)^{1/(1-\sigma)} \quad , \quad \text{and} \quad P_j = \left(\sum_i \left(t_{ij}/\Pi_i\right)^{1-\sigma} \theta_i\right)^{1/(1-\sigma)}$$

Where :P_j and Π_i are proxies of the producer price index. θ_i and θ_j represent the share of countries i and j in the world income, namely its formula are given as (Anderson & Wincoop, 2003; Park, 2002; Fontagné et al., 2011) :

$$\theta_i = y_i/y^w \quad , \quad \text{and} \quad \theta_j = y_j/y^w$$

After specific steps, estimating for AVEs is derived from the following equation (Péridy & Ghoneim, 2013):

$$\ln(1 + AVE)^{-\sigma} = Fey_j - Fey_{benchmark}$$

So, the left hand-side of the above equation reflects the difference between the fixed effects calculated for importing country j and that of the benchmark country. So that a country that has the highest fixed effect, namely the lowest protection is indicated as a benchmark country.

1.3.2.3 Trade incidence of NTMs:

There are four indicators to measure the trade incidence of NTMs, of which two are primary and two are additional. The primary indicators are the frequency index and the coverage ratio, the remaining indicators (additional) are the prevalence score and the regulatory intensity.

1.3.2.3.1 The Frequency Index:

This index is defined as the share of traded product lines of a given country which is exposed to at least one NTM**.** Its formula is written as:

$$\mathrm{F_i} = \frac{\sum_{\mathrm{j=1}}^{\mathrm{J}} \sum_{\mathrm{p=1}}^{\mathrm{HS}} \mathrm{NTM_{ijp}} \mathrm{D_{ijp}}}{\sum_{\mathrm{j=1}}^{\mathrm{J}} \sum_{\mathrm{p=1}}^{\mathrm{HS}} \mathrm{D_{ijp}}} \times 100$$

Where: p indicates the product, i refers importing country, j suggests the exporting country, $\mathrm{NTM_{ijp}}$ denotes the existence of one or more NTMs imposed by country i on product p importing from country j, so that p is taken typically at selected HS aggregation level with $\mathrm{HS_6}$ **,** $\mathrm{D_{ijp}}$ denotes a dummy variable, it expresses whether there are imports of good i, $\mathrm{D_{ijp}}$ ranges between 0 and 1, where 0 means that there is no quantity of product p imported by country i from country j, whereas 1 signifies the presence of any quantity of product p imported by country i from country j. The denominator refers to the number of products imported.

It should be noted, that products with very low import value are overemphasized by $\mathrm{F_{index}}$, since the weights of all products are equal. Calculation of $\mathrm{F_{index}}$ for export measures mentioned in the UNCTAD classification of non-tariff measures (group P), $\mathrm{D_{ijp}}$ refers to exports instead imports and $\mathrm{NTM_{ijp}}$ indicates the existence of an export NTM.

Among the main shortcomings of $\mathrm{F_{index}}$, that sums over each partner j, knowing the fact that some NTMs imposed on trade exchange across countries are bilateral.

1.3.2.3.2 The Coverage Ratio:

This index is expressed as the total imports share subject to NTMs, it calculates the imports percentage to country j exposed to at least one NTMs. This index formula is given as:

$$C_i = \frac{\sum_{j=1}^{J} \sum_{p=1}^{HS} NTM_{ijp} V_{ijp}}{\sum_{j=1}^{J} \sum_{p=1}^{HS} V_{ijp}} \times 100$$

Where: V_{ijp} represents product i's imports value, the rest variables are indicated as in the frequency index, the denominator denotes the imported products value. In the case of C_i for exports V_{ijp} points out exports value instead of imports value.

As opposed to the frequency index, products with very low import value are not overemphasized by the coverage ratio.

Both frequency index and coverage ratio do not distinguish between NTMs which have relatively little effect on trade and those with major, even prohibitive, trade impacts. However, they provide generally meaningful data about the trade prevalence level of NTMs applied by a country (UNCTAD & the World Bank, 2018; Reyes & Kelleher, 2015)

1.3.2.3.3 The Prevalence Score:

$$P_i = \frac{\sum_{j=1}^{J} \sum_{p=1}^{HS} NTM_{ijp} \#NTM_{ijp} D_{ijp}}{\sum_{j=1}^{J} \sum_{p=1}^{P} D_{ijp}} \times 100$$

Where: $\#NTM_{ijp}$ indicates the number of particular NTMs (at 3 digits), applied by country i on product p importing from country j, such that p is taken typically at selected HS aggregation level with HS_6. The remaining variables are described as mentioned on the frequency index. It is taken exports instead of imports in the case of P_i for export measures.

1.3.2.3.4 The regulatory intensity:

$$RI_i = \sum_{p=1}^{HS} S_p^w \frac{\frac{\sum_{j=1}^{J} \#NTM_{ijp}}{\sum_{j=1}^{J} D_{ijp}} - \overline{\#NTM_p}}{\sigma \#NTM_p}$$

Where: S_p^w denotes the share of product p in total world import, $\overline{\#NTM_p}$ refers to the average number of NTMs imposed by country i on product p across all countries. In other words, it represents the mean of the NTMs number per product p. $\sigma\#NTM_p$ indicates the standard deviation of the NTMs number per product p. Using both the mean and the standard deviation aims to control the differences among countries for product -specific regulatory. In the case of RI_i for exports measures, it is taken exports instead of imports (UNCTAD & the World Bank, 2018; Grübler & Reiter, 2021).

Chapter 2. BPM6, External and internal imbalances

2. BPM6, External and internal imbalances

2.1 Balance of payments and international investment positions:

The sixth edition of the balance of payments and international positions manual (BPM6) has come in a harmonizing fashion with the System of National Accounts (SNA) of 2008 (Holton et al., 2020).

2.1.1 Balance of payments:

The balance of payments (BOP) comprises three sub-balances: current account, capital account and financial account. The distinction among these accounts within the BOP is drawn on the economic resources nature which received and provided (IMF, 2021).

Table 2.1. The structure and components of the balance of payments of BPM6

CURRENT ACCOUNT	Goods and Services	Goods	General merchandise	
			Of which: re-exports	
			Net exports of goods under merchanting	
			Goods acquired under merchanting (negative exports)	
			Goods sold under merchanting (exports)	
			Non-monetary gold	
		Services	Manufacturing services on physical inputs owned by others	
			Maintenance and repair services n.i.e.	
			Transport	
			Travel	
			Construction	
			Insurance and pension services	
			Financial services	
			Charges for the use of intellectual property n.i.e.	
			Telecommunications, computer, and information services	
			Other business services	
			Personal, cultural, recreational services	
			Government goods and services n.i.e.	
	Primary income		Compensation of employees	
			Investment income	Direct investment
				Portfolio investment
				Other investment
				Reserve assets
			Other primary income	Rent
				Taxes and subsidies on production and imports
	Secondary income		Personal transfers	
			Current taxes on income, wealth, etc.	
			Social contributions	
			Social benefits	
			Net premiums on nonlife insurance and standardized guarantees	
			Nonlife insurance claims and calls under standardized guarantees	
			Current international cooperation	
			Miscellaneous current transfers	
CAPITAL ACCOUNT			Acquisitions/disposals of non-produced, nonfinancial assets	Natural resources
				Contracts, leases, and licenses
				Marketing assets
			Capital transfers	Debt forgiveness
				Other
FINANCIAL ACCOUNT			Direct investment	
			Portfolio investment	
			Financial derivatives (other than reserves) and employee stock options	
			Other investment	
			Reserve assets	

Source: (Wang, 2020, p. 75)

2.1.1.1 Current account:

It is classified into three prominent categories: Goods and services account, primary income and secondary income as shown in table 2.1.

2.1.1.1.1 Re-exports:

Re-exports are indicated as foreign goods that are produced in other economies, then re-exported without significant transformation of their original state in which they were formerly imported, so as after purchased (imported) by residents, provided passing through the residents territory.

2.1.1.1.2 Goods under merchanting:

In contrast to re-exports, these sort of goods are purchased and resold without passing through the owner's territory. Where the purchaser resells those goods to another nonresident. They are registered in BOP accounting according to the following conditions:

As negative exports in the merchant's accounts, when they are acquired by the merchant. As exports in the merchant's accounts, when they are resold by the merchant. The difference between the two operations (purchase and resale) is called net exports of goods under merchanting. This item may be positive, that is, earning profit margin, or negative (losses) (Bahadir, 2010).

2.1.1.1.3 Non-monetary gold:

Unlike monetary gold which is recorded as financial assets, non-monetary gold is classified as goods. Likewise, other valuable metals are treated as goods. It encompasses all gold except monetary gold owned by monetary authorities. It is worth noting that watches, jewelry, and so on that involve gold are classified as general merchandise items. As non monetary gold has a special role in financial markets, it appears separately from other goods (IMF, 2009).

2.1.1.1.4 Primary income:

BPM6 distinguishes between two kinds of primary income: income linked with the production process such as subsidies and taxes on production and products, also compensation of employees, and income linked with the property of financial and other assets nonproduced such as investment income (portfolio investment and direct investment) and property income (return for renting natural resources and providing financial assets). The net primary income formula is given as:

$$Net\ primary\ incomes(P_i) = GNI - GDP$$

Where: P_i represents the difference between primary income received from nonresidents and primary income paid to them, GNI represents gross national income, and GDP denotes gross domestic product measured by the production concept, in which value added is created.

2.1.1.1.4.1 Investment income balance :

Knetsch and Nagengast (2017) argue that a country's investment income balance (IIB) can be expressed as follows:

$$IIB = II^A - II^L = i^A A - i^L L \qquad (1)$$

Where: II^A refers to the earnings resulting from holding foreign assets by domestic residents, II^L indicates the payments to nonresidents resulting from holding domestic liabilities, A denotes the gross value of foreign assets, L suggests the gross value of foreign liabilities, i^A points out the overall yield on foreign assets, its expression can be written as:

$$i^A = \sum_j^J \frac{II_j^A}{A} = \sum_j^J \frac{A_j}{A}\frac{II_j^A}{A_j} = \sum_j^J W_j^A i_j^A$$

Where: J indicates the different categories of investment, i_j^A and II_j^A represent the corresponding yield and investment income, respectively, W_j^A denotes the weight of each investment category out of aggregate assets value, and A_j refers to the assets' value for each investment category.

And, i^L indicates the overall yield on foreign liabilities, its expression can be governed as:

$$i^L = \sum_j^J \frac{II_j^L}{L} = \sum_j^J \frac{L_j}{L} \frac{II_j^L}{L_j} = \sum_j^J W_j^L i_j^L$$

Subsequently, the investment income balance can be rewritten as:

$$IIB = \sum_j^J W_j^A i_j^A A - \sum_j^J W_j^L i_j^L L$$

2.1.1.1.4.2 Total returns:

Capital gains and yield are considered two salient components of total returns, capital gains are defined as the returns caused by price changes (including the changes in exchange rate), while yield refers to the return induced by income streams (e.g., dividends and coupon payments) (Curcuru et al., 2013).

2.1.1.1.4.3 Returns differentials:

Returns differentials can be split into three subcomponents as follows:

$$\underbrace{\bar{r}^c - \bar{r}^l}_{returns\ differentials} = \underbrace{\sum_{j=1}^N \frac{(\bar{r}_j^c + \bar{r}_j^l)}{2}(\bar{w}_j^c - \bar{w}_j^l)}_{the\ composition\ effect} + \underbrace{\sum_{j=1}^N \frac{(\bar{w}_j^c + \bar{w}_j^l)}{2}(\bar{r}_j^c - \bar{r}_j^l)}_{the\ return\ effect} +$$

$$\underbrace{+\frac{1}{T}\sum_{t=1}^T \sum_{j=1}^N (w_{j,t-1}^c - \bar{w}_j^c) r_{j,t}^c - \frac{1}{T}\sum_{t=1}^T \sum_{j=1}^N (w_{j,t-1}^l - \bar{w}_j^l) r_{j,t}^l}_{the\ timing\ effects}$$

Where: $\bar{r}^c$ indicates average returns on country claims, $\bar{r}^l$ denotes average returns on country liabilities, $\bar{w}_j^c$ and $\bar{w}_j^l$ represent the time-series average of the weights on asset j corresponding to claims and liabilities, respectively. $\bar{r}_j^c$ and $\bar{r}_j^l$ denote the time-series average of the returns on asset j corresponding to claims and liabilities, respectively.

The timing effects stem from reallocations (sell or by) among different asset classes (Curcuru et al., 2010).

2.1.1.1.4.4 Yield differentials:

As noted by Knetsch and Nagengast (2017), an overall derivative of equation (1) with respect to time (dynamic decomposition) yields to gauge change in the IIB into stock effect and yield effect as:

$$d(IIB) = \underbrace{(i^A dA - i^L dL)}_{Stock\ effect} + \underbrace{(di^A A - di^L L)}_{yield\ effect}$$

Further detail, the yield effect can be decomposed into two sub effects as:

$$(di^A A - di^L L) = di^A A + (ds - di^A)L = \underbrace{\frac{1}{2}(di^A + di^L)N}_{Yield\ level\ effect} + \underbrace{\frac{1}{2}ds(A+L)}_{Yield\ spread\ effect}$$

Where: s refers to the yield spread, and N denotes the net foreign assets of a country, so that, $s = i^A - i^L$, and $N = A - L$

The yield level effect arises from the changes in the international interest rate environment; it can be split into two sub effects as:

$$\frac{1}{2}N(di^A + di^L) = \underbrace{\frac{1}{2}N\sum_j^J \left(W_j^A di_j^A + W_j^L di_j^L\right)}_{Pure\ yield\ level\ effect} + \underbrace{\frac{1}{2}N\sum_j^J \left(dW_j^A i_j^A + dW_j^L i_j^L\right)}_{yield\ level\ composition\ effect}$$

The yield spread effect can be decomposed into four sub-effects as follows:

$$\frac{1}{2}(A+L)ds = \underbrace{\frac{1}{4}(A+L)\sum_j^J \left(W_j^A + W_j^L\right)\left(di_j^A - di_j^L\right)}_{Pure\ yield\ spread\ effect} + \underbrace{\frac{1}{4}(A+L)\sum_j^J \left(W_j^A - W_j^L\right)\left(di_j^A + di_j^L\right)}_{Portfolio\ effect} +$$

$$+ \underbrace{\frac{1}{2}(A+L)\sum_j^J dW_j^A i_j^A}_{Asset\ composition\ change\ effect} - \underbrace{\frac{1}{2}(A+L)\sum_j^J dW_j^L i_j^L}_{Liability\ composition\ change\ effect}$$

2.1.1.1.5 Secondary income:

Secondary income provides more details on income redistribution by current transfers; it is distinguished into two sorts: personal transfers,i.e., remittances of workers and other current transfers. The $Net\ secondary\ incomes$ formula is expressed as:

$$Net\ secondary\ incomes(S_i) = DNI - GNI = DNI - P_i - GDP$$

Where: DNI represents disposal national income. Its formula is expressed as:

$$DNI = C + G + G_S$$

Where: C and G are private and public final consumption, respectively, G_S is gross saving (Zouri, 2021).

2.1.1.1.6 International Trade in services:

It is considered an important component of the current account of BPM6. Services were divided into twelve prominent subcategories as shown in table 2.1. Furthermore, the BPM6 methodology indicated that these main components can be disaggregated into more detailed ones (Gabrielczak & Kuziemska-Pawlak, 2021). Earlier, the products of intellectual property such as copyrights and patents resulting from research and development (R&D) activities were recorded in the capital account, as non-produced assets. But now BPM6 handles the intellectual property products sales as a part of other business services under the category labeled research and development services. Thus these products have recently appeared in the current account (Holton et al., 2020; IMF, 2009).

2.1.2 The international investment position (IIP) of BPM6:

IIP is frequently used as an indicator to outline the international financial integration extent of a given country. IIP is denoted as a balance sheet of backlog financial flows. IIP is defined as a statistical record that clarifies at a point in time the composition and value of financial assets of residents of an economy which are claims on nonresidents, residents' liabilities of an economy to nonresidents, and gold bullion reserved as reserve assets. Under IIP there are two main categories: assets and liabilities, in which each one is divided into subcategories (Yu, 2020) as shown in table 2.2.

Table 2.2. The structure and components of the international investment position of BPM6

	Beginning of period IIP	Financial account transactions	Changes due to:			End of period IIP
			Other changes in volume	Exchange rate changes	Other price changes	
Assets						
By functional category						
Direct investment						
Portfolio investment						
Financial derivatives (other than reserves) and ESOs						
Other investment						
Reserve assets						
By instrument						
Equity and investment fund share/units						
Debt instruments						
Special drawing rights						
Currency and deposits						
Debt securities						
Loans						
Insurance, pension, standardized schemes						
Other accounts receivable						
Other financial assets						
monetary gold						
Financial derivatives and ESOs						
Liabilities						
By functional category						
Direct investment						
Portfolio investment						
Financial derivatives (other than reserves) and ESOs						
Other investment						
By instrument						
Equity and investment fund share/units						
Debt instruments						
Special drawing rights						
Currency and deposits						
Debt securities						
Loans						
Insurance, pension, standardized schemes						
Other accounts payable						
Other financial liabilities						
Financial derivatives and ESOs						

Source: (Wang, 2020, p. 96)

2.1.2.1 Monetary gold:

Since monetary gold is used as a tool of international payments and value store for use in reserve assets, it is addressed differently from non-monetary gold. Monetary gold is held by monetary authorities as reserve assets. Gold sales are registered as monetary gold if a gold

transaction takes place between two monetary authorities which reserve the gold as reserve assets, or between an international financial organization and a monetary authority. It may be used as a store of value or for industrial aims (IMF, 2009).

2.1.2.2 Special drawing rights:

To deal with the shortage of world liquidity the International Monetary Fund (IMF) has issued special drawing rights (SDRs) as reserve assets since 1970. The interest rate yielding by one special drawing right (SDR) is measured weekly drawing on an average interest rate of currencies basket on the money markets (Grand & Ragot, 2021). On November 30, 2015, the executive board of the IMF accepted that the Chinese renminbi (RMB) is the fifth major international currency that makes up the SDR basket, along with the USD, the Japanese yen, the euro and the pound of Great Britain. This new collection of SDR basket entered into force on October 1, 2016. Every five years, the executive board of the IMF reconstitutes the SDR currencies basket according to their relative importance in the global trading and financial systems. SDR currencies basket has to satisfy two criteria: export and freely usable. The former has been included since the 1970s; it reflects the international trading power of the member (country or monetary union as the European Union). The member has to be one of the five largest exporters of goods and services spanning five years. The latter was included in 2000; it reflects the significance of financial transactions. The currency of the member must be used broadly to pay off international transactions and is broadly traded in the main exchange markets (International Monetary Institute, 2018). Any changes to the SDR currencies basket require approval of the IMF executive board by an 85 percent majority. Any adjustments on the valuation method within which the weight of currencies is determined to require approval of a 70 percent majority (Bénassy-Quéré & Capelle, 2014). SDRs are deemed as foreign currency in all circumstances, even for the economies issued the currencies included in the SDR basket. IMF distinguishes between the holdings of SDRs by an IMF member, and the allocation of SDRs, the former is registered as assets, whereas the latter is recorded as liabilities. Both cases should be recorded gross, instead of netted (IMF, 2009).

2.1.2.3 Foreign exchange reserves:

Rising globalization of developing economies and emerging markets, besides the debt crisis, particularly the 2007-2008 global financial crisis, are the main elements that have contributed to conferring importance to studying foreign exchange reserves topic. As noted by BPM6, foreign exchange reserves comprise unencumbered international assets owned by a central bank, to face potential obligations of the external payments on one side, and to satisfy the interventions of the central bank, in the domestic foreign exchange reserves market, to maintain the stability of the exchange rate, thus enhancing the markets participants confidence by underpinning domestic currency and mitigating its vulnerability on other side. There are two parts of foreign exchange reserves subject: the theory and the management (Panda & Trivedi, 2016).

The following formula provides the widest definition of international reserve (IR) as:

$$IR = forexR + nonCR = (SecR + DepR) + (Gold + SDRs + IMF + otherR)$$

Where: $forexR$ indicates foreign currency reserves, $nonCR$ denotes non-currency reserves, so that $forexR = (SecR + DepR)$, and $nonCR = (Gold + SDRs + IMF + otherR)$. $SecR$ Represents securities, $DepR$ suggests deposits and currencies, $Gold$ points out monetary gold, $SDRs$ are special drawing rights, IMF refers to the position of the reserve at the IMF, and $otherR$ are other reserve assets.
Changes in international reserve stocks can be expressed as follows:

$$\Delta IR = (\Delta^{ps} SecR + \Delta^{ps} DepR) + (r^{s} SecR + r^{d} DepR) + (\Delta^{val} SecR + \Delta^{val} DepR) + \Delta nonCR \quad (1)$$

Where: Δ^{ps} refers to sales and purchases, r^{s} and r^{d} represent the interest rate on securities and deposits, respectively. Δ^{val} are valuation changes, $\Delta nonCR$ are changes in $nonCR$. Applying equation (1) is conditional to the availability of statistics about how much foreign currency reserve assets ($SecR + DepR$) are held by a given country (Dominguez, 2012).

2.1.3 The relationship between BOP and IIP:

In economic literature, it is generally posited that there is a close link between surpluses/deficits in the current account and the outflow/inflow of financial capital, thus existing a close link between country's the current account balance and IIP. According to BMP6, BOP can be expressed as follows:

$$CA + CAP + EO = FA$$

Where: CA refers to the current account balance, CAP denotes capital account balance, EO suggests errors and omissions, and FA points out the statements of the financial account.
The current account balance includes four components as follows:

$$CA = G + S + PI + SI$$

Where: G and S represent goods and service accounts. PI and SI indicate primary and secondary incomes.
Financial account comprises five categories as follows:

$$FA = FDI + PI + OI + DER + RES$$

Where: FDI is direct investment, PI denotes portfolio investment, OI other investment, DER financial derivatives and employee stock options, and RES refers to reserve assets.
In more detail, $NIIP$ can be rewritten as:

$$NIIP = (FDI_A - FDI_L) + (PI_A - PI_L) + (OI_A - OI_L) + (DER_A - DER_L) + RES$$

Where: $NIIP$ indicates the net international investment position, it expresses whether a country is a foreign debtor (a negative $NIIP$) or foreign creditor (a positive $NIIP$), its formula is given as: $NIIP = foreign\ assets - foreign\ liabilities$.
Changes in $NIIP$ can be expressed as follows:

$$\Delta NIIP = (\Delta FDI_A - \Delta FDI_L) + (\Delta PI_A - \Delta PI_L) + (\Delta OI_A - \Delta OI_L) + (\Delta DER_A - \Delta DER_L) + \Delta RES \quad (5)$$

The changes in IIP result from financial account transactions plus other changes as shown in table 2.2, the valuation effect in FDI can be expressed as:

$$\Delta FDI_A - \Delta FDI_L = FDI + VE_{FDI_A} - VE_{FDI_L} = FDI + VE_{FDI}$$

Where: ΔFDI_A and ΔFDI_L refer to the valuation effect in FDI assets and FDI liabilities, respectively. VE_{FDI} indicates the whole valuation effect for FDI.
So, the valuation effect can be expressed as:

$$VE = VE_{FDI} + VE_{PI} + VE_{OI} + VE_{DER} + VE_{RES}$$

$\Delta NIIP$ can be rewritten as follows:

$$\Delta NIIP = FDI + PI + OI + DER + RES + VE$$

Taking into consideration current transactions, $\Delta NIIP$ can be rewritten as:

$$\Delta NIIP = CA + CAP + EO + VE$$

The last equation outlines the relationship between BOP and IIP (Śliwiński, 2018)

2.2 Sudden stop economies, the current account sustainability, Optimal level of foreign reserves and balance of payments crisis:

2.2.1 Sudden stop economies and precautionary demand for foreign assets:

Sudden stops are defined as financial crises that take place in both emerging and advanced economies; they are identified by a significant sudden current account reversal. Among their unpleasant repercussions: are prices collapsing, deep recessions and depreciations in real exchange rates (Bianchi & Mendoza, 2020). Sudden stops are a series of economic and financial crises Durdu et al.(2009). Current account reversal is known as a drop in the current account deficit of at least 4% of GDP in one year (Edwards, 2004). Durdu et al.(2009) have indicated that financial globalization namely barriers removal which influences trading in international assets, and self-insurance against sudden interruption or sudden stop are the main key drivers in determining the optimal precautionary demand for foreign reserves in emerging economies that experienced sudden stops, whereby the median surge in the stock of foreign reserve for 17 countries (Argentina has experienced two sudden stops during 1985-2004) has been estimated at 7.7% of GDP, whereas changes in the business cycle variability of output had negligible effect on those countries.

Business cycle volatility is measured by relative standard deviation which is also known as the coefficient of variation (CV) of the real GDP growth rate in the long run. Its formula is given as: CV = (standard deviation/ mean), the Lower the value of CV, the higher the value of fluctuation of the business cycle, and vice versa, it should be highlighted that simple standard deviation may be fairly led to spurious results (Ovaska & Palardy, 2014).

2.2.2 The current account sustainability:

Commonly, the ratio of current account deficit to GDP is considered the prominent indicator used for assessing if a current account balance is sustainable or not, such that this ratio should not be overtaken by 5 percent (Kouadio & N'Guessan, 2021). However, few studies have used this ratio to test the sustainability of CAB, instead, several studies have relied on the econometric techniques by employing the long-run cointegration relationship between imports

and exports (Dissou & Nafie, 2019). Assessment of the sustainability of the current account balance (CAB) is subject to intertemporal budget constraints of that country. Hence, CAB is deemed sustainable; when the present value of its future trade surpluses is equal to the present level of debt. The assessment drawn on intertemporal budget constraint theories seeks to know the ability of an economy to satisfy its long-run intertemporal budget constraint without doing radical policies or a severe alter in its domestic absorption (Kouadio & N'Guessan, 2021). The intertemporal approach is deemed a significant theoretical development to clarify whether the current account imbalance of a given economy is sustainable in the long run or not. There are two main assumptions on which this approach is based: the perfect mobility of capital, and the consumption-smoothing behavior. (Sahoo, Babu, & Dash, 2016).

2.2.3 Optimal level of foreign reserves:

2.2.3.1 The maximization of the social welfare function:

Kelly (1970) has propounded a pioneer framework yielding to determine the optimal level of reserve, for a government trying to keep the external and internal balance, within a pegged exchange rates regime. Drawing on trade –off between lower income levels, implies the income sacrificed in holding reserve, namely the substitute return that these assets could achieve, and greater fluctuations of income resulting from exogenous external disturbances, the utility can be maximized by the government. As far as the constraint, the balance of payment random disturbances can be compensated either by financing, namely employing reserves, or by adjusting, namely generating variations in income. The former situation is indicated to lower income levels, whereas, the second situation is referred to a higher income variability. Through maximizing the objective function under this constraint the optimal level of reserves can be derived. The welfare of a country relies on the income level and variability. By tying up resources in services, the drop in income will be:

$$Y' - \mathrm{Y} = \mathrm{Ri} \qquad (*)$$

Where: Y' denotes the total output which could be achieved if no reserves are held, Y represents the level available when holding a certain amount of reserves R, at their (net) opportunity cost i. R indicates stock of foreign currencies and gold.

Through previous surpluses of the balance of payment, this stock has been accumulated, which was held for stabilization. Consider that only changes in exports (as an exogenous variable), are the key driver in the income level variations.

The following equation expresses an initial status of equilibrium as:

$$\Delta R_t = \Delta X_t - \Delta M_t$$

Where: ΔR_t refers to the change in reserves in any period t, ΔX_t indicates a change in exports (foreign demand), ΔM_t suggests a change in imports (as an endogenous variable), which is affected by the government policy. In other words ΔM_t *e*xpresses the domestic demand changes for foreign goods and services.

Overall, the government's reaction toward change in exports will occur by allowing or spurring changes in imports, to partially compensate for that external disturbance. Among available endogenous change tools: altering the exchange rate or tariffs, making the money supply follow pari passu. Kelly has introduced a policy variable (known as an import response coefficient f) which rests on the authorities willingness to permit a change in exports, because

of external disturbances to spill over to the domestic economy.i.e, change in income. Usually, its value ranges between zero and one, its formula is given as :$f = dM/dX$.
There is another coefficient g which correlated positively with f. Its formula is expressed as: $f = dY/dX$. Thus the relationship between f and g is written as follows: $f = m \cdot g$
Where: m points out the marginal propensity to import. Kelly has posited furthermore the assumption that the country is small sufficiently to avert producing feedback effects. hence:

$$\Delta R = \Delta X(1 - f) \qquad (1)$$

$$V(R) = E(\Delta R^2) \;\; ; \quad V(Y) = E(\Delta Y^2) \qquad (2)$$

By substituting (1) and the definition of g in (2), we obtain:

$$V(Y) = E(g^2 \Delta X^2) = g^2 V(X) \qquad (3)$$

$$V(R) = E(\Delta X^2 (1 - f)^2) = V(X)(1 - f)^2 \quad (4)$$

So that: $V(Y)$ and $V(R)$ represent the variance of income and reserve, respectively. E indicates the expectation, with changes evaluated from the mean.
There is a fixed target level of reserves (R') which enables the government to avert the prohibitive cost needed to continue stabilization policies, provided that $(R < R')$.
The small probability level (e) which the government desires to achieve, is given as:

$$P[R < R' | \, E(R), V(R)] = e \qquad (5)$$

Given the probability distribution of ΔX, we can measure accurately the expected value (the reserves' average level) needed to keep e. Equation (5) refers to the constraint in the problem. Then to solve this problem, Kelly has proposed an explicit probability density function as:

$$e = cV(R)/E(R)^2 \qquad c > 0 \qquad (6)$$

By combining equations (4) and (6), we obtain:

$$E(R) = \sqrt{(c/e)}\, S(R) = \sqrt{(c/e)}\, S(X)(1 - f) \qquad (7)$$

Where: S indicates the standard deviation.
From equation (3), we get $g = S(Y)/S(X)$, letting $f = m \cdot g$ and substituting into equation (7), then the final form of constraint, namely the technical relationship between $E(R)$ and income variability is obtained as follows:

$$E(R) = \sqrt{(c/e)}\, [S(X) - mS(Y)] \qquad (8)$$

Then, utility function is given as:

$$U = -a[E(Y') - E(Y)]^2$$

$$= -b[(Y) - E(Y)]^2 \qquad a, b > 0$$

By substitution from $(*)$, and taking the expected value , Kelly has obtained the expected utility as:

$$E(U) = -ai^2 E(R)^2 - bV(Y) \qquad (9)$$

By minimizing equation (9) with respect to $E(R)$ and $S(Y)$ with the constraint (8). The lagrangian form is as:

$$L = -ai^2E(R)^2 - bV(Y) + \lambda\left[E(R) - \sqrt{(c/e)}\,[S(X) - mS(Y)]\right]$$

For an extremum, the first order conditions are:

$$\partial L/\partial \mathrm{E(R)} = -2\,ai^2\mathrm{E(R)} + \lambda = 0$$

$$\partial L/\partial \mathrm{S(Y)} = -2bS(Y) + \lambda\sqrt{(c/e)}\,m = 0$$

$$\partial L/\partial \lambda = \mathrm{E(R)} - \sqrt{(c/e)}\,[S(X) - mS(Y)] = 0$$

Where: λ points out a Lagrange multiplier.
Finally, by some manipulations, the optimum average level of reserve is:

$$\widehat{E(R)} = \frac{S(X)}{\sqrt{(e/c)} + \sqrt{(c/e)}(m)^2i^2(a/b)}$$

Where: a refers to the marginal disutility of income reductions (income variations), and b denotes the marginal disutility of income variance (income variability) (Kelly, 1970; Gandolfo, 2016).
The pari passu clause is defined as a standard clause in the contracts of sovereign bonds, referring to equal treatment among creditors. *When the country continued paying bondholders of restructured bonds while refusing to pay holdout creditors*, meaning that this clause was violated (Datz, 2021). This repayment by the debtor should be ratably according to the contribution percentage of each creditor (Sarkar, 2020).
Hu et al. (2022) have denoted that Miller is considered the first economist who proposed the term feedback effect in 1963. He has attempted to evaluate the effects of economic feedback by using the input-output analysis (IOA) (Hu et al., 2022).

2.2.3.2 Utility maximization approach:

Jeanne and Rancière (2006) have attempted to calculate the optimal scale of foreign exchange reserves in case of a small open economy that may be hit with a risk of sudden stops in capital flows, where the effect of foreign exchange rate movement is insignificant. There is one single good which is consumed broadly and domestically, discrete infinite time. The trade balance (TB_t) can be written as:

$$TB_t = Y_t - A_t \qquad (1)$$

So that: Y_t expresses real output, and A_t denotes real domestic absorption.
Under the international balance of payments, equation (1) can be rewritten as:

$$TB_t = -KA_t - IT_t + \Delta R_t \qquad (2)$$

Where: KA_t indicates both financial and capital balances, IT_t suggests foreign income and transfer payment (from abroad), and ΔR_t denotes changes in foreign exchange reserves in the current period$(\Delta R_t = R_t - R_{t-1})$.

Combining equations (1) and(2), A_t can be decomposed as:

$$A_t = KA_t + IT_t + Y_t - \Delta R_t \qquad (3)$$

Equation (3) outlines simplified change mechanisms of the normal flow of capital within an open economy. Thereafter, this country hit an abrupt fall (sudden stop) in KA_t, consequently A_t will drop. Given Y_t and KA_t are changing in the same lines, Y_t effect will amplify this fall. At this stage, the strategy of the government is relying on using their foreign exchange reserves to make up for the shortage of capital inflows. A sudden halt in capital inflows in year t will occur if KA_t/Y_t drops by more than 5% of GDP relative to t-1.

There are two parts: the private sector and the government sector, the budget constraints of the representative consumer in the private sector are given as:

$$C_t = Y_t + L_t - (1 + r)L_{t-1} + Z_t \qquad (4)$$

Where: C_t indicates current consumption, L_t and L_{t-1} represent current and previous foreign debt, respectively. Z_t denotes the transfer payment from the government, in another word, Z_t reflects a contract between the government and consumers, which subsidizes, maintains the consumption level, helps consumers when they cannot pay off their foreign debt and pays off particular foreign debts. r points out that the interest rate on short-term, it is constant. The external debt of the representative consumer is paid off regularly.

Both sectors (private and government), besides private external debt grow at the same constant g, subject to that capital inflows are normal. When the sudden halt occurs, g will be stopped. As a result of a drop in total output, there is a potential risk that L_t could not be repaid. In case of a sudden stop, two things take place: first, the representative consumer is incapable of rolling over his L_t, second, output Y decreases by a fraction (or rate) γ below its long-run growth rate. There are three periods, before, during and after sudden halts denoted by a, b and d, respectively, where π indicates the probability of occurrence of a sudden halt. They have assumed that the external debt of consumer is all short-term, with $\lambda = L_t/Y_t$, hence:

Before the crisis, $Y_t^b = (1 + g)^t Y_0$; $L_t^b = \lambda(1 + g)^t Y_0$

At the time of the crisis, $Y_t^d = (1 - \gamma)(1 + g)^t Y_0$; $L_t^d = 0$

At the crisis, $Y_t^a = (1 + g)^t Y_0$; $L_t^a = 0$

As opposed to the private sector which cannot borrow long term foreign debt, the government can issue bonds that are expressed as long-term security. Since π is very small, the life expectancy of government bonds is very long, expressed by $1/\pi$, for example, if $\pi = 0.1$, then the life expectancy of the bonds is 10 years. In addition, the long-term provides a safety valve to cover the default of the private sector's short-term foreign debt. The government bond pays one unit of the government good to bondholders. The bound price before sudden halt = the discount value of the one unit of good that it needs to pay in the next period (with certainly) + the bond's expected market value, namely:

$$P = \frac{1}{1 + r + \delta}[1 + (1 - \pi) \cdot P]$$

Implying,

$$P = \frac{1}{\pi + r + \delta}$$

Where: δ considers a term premium, it is calculated as follows:
$\delta =$ long-term interest rate – short-term interest rate (r), so that, the long-term interest rate which was used to calculate the long-term bonds' present value $> r$.
The long-term bond price in a pre-sudden event halt is constant, and when a sudden stop takes place it falls to zero.
The government issues the bonds to finance a stock of foreign exchange reserves as:

$$R_t = PN_t \quad ; \quad R_{t-1} = PN_{t-1} \qquad (5)$$

Whereby: N denotes the number of issued government long-term bonds
Equation (6) represents the government budget constraints (i.e., government revenue equals government expenditure), before the sudden stop.

$$Z_t + R_t + N_{t-1} = P(N_t - N_{t-1}) + (1 + r)R_{t-1} \qquad (6)$$

Z_t^b denotes the subsidizes of the government to the consumer, to guarantee the consumption level before the sudden stop happens, as shown in equation (7).

$$Z_t^b = -\left(\frac{1}{p} - r\right)R_{t-1} = -(\delta + \pi)R_{t-1} \qquad (7)$$

As illustrated in equation (7), the value of the transfer payment is negative. The government levies taxes on the representative consumer to compensate the cost which was incurred by the government as a result of holding reserves without investment, which is proportional to $\delta + \pi$.
When the sudden stop takes place, the government will transfer the whole net foreign exchange reserves of the previous period, to help the representative consumer repay his short-term foreign debt that is not rolled over. Hence, Z_t^d is given as:

$$Z_t^d = (1 - \delta - \pi)R_{t-1} \qquad (8)$$

Z_t^d to be positive, they have assumed that $\delta + \pi > 1$. After the occurrence of the sudden halt, R_t, N_t, and Z_t are all reduced to zero.
The domestic consumption level before, during and after the sudden halt, respectively is given as:

$$C_t^b = Y_t^b + L_t^b - (1 + r)L_{t-1}^b - (\delta + \pi)R_{t-1} \qquad (9)$$

$$C_t^d = (1 - \gamma)Y_t^b - (1 + r)L_{t-1}^b + (1 - \delta - \pi)R_{t-1} \qquad (10)$$

$$C_t^a = Y_t^a \qquad (11)$$

Drawing on equations (9) and (10), we can choose the optimal level of foreign exchange reserve by trade-off among the two situations.

In order to close the model, the constraint condition was introduced which is indicated by the objective effect function of the government. They have assumed that the goal of the government is to maximize the representative consumer welfare

$$U = \sum_{S=0,\ldots,+\infty} (1+r)^{-S}\, u(C_{t+s}) \qquad (12)$$

Where: the consumption utility function is given with a constant relative risk aversion (σ)

$$u(C) = \frac{C^{1-\sigma} - 1}{1-\sigma} \qquad (13)$$

The strategy of the government focuses on finding the level of foreign exchange reserve $R_t$that maximize U_t in each period t before the sudden halt happens.
Combining equations (4) and(6), i.e, the representative consumer's budget constraints and the budget constraints of the government, they have obtained the following equation:

$$C_t = Y_t + (L_t - PN_t) - (1+r)(L_{t-1} - PN_{t-1}) + PN_t - (1+r+\delta+\pi)PN_{t-1} \qquad (14)$$

R_{t} is only linked to the level of consumption of the t+1 period, thus :

$$R_t = \text{argmax}\left[(1-\pi)u\left(C_{t+1}^{b}\right) + \pi u\left(C_{t+1}^{d}\right)\right] \qquad (15)$$

The first-order condition is:

$$(1-\pi)(\delta+\pi)u'\left(C_{t+1}^{b}\right) = \pi(1-\delta-\pi)u'\left(C_{t+1}^{d}\right) \qquad (16)$$

P_t denotes the marginal rate of substitution between consumption in the sudden halt event and consumption in the non sudden halt event, where this price should be constant as:

$$P \equiv \frac{u'\left(C_t^{d}\right)}{u'\left(C_t^{b}\right)} = \frac{(1-\pi)}{\pi}\frac{\delta+\pi}{1-\delta-\pi} \qquad (17)$$

Substituting utility function $u(C)$ can also be obtained:

$$\left(C_t^{d}\right)^{-\sigma} = p\left(C_t^{b}\right)^{-\sigma} \qquad (18)$$

Under the premise of normal capital flow, R_t is given as:

$$R_t = \rho Y_{t+1}^{b} \qquad (19)$$

Then, the ratio of the optimal level of foreign exchange reserves to the output level (ρ) is given as follows (Jeanne & Rancière, 2006; Zhou et al., 2018; Jeanne & Rancière, 2011):

$$\rho = \lambda + \gamma - \frac{p^{1/\sigma} - 1}{1 + (p^{1/\sigma} - 1)(1-\delta-\pi)}\left(1 - \frac{r-g}{1+g}\lambda - (\delta+\pi)(\lambda+\gamma)\right) \qquad (20)$$

2.2.4 Balance of payments crisis:

2.2.4.1 Currency crisis:

It is referred to as a windfall devaluation of a currency, which frequently winds up with a speculative attack in the foreign exchange market (Nakatani, 2017b). In other words, a currency crisis occurs when a country fails to defend a specific parity for the exchange rate (Alaminos et al., 2021). The exchange market pressure index ($EMPI$) is deemed a barometer to gauge the currency crisis severity, so that , a high value of $EMPI$ denotes serious pressure over that country's currency (Nakatani, 2017b). The monthly $EMPI$ index can be measured as follows:

$$EMPI_{i,t} = \frac{1}{\sigma_{\Delta e}} \% \, \Delta e_{i,t} - \frac{1}{\sigma_{\Delta IR}} \frac{\Delta \, IR_{i,t}}{M_{i,t-1}} + \frac{1}{\sigma_{\Delta r}} \Delta \left(r_{i,t} - r_{us,t} \right)$$

Where: Δ refers the changes, $e_{i,t}$ denotes the nominal exchange rate of local currency for each U.S. dollar, $IR_{i,t}$ indicates international reserves with the exception of gold, $M_{i,t-1}$ points out the money supply in the previous period. $r_{i,t}$ and $r_{us,t}$ suggest money market rate or country i's discount rate and base country, that is the US, respectively. To avert the domination of volatile components, each term is scaled by its standard deviation. A surge in EMP denotes that the currency of a country is facing devaluation stresses, and vice versa (Tan et al., 2021). Drawing solely on two underlying components: international reserves and exchange rate, Chernyak et al.,(2013) have indicated a simplified method to measure $EMPI$ as:

$$EMPI_{i,t} = \frac{1}{\sigma_e} \frac{\Delta \varepsilon_{i,t}}{\varepsilon_{i,t}} + \frac{1}{\sigma_y} \frac{\Delta \, rm_{i,t}}{rm_{i,t}}$$

Where: $rm_{i,t}$ refers reserves held by the central bank of country i, $\varepsilon_{i,t}$ denotes country i's real effective exchange rate, σ_e and σ_y suggest the standard deviation of both real effective exchange rate and reserves of country i, respectively.

A decrease in $EMPI$ signifies an increased probability of an upcoming currency crisis (Chernyak et al., 2013).

2.2.4.2 Krugman's balance of payment crisis model:

The balance of payments crisis is considered a particular case of imbalance, Krugman is credited with proposing the first generation of the balance of payments (BOP) crisis models (Fan & Liu, 2022). These models have emphasized discrepancies between macroeconomic policies domestic such as a fixed exchange rate regime, and a perpetual deficit of government budget that ultimately has to be monetized, they have depicted a situation in which a government tries to keep a pegged exchange rate regime, yet is come under to a gradual losses of its international reserve, owing to the requirement to monetize its persistent budget deficit, furthermore, they argue that the government activity is the key factor, and the fixed exchange rate regime has to breakdown (Nakatani, 2017b). Krugman (1979) has distinguished between the BOP problem and the BOP crisis, the former refers to an instance in which an economy is gradually experiencing losing its foreign exchange reserves. The latter describes the situation in which the BOP problem becomes a crisis at a specific point, in which speculators attack the currency. This crisis usually occurs before running out of the government foreign exchange reserve in the absence of speculation. Krugman (1979) argues that the BOP crisis drives the exchange rate regime that was undertaken by that economy to

shift from a pegged exchange rate to a floating exchange rate. That speculative attack is explained by changes in the investors' portfolios composition, through increasing foreign currency proportion, and decreasing domestic currency proportion, owing to expected changes in relative yields.

Krugman (1979) has assumed a small open country producing a single good, in which its domestic price is determined as: $P = sP^*$

Where: P indicates the level of domestic price, s refers to the exchange rate (i.e., domestic currency against foreign), and P^* represents the product price in international markets, which is constant equal to 1.

In addition, wages and prices are fully flexible, which implies that output is usually at its full employment level Y, so the real trade balance (B) can be expressed as:

$$B = Y - G - C(Y - T, W) \qquad C_1, C_2 > 0$$

Where: Y represents the production level, G refers real spending of government, C denotes private consumption, T indicates real taxation, and W points out real private wealth.

Further, investors can choose between only two assets: foreign and domestic money. The nominal interest of both currencies is equal to zero, that is, the current account is identified with the trade balance, as a result of excluding payments of international interest.

The domestic residents' gross real wealth expression is presented as:

$$W = \frac{M}{P} + F$$

Where: M and F refer to domestic (national) and foreign currencies, respectively.

As a last assumption, Krugman (1979) has posed that foreigners do not have domestic money, hence M indicates the domestic currency stock, and in equilibrium domestic residents have to be willing to keep that stock. So the portfolio equilibrium condition is written as:

$$\frac{M}{P} = L(\pi) \times W$$

Where: π denotes the expected inflation rate, which also represents the expected depreciation rate of the currency.

The existence of two exchange rate regimes: flexible exchange rate (accurately, freely floating exchange rate) and fixed exchange rate. The former implies that the government can't either sell or buy foreign money. Whereas the latter otherwise, which requires the existence of a foreign reserve. The economic behavior in the short term is different drawing on the system of the exchange rate. Under a flexible exchange rate regime, a surge of π would lead to a surge of P, while Under a fixed exchange rate regime, an increase of π would cause a change in the proportion of W components. Thus:

$$\Delta R = -\Delta F = \Delta \frac{M}{P}$$

Where: ΔR indicates a decline in the government reserve of foreign money, ΔF points out an increase in foreign money held by the domestic residents.

Under a flexible exchange rate regime, the creation of money to satisfy government deficit will occur solely through printing money; hence, the money stock growth is governed as:

$$\frac{M}{P} = G - T$$

The private saving formula is defined as the surplus of private income over spending, thus:

$$S = Y - T - C(Y - T, W)$$

Owing to the price level being pegged (i.e., fixed exchange rate regime), the growth of W is equal to S. Hence:

$$\dot{W} = \frac{\dot{M}}{\bar{P}} + \dot{F} = S$$

Where: $\bar{P}$ indicates a constant price level.

In a fixed exchange rate regime, if π will be equal to zero, then an increase in W will be allocated proportionally as:

$$\frac{\dot{M}}{\bar{P}} = LS \quad ; \quad \dot{F} = (1 - L)S$$

The government can meet its deficit in two ways: issuing new domestic currency, or using its foreign exchange reserve, hence the government budget constraint can be expressed as:

$$\frac{\dot{M}}{\dot{P}} + \dot{R} = G - T = g\left(\frac{M}{P}\right)$$

As depicted in the last expression, the perpetual government deficit makes it incapacitated to fixing the exchange rate, even though $S = 0$ (krugman, 1979; Alaminos et al., 2021).

2.2.4.3 Balance of payments crises in resource-rich economy:

As a result of the severe plummet of oil prices starting in a maid- 2014, unpleasant repercussions have been emerged in countries' commodity-exporting, especially low income, among those impacts: a sharp drop in exports revenues and foreign reserves, in the wake of negative export price shocks, Nakatani (2018) has developed a fourth-generation of BOP crises, which demonstrates the mechanism through which shocks in commodity prices such as oil lead to BOP crises. In addition, to address this sort of BOP crisis, two exchange rate regimes were introduced by Nakatani : a fixed exchange rate regime with foreign exchange rationing, and a flexible exchange rate regime. The optimum regime selected depended on the trade-off between them. Nakatani's model is described as follows:

The model comprises three agents: firms: agricultural and mining, households and the government which manages a central bank. Both sorts of firms are held by the foreign investors and the government. Before the occurrence of the shock, initial prices are expressed drawing on the chosen actions of all agents. There are two periods, in the former, a sudden negative commodity price shock takes place resulting in a severe drop in exports revenues which in turn, generates heavy pressure on foreign exchange reserves. Simultaneously, the government can react by using foreign reserves to maintain the pegging of its currency at the range level, or by allowing flexibility in the exchange rate. In the latter, the external shock spills over to domestic activity, for example decrease in tax revenues, hence firms and households select their proceedings based on government response policy in period 1.

Firms

Agricultural firms

They seek to maximize their profits as:

$$\Pi_t^a = (1-\tau)P_t^{a,f}E_tY_t^{a,f} + P_t^{a,d}Y_t^{a,d} - W_t^aL_t^a$$

Where: $Y_t^{a,d}$ and $Y_t^{a,f}$ represent the agricultural commodities amounts sold to domestic households and foreign consumers respectively, L_t^a refers to the agricultural sector's number of employees, τ suggests the tax rate, $P_t^{a,d}$ denotes the agricultural domestic commodities price in domestic currency, $P_t^{a,f}$ points out the agricultural export commodities price in foreign currency, E_t indicates the nominal exchange rate, and W_t^a refers to the nominal wage paid in the agricultural sector.

Agricultural firms respond to the following production function: $Y_t^a = A_t^a L_t^a$. So that: Y_t^a denotes the agricultural firms total output sold on both domestic and foreign markets, and A_t^a refers to total factor productivity, so Y_t^a can be rewritten as: $Y_t^a = Y_t^{a,d} + Y_t^{a,f}$

Commodities exports of the agricultural sector are undergoing the following demand function:

$$Y_t^{a,f} = Y_t^{a,f,D}(R_t, Y_t^F)$$

So that: R_t denotes the real exchange rate, its formula is given as: $R_t = E_tP_t^F/P_t$, whereby P_t^F indicates the price in foreign countries, Y_t^F indicates foreign income, i.e., income in foreign countries, and P_t suggests the domestic price index as:

$$P_t = \vartheta^a P_t^{a,d} + \vartheta^m P_t^m E_t + \vartheta^i P_t^i E_t$$

So that: ϑ^a, ϑ^m, and ϑ^i represent the share of each commodity in the household's consumption basket.

To optimize the problem of agricultural firms, the first order condition was applied:

$$A_t^a = W_t^a/P_t^{a,d}$$

The employment level in the agricultural sector is subject to the following constraint: the marginal product of agricultural goods = the real wage. Dividends are paid by agricultural firms to both foreign investors and the government.

Mining firms

In analogous way, these firms seek to maximize their profits as follows:

$$\Pi_t^m = (1-\tau)P_t^m E_t\left(Y_t^{m,f} + Y_t^{m,d}\right) - W_t^m L_t^m - I_t - i_{t-1}K_{t-1} - (1+i^*)E_tB_{t-1} + E_tB_t$$

They have a comparable profit function to agricultural firms, where: superscript m indicates mining, P_t^m refers to the mining commodities price imposed on both consumers: foreign and domestic, it is denominated with foreign currency, I_t suggests the investment amount of mining firms in K_t ,i.e., physical capital, each period. i_t refers to the interest rate paid off by mining firms in the next period, B_t are the bonds issued by these firms, it are denominated with foreign currency, i^* is the constant interest rate gaining by foreign investors on B_t.

The Cobb-Douglas production function is expressed as:

$$Y_t^m = A_t^m(K_t)^{\propto}(L_t^m)^{1-\propto}$$

So that: Y_t^m is the mining firms total output sold on domestic and foreign markets, namely:

$$Y_t^m = Y_t^{m,f} + Y_t^{m,d}$$

The relationship between I_t and K_t can be expressed as: $I_t = K_t - (1-\delta)K_{t-1}$
So that: δ refers to the rate of depreciation.

The demand function for mining commodities is given as: $Y_t^{m,f} = Y_t^{m,f,D}(R_t, Y_t^F)$
In the mining sector, the labor's marginal product = the real rate of wage (in domestic currency), at applying the first order conditions: $(1-\propto)A_t^m(K_t/L_t^m)^{\propto} = W_t^m/\{(1-\tau)P_t^m E_t\}$

And the capital marginal product = the real interest rate + the rate of depreciation, as:

$$\propto A_t^m(L_t^m/K_t)^{1-\propto} = (i_t + \delta)/\{(1-\tau)P_t^m E_t\}$$

Households

They maximize their utility function $U\left(L_t^a, L_t^m, Y_t^{a,d}, Y_t^{m,d}, Y_t^i\right)$, undergo to the following budget constraint:

$$P_t^{a,d}Y_t^{a,d} + P_t^m E_t Y_t^{m,d} + P_t^i E_t Y_t^i + I_t \leq W_t^a L_t^a + W_t^m L_t^m + i_{t-1}K_{t-1} + G_t$$

Where: $U_{L_t^a} < 0$, $U_{L_t^m} < 0$, $U_{Y_t^{a,d}} > 0$, $U_{Y_t^{m,d}} > 0$, and $U_{Y_t^i} > 0$. Y_t^i indicates the imported consumer commodity amount, P_t^i denotes the import price in foreign currency, and G_t refers to government transfers to households as lump-sum. The following equations are resulted by employing the first order conditions of the household's problem as:

$$U_{L_t^a}/U_{Y_t^{a,d}} = -W_t^a/P_t^{a,d}\ ;\ U_{L_t^m}/U_{Y_t^{m,d}} = -W_t^m/(P_t^m E_t)\ ;\ U_{Y_t^{a,d}}/U_{Y_t^i} = P_t^{a,d}/\left(P_t^i E_t\right);$$

$$U_{Y_t^{m,d}}/U_{Y_t^i} = P_t^m/P_t^i\ \ ;\ \ \beta U_{Y_{t+1}^{a,d}}(1 + i_t - \delta)P_t^{a,d}/\left(U_{Y_t^{a,d}}P_{t+1}^{a,d}\right) = 1$$

So that: β indicates the discount factor.

Government

The budget constraint and foreign reserves constraint $(F_t \geq 0)$ are fulfilled by the government. The government budget constraint is given as:

$$\tau\left(P_{t-1}^{a,f}E_{t-1}Y_{t-1}^{a,f} + P_{t-1}^m E_{t-1}Y_{t-1}^m\right) + (1-\alpha^a)\Pi_{t-1}^a + (1-\alpha^m)\Pi_{t-1}^m = G_t$$

Where: α^a and α^m refer to the portion of dividends of agricultural firms and mining firms paid to foreign investors, respectively. Similarly, $(1-\alpha^a)$ and $(1-\alpha^m)$ indicate the portion of dividends of agricultural firms and mining firms paid to the government, respectively. As the firms taxes draw on profits realized in the previous year, the payments of dividends and taxes are subject to one lag period. Hence the government revenue is influenced by shocks in commodity price in the second period.

Money market

When the forward market is backward, Nakatani has assumed the following uncovered interest parity condition: $1 + i_1 = (1 + i^*)E_2^e/E_1$ (1)

So that: E_2^e refers to the anticipated nominal exchange rate in the second period. If a black market exists amid a fixed rate regime with foreign exchange rationing, then the former will exhibit a higher premium than the latter. The black market exchange rate is called a shadow exchange rate, thus equation (1) will be: $1 + i_1 = (1 + i^*)E_2^e/\tilde{E}_1$

So that: $\tilde{E}_t$ denotes a shadow exchange rate. If E_2^e is unchanged, while i_1 is dropped, then E_1 has to increase,i.e., depreciation of domestic currency.

Balance of payments identity

Its identity with domestic currency takes the following expression as:

$$P_t^{a,f}E_tY_t^{a,f} + P_t^mE_tY_t^{m,f} - P_t^iE_tY_t^i = \alpha^a\Pi_t^a + \alpha^m\Pi_t^m + (1 + i^*)E_tB_{t-1} - E_tB_t + \Delta F_tE_t$$

So that: $\Delta F_t = F_t - F_{t-1}$. In foreign currency, the above BOP identity can be rewritten as:

$$P_t^{a,f}Y_t^{a,f} + P_t^mY_t^{m,f} - P_t^iY_t^i = (\alpha^a\Pi_t^a + \alpha^m\Pi_t^m)/E_t + (1 + i^*)B_{t-1} - B_t + \Delta F_t \qquad (2)$$

Shocks in commodity price

When a shock occurs in period 1, this implies that $P_1^{a,f,s} < P_1^{a,f}$ and $P_1^{m,s} < P_1^m$, such that superscript s indicates a variable after a shock, equation (2) will be:

$$P_1^{a,f,s}Y_1^{a,f} + P_1^{m,s}Y_1^{m,f} - P_1^iY_1^i = (\alpha^a\Pi_1^{a,s} + \alpha^m\Pi_1^{m,s})/E_1 + (1 + i^*)B_{t-1} - B_t + \Delta F_1^s \qquad (3)$$

As a consequence, foreign reserves would be declined as shown by subtracting (3) from (2) :

$$F_1 - F_1^s = \Delta P_1^{a,f}Y_1^{a,f} + \Delta P_1^mY_1^{m,f} - (1 - \tau)\left(\alpha^a\Delta P_1^{a,f}Y_1^{a,f} + \alpha^m\Delta P_1^mY_1^m\right)/E_1$$

Such that: $\Delta P_1^{a,f} \equiv P_1^{a,f} - P_1^{a,f,s}$ and $\Delta P_1^m \equiv P_1^m - P_1^{m,s}$

Intervention policy in foreign exchange

To deal with those shocks and to get an equilibrium situation in the first period, the government experiences four options of exchange rate and foreign exchange intervention policy. The best policy is based on the trade-off between the benefits and costs of flexible and fixed exchange rate regimes, as described below:

No intervention with fixed exchange rate: severe foreign exchange rationing

In this situation with no change of the interest rate by the central bank, the volume of import would be declined by: $Y_1^i - Y_1^{i,s} = (F_1 - F_1^s)/P_1^i$. Thus the equilibrium condition (2) is replaced by (3).

Partial intervention with fixed exchange rate: modest foreign exchange rationing

In this case, the volume of import would be dropped by: $Y_1^i - Y_1^{i,*} = [(F_1 - F_1^s) - \Delta F_1^*]/P_1^i$

Such that: $Y_1^i - Y_1^{i,*} < Y_1^i - Y_1^{i,s}$, ΔF_1^* refers to the amount of foreign reserve sold by the central bank in the foreign exchange market. In addition, the exchange rate remains without changing, hence, the equilibrium condition (2) is replaced by(4).

$$P_1^{a,f,s}Y_1^{a,f} + P_1^{m,s}Y_1^{m,f} - P_1^iY_1^{i,*} = \frac{(\alpha^a\Pi_1^{a,s} + \alpha^m\Pi_1^{m,s})}{E_1} + (1 + i^*)B_{t-1} - B_t + \Delta F_1^s + \Delta F_1^* \qquad (4)$$

Total intervention with fixed exchange rate: no foreign exchange rationing

In the equilibrium of the first period, the BOP identity will be:

$$P_1^{a,f,s}Y_1^{a,f} + P_1^{m,s}Y_1^{m,f} - P_1^iY_1^i = \frac{(\alpha^a\Pi_1^{a,s} + \alpha^m\Pi_1^{m,s})}{E_1} + (1+i^*)B_{t-1} - B_t + \Delta F_1^s + \Delta F_1^{full}$$

Where: ΔF_1^{full} denotes the amount of foreign reserve that has to be sold by the central bank in the foreign exchange market to keep the same import level as prior to the shock, its expression is set as: $\Delta F_1^{full} = F_1 - F_1^s$

Thus: the previous foreign reserves constraint $(F_t \geq 0)$, will become:

$$F_1 - \left[\Delta P_1^{a,f}Y_1^{a,f} + \Delta P_1^mY_1^{m,f} - (1-\tau)\left(\alpha^a\Delta P_1^{a,f}Y_1^{a,f} + \alpha^m\Delta P_1^mY_1^{m,f}\right)\right]/E_1 \geq 0.$$

Monetary autonomy with flexible exchange rate

Based on the derivative of the BOP identity (2) with respect to E_t, the impacts of a flexible exchange rate policy can be analyzed:

$$P_t^{a,f}\frac{\partial Y_t^{a,f}}{\partial E_t} + P_t^{m,f}\frac{\partial Y_t^{m,f}}{\partial E_t} - P_t^i\frac{\partial Y_t^i}{\partial E_t} = \frac{\frac{\partial(\alpha^a\Pi_t^a + \alpha^m\Pi_t^m)}{\partial E_t}E_t - (\alpha^a\Pi_t^a + \alpha^m\Pi_t^m)}{E_t^2} + \frac{\partial\Delta F_t}{\partial E_t} \qquad (5)$$

With respect to the exchange rate, ε^i is defined as the good i elasticity, (5) can be rewritten as:

$$P_t^{a,f}\varepsilon^a\frac{Y_t^{a,f}}{E_t} + P_t^{m,f}\varepsilon^m\frac{Y_t^{m,f}}{E_t} - P_t^i\varepsilon^i\frac{Y_t^i}{E_t} = \frac{\left[\alpha^a\left(\frac{\partial\Pi_t^a}{\partial E_t}E_t - \Pi_t^a\right) + \alpha^m\left(\frac{\partial\Pi_t^m}{\partial E_t}E_t - \Pi_t^m\right)\right]}{E_t^2} + \varepsilon^{\Delta F}\frac{\Delta F_t}{E_t} \quad (6)$$

By multiplying both sides of equation (6) by E_t, yields:

$$Y_t^{a,f}P_t^{a,f}\varepsilon^a + Y_t^{m,f}P_t^{m,f}\varepsilon^m - Y_t^iP_t^i\varepsilon^i = \varphi_t + \varepsilon^{\Delta F}\Delta F_t \qquad (7)$$

So that : φ_t refers rise in dividend payments to foreign investors induced by higher profits owing to: a decrease of costs caused by domestic currency components valuation impacts (such as local wages), in the foreign firms balance sheets that are denominated in foreign currency, and rising of export volumes (equation (7)).

$$\varphi_t = \alpha^a\left[(1-\tau)\varepsilon^aP_t^{a,f}Y_t^{a,f} - \frac{P_t^{a,d}Y_t^{a,d} - W_t^aL_t^a}{E_t}\right] +$$

$$+\ \alpha^m\left[(1-\tau)\varepsilon^mP_t^{m,f}Y_t^{m,f} - \frac{-W_t^mL_t^m - (1+i_{t-1}^B)B_{t-1} + B_t + (1-\delta)K_{t-1} - K_t}{E_t}\right]$$

Thus, from equation (7) domestic currency depreciation can be a useful policy to alleviate the BOP problem, if trade is elastic with respect to exchange rates (Nakatani, 2018; Nakatani, 2017a).

2.3 External and internal imbalances, relative prices and the pace of economic growth:

2.3.1 Harrod's foreign trade multiplier:

Based on unrealistic assumptions which are: (i) the real terms of trade are unchanged (constant); (ii) $Y = C + X$ (i.e., $I, S,$ and $G = 0$); and (iii) $Y = C + M$, Harrod formulated his multiplier. These assumptions imply that trade is balanced (i.e., $X = M$), such that, Y adjusts to maintain equilibrium.

Turning now to the function of import which is expressed as follows:

$$M = \bar{M} + m\,Y$$

Where: Y, X, I, S, M, $\bar{\text{M}}$, m, G refer to income, exports, investment, saving, imports, autonomous imports, marginal propensity to import, and government activity, respectively. C noted in the second assumption indicates the production of consumption goods, while C noted in the third assumption indicates consumptions goods.

Substituting M by X in the import function, we get: $Y = (X - \bar{M})/m$

Subsequently,

$$\partial Y/\partial(X - \bar{M}) = 1/m$$

Where: $1/m$ indicates Harrod's foreign trade multiplier (Thirlwall, 2011;Thirlwall & Hussain, 1982). If $\bar{M} = 0$, then : $Y = (1/m)\,X$. This expression expresses the static Harrod foreign trade multiplier (Trigg & Araujo, 2018).

2.3.2 Thirlwall's law:

Thirlwall's framework is deemed one of the most salient contributions of the post-Keynesian school, as well it is also known as the balance of payments constrained model (BPCM) (Spinola, 2020). Thirlwall's law is known as the dynamic Harrod foreign trade multiplier, in which the pace of growth is demand-led instead of supply-constrained (Trigg & Araujo, 2018). Drawing on the Harrod foreign trade multiplier, Thirlwall argues that the income growth rate of an economy in the long-run is set by the world income growth rate, and by its import and export income elasticities (Kvedaras et al., 2020). In other words, Thirlwall states that the economic growth pace in the long-run can be estimated as the ratio of the exports growth rate over the income elasticity of demand for imports (Marwil J. Dávila-Fernández, 2019). Based on the payments balance accounting identity, Thirlwall derived its law as:

$$P_d\,X + F \equiv E\,P_f\,M$$

Where: E, P_f , and P_d indicate the exchange rate, the imports price measured in the foreign currency, and the exports price measured in the domestic currency. F denotes the flows of capital measured in the domestic currency with the nominal value. If $F > 0$, refers to capital inflows, and vice versa. X and M represent the volume of both exports and imports, respectively.

The exports demand function is expressed as:

$$X = k_1 Z^{\varepsilon}\left(P_d/E\,P_f\right)^{\eta}, \qquad (\eta < 0)$$

The imports demand function is governed as:

$$M = k_2 Y^{P\pi} \left(E\ P_f\ /P_d\right)^{\Psi}, \qquad (\Psi < 0)$$

Where: Z denotes world income, Y refers to domestic income, π and ε point out the income elasticities of demand for imports and exports, respectively. Ψ and η represent the appropriate price elasticities, k_1 and k_2 denote constants.

After some algebraic manipulation, we get:

$$y = \frac{\varphi\varepsilon z + (1-\varphi)(f - P_d) - (1 + \varphi\eta + \Psi)\left(e + P_f\ - P_d\right)}{\pi} \qquad (*)$$

Where:

$$\varphi = P_d\ X/(P_d\ X + F)$$

The numerator of equation $(*)$ comprises three components: (i) the impact of the world income growth on the growth rate of the country under consideration (i,e., $\varphi\varepsilon z$), (ii) the impact of the real capital flows growth, and (iii) the combined impact of the price elasticities and the terms of trade's change rate.

Assuming that $\varphi = 1$, the capital flows growth is equal to zero, and the terms of trade are constant (i.e., no changes), then equation $(*)$ can be rewritten as:

$$y = \frac{x}{\pi}\ \ or\ \ y = \frac{\varepsilon z}{\pi}$$

Where: z is the world growth rate, y denotes the country's growth rate, x refers country's export growth rate, and π suggests the income elasticity of demand for imports (McCombie, 1993).

In spite of Thirlwall's law being extended to encompass foreign debt and capital flows, however, the role of public imbalances in affecting economic growth has been neglected. Motivated by public debt crises that have hit some European countries such as Italy, Soukiazis et al. (2014) have developed a growth model which relies on external imbalances (estimated through deficits of the current account), internal imbalances (estimated through public debt and budget deficits), as well as the relative price. This model comprises the following equations:

The function of import demand:

Other than conventional frameworks that deem real total domestic income as the prominent determinant of import demand, this function employs the domestic income components to analyze import trends. It is expressed as:

$$\dot{m} = \pi_c \dot{c} + \pi_g \dot{g} + \pi_x \dot{x} + \pi_k \iota n\dot{v} + \delta_m(\dot{p}^* + \dot{e} - \dot{p})$$

Where: superscript $(\cdot)$ refers to the growth rate of each component except $(\dot{e})$. m, c, g, x, inv, p^*, and p indicate imports, private consumption, government expenditures, exports, investment, foreign prices and domestic prices, respectively. $\dot{e}$ refers to the exchange rate variation over time, π_c, π_g, π_x, π_k are the elasticity of imports with respect to private consumption, government expenditures, exports, and investment, respectively. It is expected that all these elasticities will have a positive sign, whereas the relative price elasticity of demand for imports will have a negative sign (i.e., $\delta_m < 0$).

The function of export demand:

It is governed as: $\dot{x} = \varepsilon_x \dot{y}^* + \delta_x(\dot{p}^* + \dot{e} - \dot{p})$

Where: y^* refers to real foreign income. It is assumed that the competitiveness of exports (is drawn on non-price competitiveness such as reliability, quality, variety, design, etc (captured by the income elasticity of demand for exports (ε_x)), and price competitiveness (captured by the relative price elasticity of export demand (δ_x)). It is expected that both signs of ε_x and δ_x will be positive.

Investment function:

It is given as:

$$\dot{\imath nv} = \varepsilon_K \dot{y} + \varepsilon_r \dot{r}$$

Where: y refers to the domestic income, $\dot{r}$ is the change in real interest rate, ε_K and ε_r denote the accelerator effect, and the effect of the real cost with financing gross investment. Is is assumed that $\varepsilon_K > 0$, and $\varepsilon_r < 0$.

Private consumption function:

It is given as follows:

$$\dot{c} = \varepsilon_c \dot{y}_{\mathrm{d}}$$

Where: y_d points out disposable income, and ε_c refers to consumption income elasticity. It is assumed that $\varepsilon_c > 0$.

The government sector function:

The government budget is given (in nominal terms) as:

$$G_n + iB_H + i^*B_F e = tYP + D$$

Where: G_n indicates the government expenditures in nominal terms, B_H and B_F are public debt owned by both home and foreign bond holders, respectively. $i,\ i^*, e,\ t,\ Y, D$ are the nominal interest rate paid to home public debt holders, the nominal interest rate paid to foreign public debt holders, the nominal exchange rate, the tax rate on nominal income, domestic income in real terms, and the public deficit, respectively.

It seems vividly that if $G_n + iB_H + i^*B_F e - tYP > 0$, it implies the existence of a public deficit.

In line with the government sector function, the behavior of $\dot{g}$ in the long-run is given as:

$$\dot{g} = \frac{t\dot{y}}{w_G} + \left(\dot{d} - \dot{p}\right)\frac{w_D}{w_G} - \left[\Delta i + i\left(\dot{b}_H - \dot{p}\right)\right]\frac{w_{BH}}{w_G} - \left[\left(e\Delta i^* + i^*\Delta e\right) + i^* e\left(\dot{b}_F - \dot{p}\right)\right]\frac{w_{BF}}{w_G}$$

Where: w_D suggests the ratio of the budget deficit, w_G points out the ratio of the government expenditure, P refers level of the domestic price, w_{BF} and w_{BH} represent the proportions of public debt owned by foreign and home bond holders as a portion of nominal income.

$w_D = D/YP$; $w_G = G/Y$; $w_{BH} = B_H/PY$; $w_{BF} = B_F/PY$

The condition of the external equilibrium:

The balance of payments condition is expressed as follows:

$$XP + D_{F^e} - i^*B_{F^e} = MP^*e$$

The left-hand side of the equation exhibits three components that form the money resources allocated to finance imports which are: (i) the revenues of export, (ii) the magnitude of public

deficit financed by foreigners, and (iii) the payments of interest rates to foreign bond holders. So, the above balance of payments condition can be rewritten as:

$$\dot{x} + \dot{p} + (1-\xi)\frac{w_D}{w_X}(\dot{p} + \dot{y} - i^*) - (1-\xi)\frac{w_B}{w_X}\Delta i^* = \frac{w_M}{w_X}\frac{P^*e}{P}(\dot{m} + \dot{p}^* + \dot{e})$$

Where: w_M, w_B, w_X, and w_D refer respectively the ratios of imports, public debt, exports and budget deficits on income. $(1-\xi)$ indicates the portion of public debt (or deficit) financed by external markets.

Domestic income growth:

It is expressed as follows: $\dot{y} = A/B$, in which:

$$A=\begin{bmatrix} \left(\varepsilon_x - \frac{w_M}{w_X}\left(\frac{P^*e}{P}\right)\pi_x\varepsilon_x\right)\dot{y}^* + \left(\delta_x\left(1 - \frac{P^*e}{P}\frac{w_M}{w_X}\pi_x\right) - \delta_m\frac{w_M}{w_X}\left(\frac{P^*e}{P}\right)\right)(\dot{p}^* + \dot{e} - \dot{p}) + \\ + \left(\dot{p} - \frac{P^*e}{P}\frac{w_M}{w_X}(\dot{p}^* + \dot{e})\right) + (1-\xi)\frac{w_D}{w_X}(\dot{p} - i^*) - (1-\xi)\frac{w_B}{w_X}\Delta i^* - \\ -\left(\frac{P^*e}{P}\right)\frac{w_M}{w_X}\left\{\frac{(\Delta i - \Delta\dot{p})\xi w_B}{(1-t)+r\xi w_B}(\pi_c\varepsilon_c) + \pi_k\varepsilon_r(\Delta i - \Delta\dot{p}) + \pi_g\left[-\Delta i\frac{\xi w_B}{w_G} - \Delta i^* e(1-\xi)\frac{w_B}{w_G}\right]\right\} \end{bmatrix}$$

$$B = \frac{w_M}{w_X}\left(\frac{P^*e}{P}\right)\left[\pi_c\varepsilon_c + \pi_k\varepsilon_k + \pi_g\left(\frac{t}{w_G} + \frac{w_D}{w_G} - \frac{i\xi w_B}{w_G} - i^*e(1-\xi)\frac{w_B}{w_G}\right)\right] - (1-\xi)\frac{w_D}{w_X}$$

Thus, $\dot{y}$ is set by external and internal imbalances, besides relative prices (Soukiazis et al., (2013-2014); Soukiazis et al., 2014).

2.3.3 The twin deficits hypothesis versus twin divergence hypothesis:

2.3.3.1 The relationship between the current account balance and the budget balance:

Based on national income accounting identity, GNI can be expressed as:

$$GNI = C + I + G + NX + NFI$$

Where: GNI, C, I, G, NX and NFI indicate gross national income, consumption, investment, government spending, net exports, and net factor income from abroad, respectively.

As the current account balance is the sum of NX and NFI, so CA can be written as:

$$CA = GNI - C - I - G = S - I$$

Since domestic savings are the sum of private savings (S^p) and public savings(S^g), CA can be rewritten as follows:

$$CA = S^p + S^g - I$$

Further detail, CA can be rewritten as:

$$CA = BD + S^p - I \qquad (*)$$

Where: BD denotes the budget balance which is the difference between tax revenues (T) and government spending (Rajakaruna & Suardi, 2021).

Commonly, economic theory states that the relationship between current account deficits and fiscal balance deficits can be investigated through three different inconsistent approaches, which are: the twin deficits hypothesis, twin divergence hypothesis, and Ricardian equivalence hypothesis (Lahiani et al., 2022).

2.3.3.2 The twin deficits hypothesis:

The majority of economists argue that serious economic problems (e.g., current account balance worsening, low growth and inflation) can result from uncontrolled substantial budget deficits (Dissou & Nafie, 2021). The twin deficits hypothesis believes that fiscal deficit is a staple cause of current account deficit (Akalpler & Panshak, 2019). Equation $(*)$ outlines that, the current account is directly linked to the budget balance.

If $S^p \approx I$ (i.e., domestic investment is wholly financed by private savings), then, any increase in the budget deficit (i.e., $G > T$), will positively influence the current account, meaning twin deficits (i.e., BD and CA move together) (Lahiani et al., 2022). There are two approaches within which budget balance deficits trigger current account deficits, which are: the Mundell-Fleming framework and the Keynesian absorption theory (Bilman & Karaoğlanb, 2020).

2.3.3.2.1 The Mundell-Fleming framework:

Under flexible exchange rates and perfect mobility of the capital, wide budget deficits will trigger an increase in interest rates, which contributes to attracting foreign capital inflows, hence, the demand for domestic currency would increase, which yields an appreciation of that currency, a decrease in exports versus increase in imports, thus current account deficits. In addition, within a fixed exchange rate regime, trade balance deficits will create higher real income, thus worsening the trade balance (Bilman & Karaoğlanb, 2020; Helmy, 2018).

2.3.3.2.2 The Keynesian absorption theory:

It stipulates that a rise in the budget deficit would spur domestic absorption, hence an increase in imports, ultimately, deterioration of the trade balance (Bilman & Karaoğlanb, 2020).

2.3.3.3 The twin divergence hypothesis:

On the contrary, this hypothesis believes the existence of a negative relationship between current account deficits and fiscal deficits, that is, a drop in the budget deficit triggers a surge in the current account deficit (Mallick et al., 2021; Lahiani et al., 2022).

2.3.3.4 The Ricardian equivalence hypothesis:

It lies between the twin deficits hypothesis and the twin divergence hypothesis, where a surge in budget deficit has no impact on the trade deficit (Lahiani et al., 2022). According to Ricardo's equivalence theory, deficits in the government budget should not change the aggregate demand level and economic growth or capital formation, meaning that an increase in budget deficit would entirely compensate by increasing private saving, thus the aggregate demand is not influenced (Magazzino, 2021).

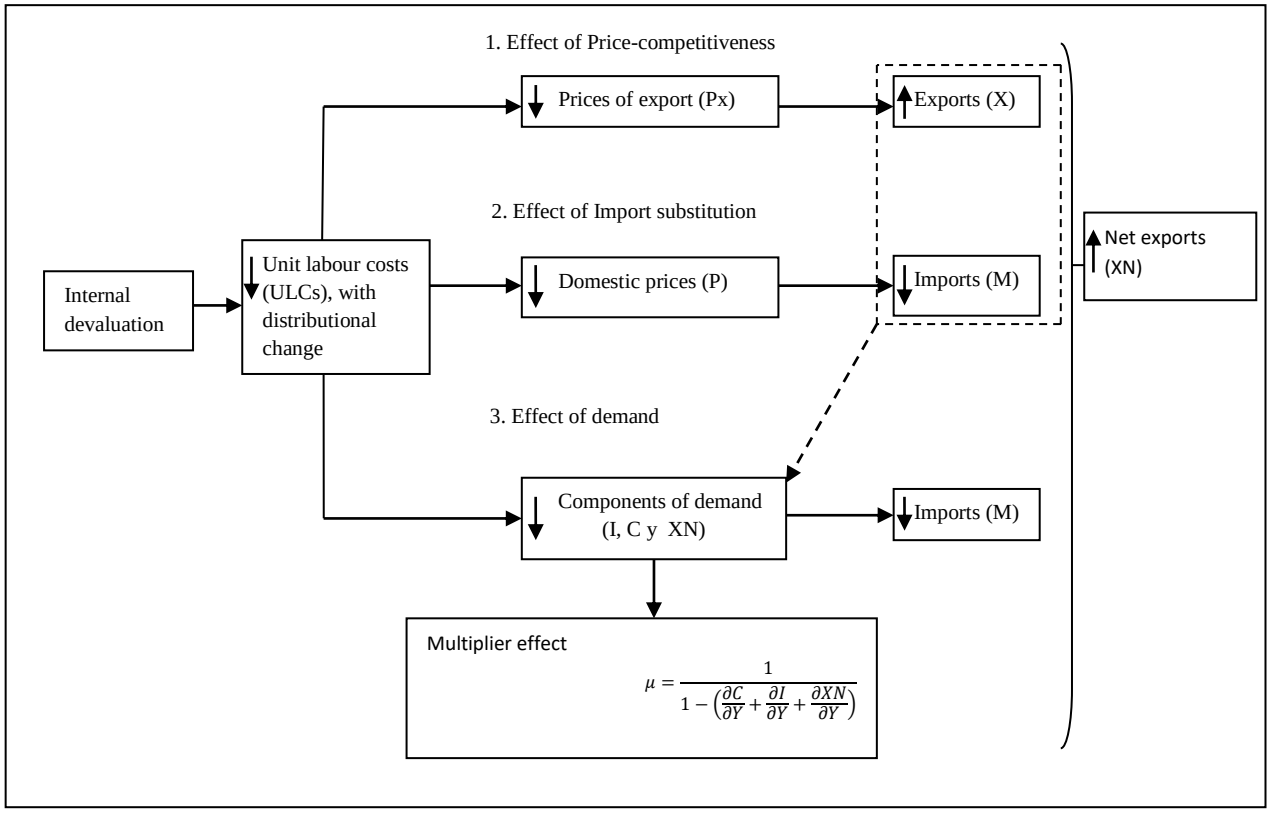
2.3.4 The impact of internal devaluation in addressing external imbalance:

Villanueva et al.,(2020) argue that the steady increase of external imbalances (i.e., growing external liabilities) in Portugal, Spain, Greece, Ireland and to a lesser degree, Italy, is the main cause of the Eurozone debt crisis in 2009. They observed a simultaneous of these external deficits with the loss of competitiveness as a result of steady wages increase (measured by unit labor costs (ULC)). In 2007, external deficits as a ratio of current account balance to GDP were estimated at -4.8% and -1.9% in Greece and Spain respectively. Correspondingly those countries registered 125.6 and 129.6 nominal ULC, respectively, whilst the average nominal ULC of the Euro area reached 113.6.

To tackle those deficits, the European Commission in collaboration with the European Central Bank has demanded those countries undertake an internal devaluation strategy based on

reducing wages, beginning in 2010. The potential mechanisms by which an effective internal devaluation policy can address external deficits are summarized in figure 2.1.

Figure 2.1. The potential channels of internal devaluation strategy in addressing external imbalance



Source: Villanueva et al., 2020

The marginal effect of ULC change on net exports is given as follows:

$$\frac{\Delta XN/Y}{\Delta ULC} = \frac{\Delta X/Y}{\Delta ULC} - \frac{\Delta M/Y}{\Delta ULC}$$

where: XN, X, M and Y are a country's net exports, exports, imports and GDP, respectively. This effect could occur through three potential channels as mentioned in figure 2.1.

Effect of the price competitiveness on exports:
This channel requires at least partial translation of ULC containment from domestic prices into a decline in exports prices, which in turn triggers the price competitiveness of that country in comparison to its competitors. Its formula can be expressed as:

$$\left[\frac{\Delta X/Y}{\Delta ULC}\right]_{Xcomp} = \varepsilon_{ULC}^{X} * \frac{X}{Y} * \frac{1}{ULC} = (\varepsilon_{ULC}^{PX} * \varepsilon_{PX}^{X}) * \frac{X}{Y} * \frac{1}{ULC}$$

Where: ε_{ULC}^{X} denotes the elasticity of exports with respect to ULC, ε_{ULC}^{PX} indicates the elasticity of exports prices with respect to ULC, and ε_{PX}^{X} refers to the elasticity of exports with respect to exports prices.

Effect of import substitution:

This channel requires that ULC drop must be transferred to domestic prices, which in turn prompt the import substitution process by improving domestic production. Its expression can be written as follows:

$$\left[\frac{\Delta M/Y}{\Delta ULC}\right]_{Msust} = \varepsilon_{ULC}^{M} * \frac{M}{Y} * \frac{1}{ULC} = (\varepsilon_{ULC}^{P} * \varepsilon_{P}^{M}) * \frac{M}{Y} * \frac{1}{ULC}$$

Where: ε_{ULC}^{M} points out the elasticity of imports with respect to ULC, ε_{ULC}^{P} represents the elasticity of domestic prices with respect to ULC, and ε_{P}^{M} is the elasticity of imports with respect to domestic prices.

Effect of demand on imports:

It takes place if a decline in ULC is accompanied by a change in the functional distribution of income, in other words, it occurs when a reduction in ULC leads to an upsurge in profit margins, hence reducing the share of wages (Ω), rather than translate wholly into lower prices. Hence diminishing the share of wages. Its formula can be governed as:

$\left[\frac{\Delta M/Y}{\Delta ULC}\right]_{Mdem} = \left(\varepsilon_{ULC}^{\Omega} * \varepsilon_{\Omega}^{Y} * \varepsilon_{Y}^{M}\right) * \frac{M}{Y} * \frac{1}{ULC}$; Or $\left[\frac{\Delta M/Y}{\Delta ULC}\right]_{Mdem} = \left[\frac{\Delta Y/Y}{\Delta ULC}\right]_{\mu} * \frac{M}{Y} * \varepsilon_{Y}^{M}$

Where: μ refers to the multiplier, which takes into consideration the change in income.

$$\mu = \frac{1}{1 - \left(\frac{\partial C}{\partial Y} + \frac{\partial I}{\partial Y} + \frac{\partial XN}{\partial Y}\right)}$$

It should be recalled that the functional distribution of income indicates the national income distribution between profits and wages, and in addition, the functional distribution pattern helps analyze the development of personnel distribution of income.

Commonly, there are two sorts of income: labor incomes which are broadly concentrated in low- and medium–income households, and capital incomes which are generally concentrated in top-income households (Molero-Simarro, 2017).

Chapter 3. 21st century regionalism versus 20th century regionalism: the requirements and purposes

3. 21st century regionalism versus 20th century regionalism: the requirements and purposes

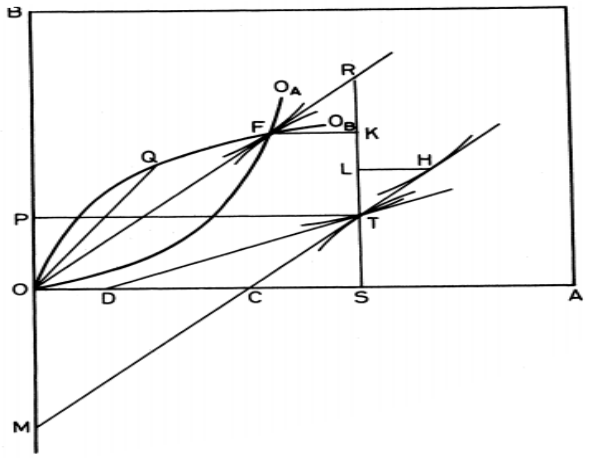
3.1 A general equilibrium analysis of the impact of tariffs on the payments balance:

With respect to the implications of foreign trade liberalization on the balance of payments or balance of trade, they are unclear, whatever balance of payments adjustment theory framework is applied. However, these effects are based on the relative impact of liberalization on both growth rates of export and import, and on traded goods prices (Santos-Paulino & Thirlwall, 2004). It is agreed that the common impacts of trade liberalization on the developing countries' balance of trade are import growth more than export increase (Pacheco-López, 2005). As noted by the standard partial equilibrium trade theory, foreign trade liberalization can play a crucial role in spreading knowledge and transfer of the technology among countries, and thus inducing exports (Khan & Ahmed, 2012).

3.1.1 The case of variable trade balance and constant exchange rates:

Ozga (1957) attempted through a general equilibrium analysis to investigate the effect of tariffs on the payments balance using a simple geometrical model, to this end, he assumed that any potential changes in the terms of trade were neglected (i.e., constant exchange rate and variable trade balance). He suggests that tariffs are an efficient way to improve the payments balance other than exchange rate depreciation and deflation of incomes and money prices. He has stated that unbalanced trade can occur in two cases :(i) the existence of capital movements, and (ii) inequality between total income resulting from production and a country's domestic expenditure (total expenditure on imported goods and home-produced goods). Furthermore, he argues that the payments balance is identified as the trade balance, since any gap resulting from overtaking of exports over imports or vice versa, would be automatically filled via changes in the reserves of the foreign currency, so that all other capital movements are overlooked. As a result of the second case of unbalanced trade, he proposes that a government can weather both inflationary and deflationary pressures by supplementing consumers' income, whether via allowances or taxes. To manage the budget deficit or the budget surplus in the two cases, he assumed that this government intervention was enough to keep an economy in a state of full employment. In addition, he assumed that any direct expenditure on goods and services by the government isn't permitted.

Figure 3.1. The effect of tariffs on the balance of payments using a simple geometrical model



Source: Ozga, 1957

As depicted in figure 3.1 there are two countries A and B, each country produces only one commodity referred to as OA and OB, respectively. Free-trade situation is set by the intersection of the two offer curves OA and OB, that is, at the point F. OF represents the price line which is tangential to indifference curves of A and B. He supposes that country A has imposed tariffs on imports, in which the adjustment occurs merely through changes in the terms of trade, and the trade balance remaining constant, hence, the new equilibrium situation has to be at some point Q on the offer curve of country B, and the new terms of trade are referred by the slope of the line OQ. In the reverse case, the new equilibrium situation will be at some point T which meets the following conditions: (i) OF is parallel to the line TM, (ii) since country B doesn't impose tariffs, the line TM refers also the ratio of internal price applied in that country, (iii) it has to be tangential at T to one of indifference curves of country B, and (iv) the previous rate of tariff imposed by country A represents also the difference between the ratio of internal price applied in country A and that in country B. He presumes that the ratio is a DT-line slope, so, the tariff rate is referred to as (DC/CS), hence, the line DT has to be tangential at the point T to one of the indifference curves of country A. Consequently, he assumes the following situation. Country B produces OB, total expenditure of country B on B's good is BM, the consumers in country B move along MT up to T, their expenditure is divided into imported goods from country A referred to as PM (PT of A's goods), and home-produced goods referred to as BP. The exports of country B of good B are only the line OP, hence, country B would record deficits in its trade balance referred to as OM.

Country A produces OA, total expenditure of country A on A's good is DA, the consumers in country A move along DT up to T, their expenditure is divided into imported goods from country B referred to as DS, and home-produced goods referred to as SA. However, only CS is indicated as the effective payments for imports (for TS of B's goods), whereas, DC represents the payments to the governments as tariffs. Since the exports of country A are set by OS, it would register a surplus in its trade balance in terms of A's goods denoted as OC.

In terms of B's goods, a surplus recorded in country A's trade balance equals the deficit registered in country B (i.e., OM).

To diagnose the impact of tariff rate on the trade balance, Ozga (1957) completed his diagram as:(i) extending CT up to H, which is tangential to one of the indifference curves of country A, (ii) drawing horizontal lines via the points H and F, and vertical line via the point T, and (iii) determining the points of intersection L, K . and R

As mentioned above, the tariff rate can be set as:

$$\mathrm{t} = \frac{\mathrm{DC}}{\mathrm{CS}}$$

OC as a share of the value of actual imports (CS) is expressed as follows*:*

$$\mathrm{b} = \frac{\mathrm{OC}}{\mathrm{CS}}$$

The marginal propensity to import in country A (π_A) refers to the proportion of the change in the expenditure on imports in response to the change in the total expenditure, in which prices remain constant. The points H and F are deemed the key determinants to set π_A, they indicate positions of equilibrium of country A corresponding to the price lines CH and OR. Since those lines are parallel one to another, they suggest the same prices. Nevertheless, the total

expenditure at the point H is lesser than at F. In terms of goods of country B, the difference is RT = OM. The difference in the demand of country A for imports is KL, that is, KS-LS. Hence, π_A is expressed as:

$$\pi_A = \frac{KL}{RT}$$

In analogous way, the marginal propensity to import in country B (π_B) is governed as:

$$\pi_B = \frac{RK}{RT}$$

Where: T and F are considered as two substitute situations of equilibrium of country B.

Expenditure-compensated elasticity of demand for imports in country A (ε_A) can be defined as the ratio of the proportional change in the quantity demanded denoted to as (LT/TS) to the proportional change in the price of imports. Hence ε_A can be written as:

$$\varepsilon_A = [(LT/TS)/(DC/CS)]$$

By Substituting t (i.e., (DC/CS)) into ε_A and rearranging, he has gotten the following formula:

$$\frac{LT}{TS} = t \cdot \varepsilon_A$$

Yet

$$\frac{LT}{TS} = \frac{RT}{TS} \cdot \frac{LT}{RT} = \frac{OC}{CS} \cdot \left(\frac{RT - RK - KL}{RT}\right) = b \cdot (1 - \pi_A - \pi_B)$$

Consequently

$$b = t \cdot \frac{\varepsilon_A}{1 - (\pi_A + \pi_B)}$$

According to Johnson (1958), the last expression of Ozga (1957), implies that tariffs may trigger deficits in the payments balance rather than a surplus. Further detailed, Ozga (1957) has concluded through its last equation to three salient results:

(i) If $(\pi_A + \pi_B < 1)$, then the imposition of tariffs would trigger a surplus in the trade balance. The greater the sum$(\pi_A + \pi_B)$ the more sizable their effects (ii) if $(\pi_A + \pi_B > 1)$, the imposition of tariffs would trigger an adverse result (a negative impact on the trade balance), and (iii) the greater the ability of substitution for import goods with home produced goods, the more significant impact of tariffs on the trade balance for the country imposing those tariffs.

3.1.2 The case of constant trade balance and variable exchange rates and vice versa:

to determine the impact of tariffs on both the payments balance and the terms of trade, Ozga (1956) began his analysis from a specific equilibrium situation, then he pursued the trajectory of its displacement depending on a general equilibrium analysis, in which tariffs are the sole independent variable, implying that the standard conditions of equilibrium such as techniques, tastes and available productive resources remaining constant. He presumes the following assumptions:(i) there are two countries denoted to as I and II (country II may be considered as a proxy of the rest of the world), in which country I applies changes in tariffs, (ii) perfect competition in both countries, (iii) transport costs are equal to zero, (iv) there are two goods Y and X (or two groups of goods), where changes in the price ratios within neither of them

being overlooked, (v) home produced goods don't come under to indirect taxes, and (vi) internal balance for both countries.

Given the sixth assumption, a country may be depicted as being in internal balance, if there are no deflationary or inflationary trends in prices and incomes, in addition, no unemployment of productive resources (i.e., success of both countries in keeping full employment of their productive resources). According to Ozga (1956), this success implies a specific monetary policy that leads to a specific level of prices. With respect to the price system, he followed the classical line, at which that system is split into a monetary sector and a real sector. To avoid any inflationary trends in prices and costs which may result from tariffs revenues, besides keeping full employment, he asserted that those revenues have to not influence consumers' total expenditure, in which:

Consumers total expenditure = revenue resulting from their production activities + income allowances directed to them from the government. To achieve this condition he assumed that there is no government expenditure on goods and services, in which the role of those allowances is confined to keeping full employment.

At equilibrium, he argues that money is merely a means of exchange, it is neither consumed nor produced and the ratios of prices have to be constantly equal to marginal rates of substitution in consumption and marginal opportunity costs. He stated that the linear relationship between changes in tariffs, in the trade balance and the world market prices is expressed as:

$$\left[\frac{db}{I'}\right] = \left[\frac{dP_y}{P_y}\right] - R \cdot \left[\frac{dP_x}{P_x}\right] - \frac{A + R \cdot B}{D} \cdot \left\{\left[\frac{dP_y}{P_y}\right] - \left[\frac{dP_x}{P_x}\right]\right\} - \frac{A}{D} \cdot \left[\frac{dt'}{(1+t')}\right]$$

So that:

$$A = \left[\frac{(1-\emptyset') \cdot \epsilon' - (1-\theta')(1-\Omega') \cdot \eta'}{\theta'}\right] \cdot \left[1 - \pi'' \cdot \frac{t''}{(1+t'')}\right]$$

$$B = \left[\frac{(1-\emptyset'') \cdot \epsilon'' - (1-\theta'')(1-\Omega'') \cdot \eta''}{\theta''}\right] \cdot \left[1 - \pi' \cdot \frac{t'}{(1+t')}\right]$$

$$D = (1-\pi') \cdot (1-\pi'') - \frac{\pi' \cdot \pi''}{(1+t'')(1+t')}$$

Where: $b = (Y' - y')P_y - (X'' - x'')P_x$, P_y and P_x represent the export (world market) prices of commodities Y and X respectively, I' refers the imports value in the country I, namely $I' = (Y' - y')P_y$, t' and t'' denote the tariffs rates (ad valorem) on imports in countries I and II, $R = \left((X'' - x'')P_x/(Y' - y')P_y\right)$, $\theta' = (Y' - y')/Y'$, $\theta'' = (X'' - x'')/X''$, $\emptyset' = Y' \cdot P_y'/\left(X' \cdot P_x' + Y' \cdot P_y'\right)$, and $\emptyset'' = X'' \cdot P_x''/\left(X'' \cdot P_x'' + Y'' \cdot P_y''\right)$.

In case of the country I, the marginal propensity to consume import commodity is given as:

$$\pi' = \partial\left(Y' \cdot P_y'\right)/\partial E'$$

Where: Y' refers to the quantity consumed of commodity Y, P_y' denotes the home market price of that commodity, and E' indicates the total expenditure, in which:

$$E' = X' \cdot P_x' + Y' \cdot P_y'$$

X' suggests the quantity consumed of commodity X, P_x' points out the home market price of that commodity.

In case of the country II, the marginal propensity to consume import commodity is written as:

$$\pi'' = \partial(X'' \cdot P_x'')/\partial E''$$

Where: X'' is the quantity consumed of commodity X, P_x'' refers the home market price of that commodity, and E'' denotes the total expenditure, so that:

$$E'' = X'' \cdot P_x'' + Y'' \cdot P_y''$$

Y'' the quantity consumed of commodity Y, P_y'' suggests the home market price of that commodity.

Both formulas π' and π'' come under the requirement that prices are constant. Both π' and π'' are less than unity and positive if both goods are not inferior. Moreover, both commodities X and Y were produced in both countries, he assumed that country I imports commodity Y and exports commodity X, while country II imports commodity X and exports commodity Y. Hence:

Ω' and Ω'' are the ratios of the money values of production of import commodities to the total production's money values in countries I and II respectively, namely:

$$\Omega' = y' \cdot P_y'/(y' \cdot P_y' + x' \cdot P_x')$$

$$\Omega'' = x'' \cdot P_x''/(x'' \cdot P_x'' + y'' \cdot P_y'')$$

Where: x' and y' refer to the quantities produced of the commodities X and Y in country I. x'' and y'' are the quantities produced of those commodities in country II.

On the side of consumption, the substitution elasticities of X for Y, or of Y for X are given as:

$$\epsilon' = \frac{d\left(\frac{Y'}{X'}\right)}{d\left(\frac{P_x'}{P_y'}\right)} \cdot \frac{X' \cdot P_x'}{Y' \cdot P_y'} = \frac{d\left(\frac{X'}{Y'}\right)}{d\left(\frac{P_y'}{P_x'}\right)} \cdot \frac{Y' \cdot P_y'}{X' \cdot P_x'}$$

In an analogous way to ϵ', ϵ'' is derived. He argues that on the side of consumption, the substitution elasticities are usually positive.

On the side of production, the substitution elasticities of X for Y, or of Y for X are given as:

$$\eta' = \frac{d\left(\frac{y'}{x'}\right)}{d\left(\frac{P_x'}{P_y'}\right)} \cdot \frac{x' \cdot P_x'}{y' \cdot P_y'} = \frac{d\left(\frac{x'}{y'}\right)}{d\left(\frac{P_y'}{P_x'}\right)} \cdot \frac{y' \cdot P_y'}{x' \cdot P_x'}$$

In analogous way to η', η'' is derived. Unlike positive signs of ϵ' and ϵ'', he argues that the signs of η' and η'' are usually negative.

Ozga (1956) has summarized his results as shown in table 3.1

Table 3.1 Heterogeneous effects of tariffs on both terms of trade and the balance of trade

Row	$(\pi' + \pi'')$	$(\Omega' + \Omega'')$	$\epsilon', \epsilon'', \eta', \eta''$	The effects of tariffs on	
				The terms of trade	The trade balance
1	> 1	> 1	large	favorable	uncertain
2			small	favorable	favorable
3		< 1	Large	unfavorable	uncertain
4			Small	unfavorable	unfavorable
5	< 1	> 1	Large	favorable	uncertain
6			Small	favorable	favorable
7		< 1	Large	unfavorable	favorable
8			Small	unfavorable	unfavorable

Source: Ozga, 1956

3.2 Nexus between the degree of deep RTAs and the FDI trend:

3.2.1 Depth and Breadth of RTAs:

Remarkably, many regional trade agreements (RTAs) have overtaken conventional tariffs reduction to comprise a broad set of non-tariff policy areas. The depth of RTAs points out the level of cooperation in bilateral economic. On the contrary of shallow RTAs, Deep RTAs include a variety of provisions such as labor market regulation, investment, and environment (Jinji et al., 2022). Underpinning on WTO+ and WTO-X policy areas, they indicated that the degree of deep RTAs can be expressed through a combination of two indexes: the area-covered (AC) index, and the legal enforceability (LE) index. The former refers to what extent RTA provisions cover fifty two policy areas, it takes the value one if a policy area is covered and zero otherwise. The latter estimates the legal enforceability of each policy area, it takes three values: zero if it isn't legally enforceable, one if it is legally enforceable yet it is explicitly ruled out by a dispute settlement provision, and two if it is legally enforceable. Those policy areas are divided into two groups WTO+(WTO plus), and WTO-X(WTO extra), the former group comprises provisions which fall under the current mandate of the WTO, yet overtake commitments at the multilateral level, whereas the latter group comprises issues which fall outside the current WTO mandate. The group WTO plus comprises 14 policy areas, while the group of WTO extra comprises 38 policy areas as illustrated in table 3.2.

With an aim to distinguish between the depth and breadth of RTAs, Jinji et al. (2022) have constructed two indexes: $RTA_Depth_d_index_{ijt}$and $RTA\_Breadth\_c\_index_{ijt}$, through reclassification of those 52 policy areas into four fields for the depth, and five fields for the breadth as clarified in table 3.3. The first index is given as:

$$RTA\_Depth\_d\_index_{ijt} = \frac{\sum_{P \in \Theta^d} Max\_LE_{ijt}^{P}}{2K^d}$$

Where: d indicates the field (i.e., $d \in \{NTB, OP, tariff, BBP\}$), Θ^d represents the set of policy areas that consist of field d, $Max\_LE_{ijt}^{P}$ refers to the maximum point of the LE index of policy area P in all RTAs, when countries i and j sign a common RTA in year t, in which $Max\_LE_{ijt}^{P} \in \{0, 1, 2\}$. K^d suggests the policy areas number in field d. If all LE indexes are equal to two in field d, then $2K^d$ denotes the aggregate points of the LE index of policy areas in that field. The value of $RTA\_Depth\_d\_index_{ijt}$ ranges between zero and one.

In an analogous way, the breadth index is expressed as follows:

$$RTA\_Breadth\_c\_index_{ijt} = \frac{\sum_{P \in \Theta^c} Max\_LE_{ijt}^{P}}{2K^c}$$

Where: $c \in \{GATS, Tech, Cap, Lab, non-EP\}$

Table 3.2. WTO plus and WTO extra areas in RTAs

WTO extra Areas		WTO plus Areas
Competition policy	Human Rights	FTA Industrial Goods
Environmental Laws	Illicit Drugs	Customs Administration
Anti-Corruption	Illegal Immigration	FTA Agricultural Goods
Investment	Health	Sanitary and phytosanitary (SPS) measures
Intellectual Property Rights (IPR)	Industrial Cooperation	Export Taxes
Labor Market Regulation	Mining	State Trading Entreprises
Consumer Protection	Information Society	State Aid
Movement of Capital	Money Laundering	Anti-dumping
Agriculture	Political Dialogue	Countervailing Measures
Audio Visual	Nuclear Safety	Public Procurement
Approximation of Legislation	Public Administration	Technical barriers to trade(TBT)
Data Protection	Research and technology	General Agreement on Trade in Services (GATS)
Innovation Policies	Regional Cooperation	Trade-related investment measures (TRIMs)
Civil Protection	Social Matters	Trade-related intellectual property rights (TRIPs)
Economic Policy Dialogue	Taxation	
Cultural Cooperation	Small and medium enterprise	
Energy	Statistics	
Education and Training	Visa and Asylum	
Financial Assistance	Terrorism	

Source:(Horn et al., 2009; Jinji et al.,2022)

Table 3.3. Depth and Breadth of RTAs by field and policy area

Depth		Breadth	
Field	Policy area	Field	Policy area
(a) Import tariffs (tariff)	FTA Agricultural Goods FTA Industrial Goods	(a) Services	GATS
(b) Non- tariff barriers (NTB)	SPS measures Anti-dumping Customs Administration Countervailing Measures TBT	(b) Technology (Tech)	Information Society Innovation Policies IPR TRIPs Research and technology Economic Policy Dialogue
(c) Behind the border policies (BBP)	Anti-Corruption State Trading Entreprises Competition policy Public Procurement State Aid	(c) Investment/capital (Cap)	Investment Movement of Capital TRIMs
(d) Other policies (OP)	Agriculture Civil Protection Energy Taxation Financial Assistance Mining Approximation of Legislation Education and Training Consumer Protection Industrial Cooperation Data Protection Public Administration Small and medium enterprise Nuclear Safety Regional Cooperation Statistics	(d) Labor (Lab)	Illegal Immigration Visa and Asylum Social Matters Labor Market Regulation
		(e) Non-economic policies (non-EP)	Illicit Drugs Audio Visual Health Terrorism Environmental Laws Human Rights Money Laundering Cultural Cooperation Political Dialogue

Source: Jinji et al. (2022

3.2.2 Trade-investment-services-intellectual property nexus:

According to Baldwin (2011), the salient difference between 20th and 21st century trade is due to tendencies of the complex two-directional flows of goods, ideas and people. Given 20th century trade, these flows mainly occurred within a country's factories, whereas in the case of 21st century trade, some of those flows occur across international borders, where offices and factories have been unbundled internationally, and so emerging the trade-investment-service nexus. He has demonstrated that the cornerstone of 21st century trade is an interlocking of: (i) trade in goods, (ii) technology, international investment in production facilities, training and long-term business relationships, and (iii) using services of infrastructure to coordinate fragmented production, particularly services such as internet, finance which related to trade, telecoms, customs clearance and so on. This intertwining could be labeled the trade-investment-service nexus. He has denoted that there are two unbundling of globalization: the first unbundling and the second unbundling, the former signifies that consumption and production could be unbundled geographically as a result of transport costs reduction, in which comparative advantage and economies of scale made it inevitable once was imperative. The first unbundling of globalization produced a paradox, despite the dispersion of production internationally; it clustered locally (into factories and industrial zones). Reducing the cost of the two-way flows due to proximity has enhanced local clustering; this cost based on distance could be labeled coordination glue. The latter implies that some phases of production could be dispersed internationally (i.e., the spatial unbundling of some production phases) as a result of the information and communications technology (ICT) revolution. Similar to the former, comparative advantage and scale economies made it imperative once ICT made that dispersion feasible. 21st century trade requires stronger disciplines, which have been afforded by 21st century regionalism such as deep RTAs. He noted that 21st century regionalism is primarily concerned with those disciplines that support that nexus rather than preferential market access, that is, the standard bargain is foreign factories for domestic reform, while 20th century regionalism focuses underlying on preferences that allow market access (i.e., the basic bargain is an exchange of market access. Jinji et al. (2022) argue that the ICT revolution has mainly contributed to combining know-how in North (rich) countries with low-wage labor in South (poor) countries, this combination is called a high-tech/low-wage mix. They state that this mix in turn has contributed to the emerging trade-investment-services-intellectual property nexus, meaning that multinational corporations (MNCs) invest in the factories that were built in poor countries, through employing their intangible property, as a result, parent firms trade components and parts as their foreign affiliates, hence under trade-investment-services-intellectual property nexus, branded goods would be produced across intertwining of :(i) trade of goods, (ii) the capital movement, (iii) services which connect unbundled factories, and (iv) intellectual property. They argue that this nexus requires new and strong disciplines that can be afforded by deep RTAs.

3.2.3 RTAs with investment provisions, political risks, and FDI:

3.2.3.1 Time-inconsistent preferences and Obsolescing bargain:

Berger et al. (2013) indicate that FDI flows among developed countries, less number of less advanced countries, and the previous set of countries have conventionally been much greater than FDI flows among those countries and developing countries. They argue that among the convincing reasons for such discrepancy is the developing countries' lack the reputation.

Therefore, the latter countries must overcome two main problems :(i) time-inconsistent preferences, and (ii) obsolescing bargain (Berger et al., 2013; Büthe and Milner., 2014).
RTAs with strong investment provisions, especially NT provisions in the pre-establishment stage will prompt FDI, in contrast, RTAs without strong investment provisions may even inhibit FDI flows(Berger et al., 2013).

3.2.3.1.1 Time-inconsistent preferences:

This problem is taken place when a host country reneges on its previous commitments toward foreign investors, that is, ex-ante granted preferences such as regulatory concessions, zoning, special tax, or heavy compensating costs as promises for luring foreign investors, could be withdrawn, imposing other costs which result even to expropriation and that once the investment made it (i.e., inconsistency over time between ex-ante and ex-post granted preferences) (Simmons, 2014).

3.2.3.1.2 Obsolescing bargain:

The Obsolescing bargain argument was developed for the first time by Raymond Vernon; he argues that the bargaining power would be spilled over from a foreign corporation, especially a multinational corporation (MNC) into a host country, particularly a developing country. Obsolescing bargain occurs as follows: at the beginning of investment arrangements between a natural resources-rich host government and an MNC that possesses technology, financial resources and marketing power, the bargaining position of the latter is stronger than the former. Consequently, a host government has to afford generous concession agreements to prompt an MNC to incur potential risks which could arise as a result of its investment in that country. Once the investment is successfully operating, MNC profits rise gradually up to an enormous level, at the same time, the recipient country's capabilities will grow. As a result of the contradiction between exponential profits gained by MNC and the marginal increase of government income, local resentment will drive the host government to change their bargaining position to become stronger than the MNC, in which the previous lucrative bargain inevitably becomes an obsolesce bargain (Jenkins, 1986).

3.2.3.1.3 Political risks:

According to Büthe and Milner (2014), there are three types of political risks: policy risks, expropriation, and contract arise as a result of time-inconsistent preferences and Obsolescing bargain problems.

3.2.3.2 RTAs with investment provisions:

The developing countries especially the poorest among them have experienced problems linked to the underprovision of investment, hence, those countries have to afford credible commitments for foreign investors to reassure them. Interestingly, the inexistence of a multilateral agreement regulating FDI as opposed to international trade, which has been regulated by WTO. Despite the existence of the TRIMs agreement, yet, it has commonly appeared as weak protection for FDI (Milner, 2014).
The TRIMs agreement is one of the three products came out from the Uruguay Round of WTO (including TRIPs and GATS), the focal point of the mechanism of TRIMs is to move the trade rules from avert discrimination principle among countries (the MFN principle) into avert trade and investment distortions. It considers any performance requirements dictated by the authority of developing countries (host countries) on foreign firms to limit their choices as distortions; hence, it is strictly banned from use. It prohibits performance requirements linked

to trade balancing, local content, and export requirements. In addition, it prohibits imposing requirements on public agencies, which aim to push them into procuring goods from local suppliers. Any attempt from a host country to dictate such requirements would drive that country to the dispute settlement mechanism, in which it would certainly lose the case. The TRIMs agreement doesn't take into account the main concerns of developing countries such as competitiveness, and time required for infant industries. In a nutshell, the TRIMs agreement limits the developing countries' space of development (Wade, 2003).

3.2.3.2.1 NT and ISDS provisions:

In spite of potential risks (especially loss of sovereignty) that have been faced by the developing host countries as a result of an unpredictably considerable wave of litigation, these countries are pursuing tougher provisions related to FDI in international investment agreements such as PTAs with investment provisions. The competitive diffusion is the staple engine for these deeper PTAs, in which developing host countries move defensively to tame FDI diversion into competing host countries (Neumayer et al., 2016). There are two prominent legal innovations associated with the protection and liberalization of FDI:(i) guarantees of access to the market for foreign investors, which could be provided by national treatment (NT) and MFN treatment in the pre-establishment stage, and (ii) credible commitments which could be afforded by ISDS once the investment made it (Berger et al.,2013).

3.2.3.2.1.1 Pre-establishment national treatment (NT):

National treatment (NT) standard ensures fairly competitive competition among foreign and domestic investors, it binds the host countries to afford the foreign investors the same treatment as their domestic investors. The more liberal NT covers not only the post-establishment stage of investments, by also the pre-establishment stage (Abgaryan, 2018). This obligation guarantees a level of transparency, predictability and security of entry conditions, thus it reassures foreign investors who are planning long-term investments (Berger et al., 2013).

3.2.3.2.1.2 Investor-State Dispute Settlement (ISDS):

According to Berger et al. (2013), there are three types of ISDS provisions classified from the stronger to the weaker as follows:

3.2.3.2.1.2.1 Comprehensive pre-consent to international arbitration:

It is the strongest type, in which the foreign investors have thorough pre-consent to sue the host country unilaterally before international arbitration in case of investors-state disputes

3.2.3.2.1.2.2 Partial pre-consent to international arbitration:

It is similar to the previous type, yet, it is confined to limited categories of disputes (partial pre-consent). For instance the compensation amount for expropriation.

3.2.3.2.1.2.3 Promissory consent to international arbitration:

It is the weakest type, it affords merely promissory ISDS, that is, the foreign investors haven't any guarantees to sue the host country before international arbitration.

3.2.3.3 Investment provisions index:

To measure the extensiveness and the depth of FDI provisions, lesher and Miroudot (2006) have constructed a synthetic index comprised of six sub-categories, in which each element of a sub-category is coded numerically on a zero-to-one scale, as shown in table 3.4 (Lesher & Miroudot, 2006; UNCTAD, 2009).

Table 3.4. Lesher & Miroudot's investment provisions extensiveness index

Category	Score	Category	Score
Establishment (non-services sectors)		**Investment regulation and protection**	
Right of establishment		Provisions prohibiting performance requirements	
No	0.00	No	0.00
NT	0.50	Yes	0.50
MFN+NT	1.00	Yes, beyond TRIMs	1.00
Pre-establishment limitations		Specific provision prohibiting ownership requirements	
(n/a)	0.00	No	0.00
Positive or negative list	0.50	Yes	1.00
None	1.00		
Non-discrimination (non-services sectors)		Free transfer of funds	
National treatment		No	0.00
No	0.00	Yes	1.00
Yes	1.00		
Limitations to national treatment		Temporary entry and stay for key personnel	
(n/a)	0.00	No	0.00
Positive or negative list	0.50	Yes	1.00
None	1.00		
Most-favored-nation		Provisions on expropriation	
No	0.00	No	0.00
Yes	1.00	Yes	1.00
Limitations to most-favored-nation		Specific reference to fair and equitable treatment	
(n/a)	0.00	No	0.00
Positive or negative list	0.50	Yes	1.00
None	1.00		
Investment in services sectors		**Investment protection and dispute settlement**	
Investment in services covered by the RTA		State-Investor dispute settlement	
No	0.00	No	0.00
Yes	1.00	Ad hoc or permanent arbitration (only one)	0.50
Provisions on establishment		Ad hoc and permanent arbitration	1.00
None	0.00	**Investment promotion and co-operation**	
NT	0.50	Investment promotion	
MFN+NT / Market access	1.00	No	0.00
Pre-establishment Limitations in services		Yes	1.00
(n/a)	0.00	Co-operation mechanisms	
Positive or negative list	0.50	No	0.00
None	1.00	Yes	1.00
National treatment		Harmonisation of rules	
No	0.00	No	0.00
Yes	1.00	Yes	1.00
Limitations to national treatment in services		Any type of asymmetries (in favor of the developing economy)	
(n/a)	0.00	No	0.00
Positive or negative list	0.50	Yes	1.00
None	1.00		
Most-favored-nation		Clause foreseeing the future liberalisation of investment	
No	0.00	No	0.00
Yes	1.00	Yes	1.00
Exceptions to most-favored-nation		(Services only)	0.50
(n/a)	0.00		
List of exceptions	0.50		
None	1.00		

Source: Lesher & Miroudot, 2006

Where: Ad hoc arbitration and permanent arbitration are referred to as two types of dispute settlement provided, in which the distinguishing among them is based on the international arbitrator's identity. The former involves an independent international arbitrator usually under the rules of the United Nations Commission on International Trade Law (UNCITRAL), while the latter usually indicates the International Centre for the Settlement of Investment Disputes (ICSID).

The investment provisions index is built by weighting the numerical value of types of investment provisions, in which the simple average is the convenient method (Lesher & Miroudot, 2006).

3.3 Trade agreements, dissimilarity, FDI, intensive and extensive margin:

3.3.1 Effect of dissimilarity of partner countries' characteristics upon the gain from PTAs:

Cheong et al. (2015) argue that partner countries' characteristics (i.e., size, income, and location) under a PTA are major determinants of PTAs effects. They have provided simple indices of those determinants to measure similarity or dissimilarity between two partner countries as follows:

The index of size dissimilarity can be measured as:

$$SD_{ijt} \equiv \left|Y_{it} - Y_{jt}\right| / \left(Y_{it} + Y_{jt}\right)$$

Where: Y_{it} and Y_{jt} refer to real GDP measured in purchasing power parity based on reference year in US dollars at time t for countries i and j, respectively. The value of SD ranges between 0 and 1, in which zero denotes identical sizes between those countries (i.e., full similarity in terms of size), whereas one points out full dissimilarity in terms of size.

The index of income dissimilarity can be expressed as:

$$ID_{ijt} \equiv \left|y_{it} - y_{jt}\right| / \left(y_{it} + y_{jt}\right)$$

Where: y_{it} and y_{jt} denote real GDP per capita measured in purchasing power parity based on reference year in US dollars at time t for countries i and j, respectively. Similarly, The value of ID ranges between 0 and 1.

The index of location dissimilarity can be governed as:

$$LD_{ij} \equiv d_{ij} / d_{max}$$

Where: d_{ij} refers to the geographical distance measured in kilometers among the most populated cities in those countries as of a reference years, d_{max} indicates the maximum distance among any two points on the Earth, it is estimated at 20037 kilometers. Similarly, The value of LD ranges between 0 and 1, in which a higher value means that the concerned countries are geographically farther away, meaning not only higher transportation costs among them, yet the possibility of more dissimilarity of their natural endowments and climates. Cheong et al.(2015) assert that the more dissimilar the partner countries are, the larger the decline in trade flows among them under a PTA. Interestingly, the earnings for developing countries from a PTA among themselves are more than a PTA with industrial partner countries (i.e., a sizable development neighborhood premium). So, why is a South-South partnership usually more fruitful than a North-South partnership? The answers can be boiled down to four underlying points: (i) the substantial negotiating power of developed

countries compared to their developing countries' partners, which contributes effectively to inducing the developing countries to confer more concessions for them (Perroni & Whalley, 2000). Specifically, industrial countries usually dictate conditions related to non-tariff issues such as environmental matters, rights of intellectual property, investment rules, origin proof, and standards of labor at the cost of their smaller peers. For example, nearly 54% of total Mexican firms exporting to the United States of America have benefited from preferential terms under the North American Free Trade Agreement (NAFTA); while the rest firms were deprived of those concessions (i.e., the remained firms were dealt as other competitors that don't belong to NAFTA) (Cheong et al., 2015), (ii) primarily, the developing countries seeks to get safe trade arrangements from industrial countries, which enable them to access into large markets more safe (Perroni & Whalley, 2000), (iii) before a PTA North-South enter into force, tariff rates applied in industrial countries were much lower than their developing countries partners. (iv) Industrial countries could tend to protect their sectors which don't have a comparative advantage such as textiles and agriculture, through increasing non-tariff barriers to offset tariff drop (Cheong et al., 2015).

3.3.2 The effects of Free trade agreements (FTAs) on FDI:

FTAs are considered the most frequent type of preferential trade agreements (Saggi et al., 2018). Many studies have particularly focused on the trade effects of FTAs, whereas their effects on FDI didn't take the same attention as much as the former, in spite of the closeness of the tie between investment and trade which implies that forming FTAs could also have considerable effects in stimulating FDI (Li et al., 2016). In the most basic Heckscher-Ohlin world, capital has no motivation to flow across countries, if free trade has led factor price to equalization. Conversely, free trade would enhance flows of capital into labor-intensive country, when factor endowments among those countries are adequately disparate. Furthermore, a trade agreement non-member country (i.e., corporations of a third country) may want to invest in one of that trade agreement members to benefit from the tariffs reduction prevailed among the trading partners in that agreement (i.e., diversion effect) (Cuevas et al., 2005). Formation of an FTA could result in two effects upon investment: the creation effect and the diversion effect. The former is defined as the motivations to surge investment among PTA trading partners, while the latter effect is described as the adverse effects on investment outside the PTA (i.e., not covered by that PTA) (Lakatos & Walmsley, 2012). Motta and Norman (1996) argue that country size, tariff and nontariff barriers to trade are the overriding determinants of MNCs' choices between exporting and FDI, they stipulate that increased country size triggers dispersed FDI, whereas improved market accessibility (i.e., lowering tariff and nontariff barriers to trade among intra-regional trading partners) triggers to export-platform FDI, that is, spurring extra-bloc firms to invest in the regional bloc. Im (2016) argues that the effects of RTAs on FDI rely on both the origin (i.e., member or non-member countries) and the type of FDI. Given the latter, he addresses three types of FDI: (i) Horizontal FDI, (ii) vertical FDI, and (iii) export platform FDI. Horizontal FDI is defined as an investment that seeks a market, in which an MNC constructs plants in several countries, which in turn produce the same goods serving local markets. Vertical FDI emerges as a result of labor division, in which the production process becomes internationally fragmented. Export platform FDI takes place when an MNC builds foreign subsidiaries in other countries, which in turn export final goods into third countries except the home country.

Intra-FTA firms have fewer motivations to invest in member countries' markets; hence they can prefer exporting rather than investing, thus an FTA formation could decline horizontal FDI from member countries, while an FTA formation would prompt vertical FDI because Intra-FTA firms want to benefit from cheaper production costs on intermediate goods and parts. Besides, these firms can re-export cheaper finished goods to the home country. On the other hand, an FTA formation could trigger extra-FTA MNCs to invest in the FTA market instead of export to that market, meaning that the effects of an FTA on both horizontal and export-platform FDI from non-member countries are positive (Im, 2016). Theoretical studies have identified two mechanisms through which FTAs could be a prominent factor in encouraging inward foreign direct investment, which are :(i) the market expansion effect, and (ii) the vertical fragmentation effect (Li & Maani, 2018). Those studies have argued that FTAs may have adverse effects on FDI via a plant rationalization effect, which points out the substitution of horizontal FDI with trade (Li et al., 2016). The market expansion effect is indicated as the positive effect of an FTA formation on horizontal FDI from non-member countries, in which the expansion of the market is the impetus for MNCs to invest in the FTA area. This effect could underpin sectors with international competitiveness in luring more Horizontal FDI. The vertical fragmentation effect is referred to as the positive effect of an FTA formation on vertical FDI. This effect could support sectors with intense trade in intermediate goods in attracting more vertical FDI (Li & Maani, 2018).

3.3.3 Foreign trade liberalization, vertical specialization, intensive and extensive margin:

Since the Second World War, the global economy has witnessed a steady growth of international trade; yet, this enormous growth formed a significant quantitative challenge (Debaere & Mostashari, 2010). Yi (2003) has indicated two puzzles: (i) quantitative, and (ii) qualitative. The former is the combination of substantial increases in international trade with a relatively modest decrease in tariffs, in which during the period from 1962 to 1999 the elasticity of exports with respect to tariffs was estimated by roughly 20, which far exceeded the perspective of standard trade models. The latter is the nonlinear effect, whereas these models usually denote no nonlinear or little effects, in which during the same period that elasticity has varied between 20 from 1962 to 1985, and 50 during the remaining period. To address these puzzles, he has stipulated that even small tariff reductions would trigger an increase in vertical specialization, thus important surges in the extensive margin (Debaere & Mostashari, 2010). The extensive margin is deemed a significant tool in diagnosing the pattern of growth in trade which accompanies stages of fast development and economic growth. In international trade there are two kinds of changes in trade patterns of exported goods: (i) Changes on the extensive margin, and (ii) Changes on the intensive margin. Changes on the extensive margin refer to new goods that have been started exported by countries (i.e., goods that were not exported before) (Kehoe & Ruhl, 2013). The extensive margin is expressed as:

$$EM_{ij} = \frac{\sum_{n \in N_{ij}} v_{kjn}}{\sum_{n \in N} v_{kjn}}$$

Where: N_{ij} refers to the set of observable categories (the group of goods) that are exported from country i to country j, v_{kjn} indicates country k's exports value of units of good n to country j. k denotes the reference country, which has positive exports to country j in all N

categories. (Falvey & Foster-McGregor, 2022; Kehoe & Ruhl, 2013). In other words, EM_{ij} is the ratio of country k's exports to j in N_{ij} over country k's exports to j in all N categories (Hummels & Klenow, 2005), they indicated the reference country as the rest of the world.
Unlike changes on the extensive margin, changes on the intensive margin denote changes in exports of goods that were earlier exported (i.e., traditional goods) (Kehoe & Ruhl, 2013).
The intensive margin is written as:

$$IM_{ij} = \frac{\sum_{n \in N_{ij}} V_{ijn}}{\sum_{n \in N_{ij}} V_{kjn}}$$

Where: IM_{ij}'s numerator represents nominal exports of country i to country j in N_{ij}, whereas IM_{ij}'s denominator refers to nominal exports of country k to country j in those categories (Falvey & Foster-McGregor, 2022; Hummels & Klenow, 2005).
More accurately, the intensive margin combines the continuing margin and compositional margin, in which the continuing margin refers to changes in the amount of goods sold by continuing exporters, while the compositional margin reflects changes in the quantity of exports caused by the exit or entry of exporters. A lowering in trade costs may trigger positive changes in continuing exporters' average trade value, while that reduction may lead to adverse changes in the compositional margin if it decreases the volumes of exports despite the entry of many new exporters. The proportion of country i's to country k's exports to country j is given as (Falvey & Foster-McGregor, 2022):

$$EXPRAT_{ij} = \frac{\sum_{n \in N_{ij}} V_{ijn}}{\sum_{n \in N} V_{kjn}} = HKIM_{ij} \times HKEM_{ij}$$

Hummels et al. (2001) argue that vertical specialization takes place when: (i) the production of a good occurs in two or more consecutive stages, (ii) During the production of a good, values added are provided by two or more countries, and (iii) imported inputs must be used by at least one country in its phase of the production process, and some of the resulting output has to be exported.
In general, there are two approaches to measure bilateral vertical specialization (VS): (i) direct approach, and (ii) input-output (IO) approach (Leung, 2016).
The measure for bilateral vertical specialization using a direct approach is given as follows (Hummels et al., 2001):

$$VS_{ki} = \left(\frac{imported\ intermediates_{ki}}{gross\ output_{ki}}\right) \cdot exports_{ki}$$

Where: k refers recipient country, i denotes sector or good, VS_{ki} points out the content of imported input of exports, in other words, it suggests foreign value added involved in exports.
For example, as depicted in figure 3.2, for country 2 its VS is measured as follows:

$$VS_{2i} = (A/(D+E)) * E$$

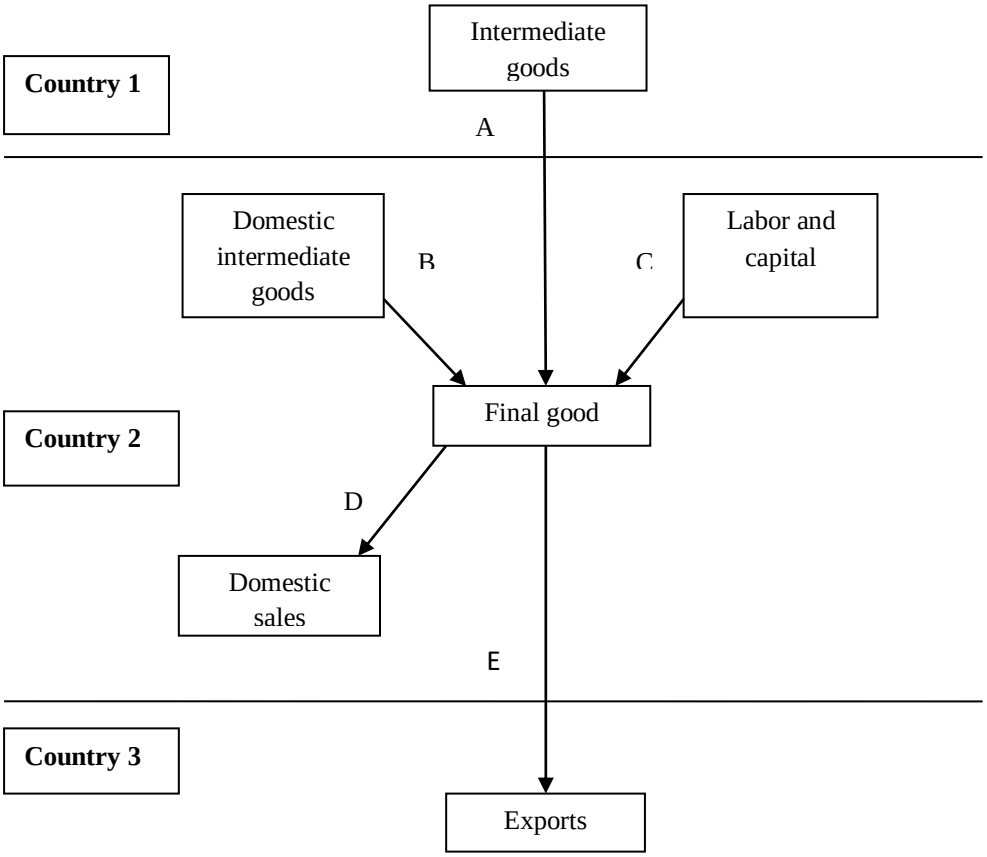
Despite the advantages of using the IO approach such as easy access to public data related to exports and imports of goods, yet, reconciling between different data sources, and between different classification systems is a major challenge. In addition, it does not set in detail the

sources of the intermediate inputs (i.e., exported countries to that inputs). Indeed, the two approaches are expected to trigger the same results.
The measure for bilateral vertical specialization using the IO approach is given as:

$$\mathrm{VS_k} = \mathrm{A^M}\,[\mathrm{I} - \mathrm{A^D}]^{-1}\,\mathrm{X}$$

Where: A^M indicates the matrix of n x n import coefficient, I refers to the identity matrix, $\mathrm{A^D}$ suggests the matrix of n x n domestic coefficient, X, VS, and n denote an $n\,x1$ vector of exports, $n\,x1$ vector of VS for country k, and the manufacturing industries number, respectively. $[\mathrm{I} - \mathrm{A^D}]^{-1}$ refers to the Leontief inverse matrix (Leung, 2016).
Figure 3.2. depicts an example of vertical specialization relating to three countries.

Figure 3.2. Vertical specialization



Source: Hummels et al. (2001)

3.4 The role of unilateral preferences in prompting developing countries exports:
To achieve and strengthen sustainable development, developing countries have striven to increase their exports to developed countries by getting differential and special treatment from those countries. The generalized system of preferences (GSP) is deemed the most prominent instrument of that treatment; which is an exception to the general agreement on tariffs and trade (GAAT) principle of nondiscrimination and reciprocity that appeared in the second half of the 1960s. Through GSP, developing countries' exports gain nonreciprocal preferences providing preferential access to their exports into developed countries' markets (Gil-Pareja et

al., 2014). Unilateral preferences seek to surge developing countries' exports by tariffs cuts and the concessions provided by the preference margin, yet, their results on developing countries are differentiated. There are several reasons that may undermine desirable trade impacts from unilateral preferences such as: (i) the graduation clauses that are usually built in, (ii) the potential distortionary effect that might trigger countries to specialize in domains in which they may not enjoy a comparative advantage, (iii) ruling out of primary products from several schemes, (iv) uncertainty about the durations of the schemes, (v) the breadth of free trade agreements and multilateral trade liberalization, (vi) the origin rules, and (vii)some preferences regimes give away developed countries a sizable bargaining power to dictate their conditions over smaller trading partners on the form of international conventions associated with good governance, labor and human rights, and environment (Cirera et al., 2016). With respect to the first reason, what is the graduation principle? What are its trade repercussions on remaining beneficiaries?

3.4.1 Trade fallout of graduating countries on remaining beneficiaries:

As this clause, preferential treatment would be progressively withdrawn from developing countries that have realized a certain level of advance, drawing on their development, and their trade and financial needs. For instance, the US administrations decided that as of January 1989, four countries: South Korea, Hong Kong, Taiwan, and Singapore, would be removed from the beneficiaries list which they had enjoyed preferential access to the US market within the generalized system of preferences (GSP), even the remaining beneficiaries (less developed countries compared to graduating countries) take advantage entirely from the program. In general, the trade effect of graduation on remaining beneficiaries underlying relies upon the export similarity index among graduating, and remaining countries. The greater the similarity level, the greater trade diversion taking place toward the remaining beneficiaries. Yet, in the stance of a low level of similarity little or no trade diversion with the potential of losses of trade creation for remaining countries could be expected (E.Kirkman, 1989). The export similarity index was developed by Finger and Kreinin in 1979; it measures the degree of similarity or dissimilarity of the export composition of two countries or two groups to a third country or market. It is defined by the following formula:

$$\text{ESI} = \text{S (ab, c)} = \{ \sum_i Minimum\ [Xi(ac),\ Xi(bc)]\}\ 100$$

Where: a and b refer country or country groups, c indicates third market (country or country groups), $Xi(ac)$ suggests the share of commodity i in exports of a to c, $Xi(bc)$ denotes the share of commodity i in exports of b to c. Its value ranges from 0% to 100%, where 0% refers to total dissimilarity (for $Xi(bc) > 0,\ Xi(ac) = 0, and\ vice\ versa$) and the two countries (a and b) are considered imperfect competitors in the third market (c), while 100% indicates that the two countries (a and c) considered perfect competitors in the third market (c), namely ($Xi(bc) = Xi(ac)\ for\ each\ i$) (Finger and Kreinin, 1979; Akgüngör et al., 2002).

In other words, the Export Similarity Index can be measured as follows:

$$\text{ESI}= 1 - \frac{1}{2}\sum_i \left|\frac{Xi_{ac}}{X_{ac}} - \frac{Xi_{bc}}{X_{bc}}\right|$$

Where: Xi_{ac} represents the exports value of the ith good from country a to country (or market) c, X_{ac} denotes overall exports from country a to country (or market) c, Xi_{bc} suggests

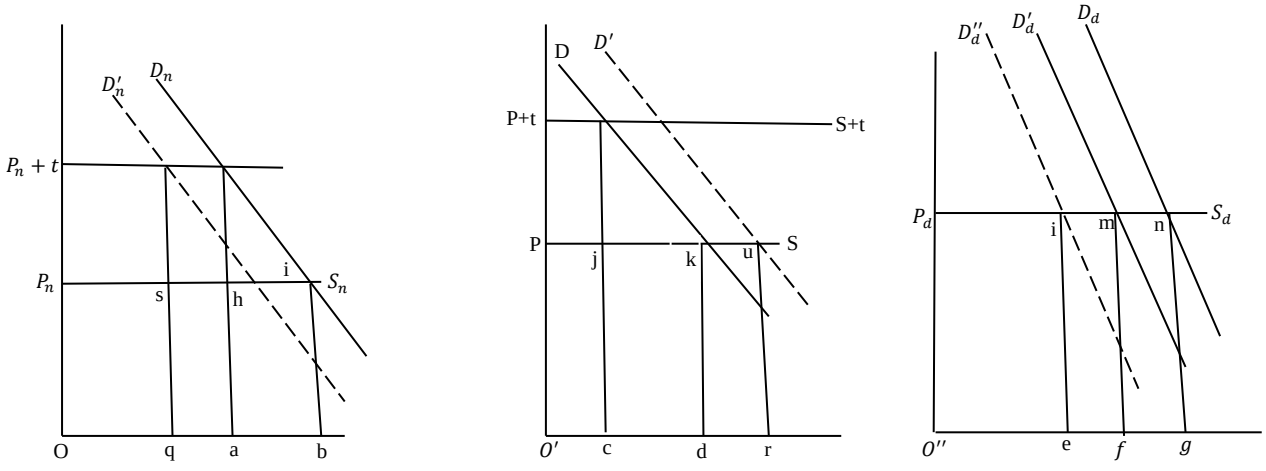
the value of exports of the ith good from country b to country (or market) c, X_{bc} denotes total exports from country b to country (or market) c (Pomfret, 1981).

3.4.2 Trade benefits under MFN tariff cuts versus GSP tariff rates for developing countries:

In general, it seems vividly that GSP schemes, unlike MFN tariff reductions, could trigger more trade benefits for developing countries. Nevertheless, there are some exceptions. For instance, neither not all manufactured goods nor all developing countries are concerned by the different preferences arrangements, the MFN reductions cover a wider range of products. Furthermore, they confer unlimited accession to international markets other than GSP tariff rates, which cover a specific bundles of products with limits imposed on the volume of trade (Baldwin & Murray, 1977).

Their model assumes three assumptions: (i) imperfect substitutions among exports of developing countries under GSP schemes (beneficiaries) into preference-granting countries and exports from non-beneficiaries (mostly developed countries), because of significant differences in quality, (ii) exports of both countries' groups are deemed to be imperfect substitutes for national production, and (iii) supply curves are perfectly elastic for both foreign and domestic (Baldwin & Murray, 1977; Ow-Taylor & Hock, 1991).

Figure 3.3. The impacts of MFN against preferential tariffs cuts



(a) Imports from non-beneficiaries (b) Imports from beneficiaries (c) Domestic output

Source: Baldwin & Murray, 1977

As shown in figure 3.3 there are three subfigures: (a) comprises two components:(i) import demand curve of donors country from non-beneficiaries, and (ii) supply curve of non-beneficiaries, (b) Contains similar components as (a), taking into account beneficiaries instead non-beneficiaries, and (c) applies to domestic producer.

P and P_n refer to free trade prices of the two exporter countries, and t indicates ad valorem tariffs.

Suppose that in the pre-GSP case, the import duty on a product is equal to zero on an MFN

basis. Exports from preferred and non-preferred countries would increase from O'c to O'd, and from Oa to Ob, respectively. Consequently, demand for a similar domestic product would decrease (effect of cross price), assuming that the curve of domestic demand is underpinned on unchanged (constant) prices of imports. As a result of the cross-price effect, the domestic output will decrease from $O''g$ to O''e. This cut in demand can be decomposed into two components: (i) the imports substitution from beneficiaries, indicated from D_d to $D_d^{'}$, and (ii) the imports substitution from non-beneficiaries, indicated from $D_d^{'}$ to D_d''.

Turning now, in the post-GSP case with duty-free treatment conferred merely to beneficiary nations. Hence, domestic output will drop merely from $O''g$ to $O''f$, in which this demand reduction is confined only to the substitution of imports from beneficiaries, denoted from D_d to $D_d^{'}$. Besides this trade creation effect, there is the trade diversion effect, which occurs as a consequence of domestic consumer's tendency to shift, from non-beneficiaries' imports to beneficiaries' imports due to attractive prices provided by the latter. This trade diversion triggers the demand for imports from preferred sources to increase from D to D', and the demand for imports from non-preferred sources to decline from D_n to $D_n^{'}$.

From the above explanation, GSP-based trade benefits for beneficiary countries can be divided into two effects: (i) trade creation effect indicated by area cdkj, which is at the cost of domestic producers, and (ii) trade diversion effect referred by area druk, which is at the cost of the non-beneficiary nation (Baldwin & Murray, 1977). The former is traditionally measured using elasticities of import demand as:

$$TC_i = M_i \eta_i [\Delta t_i / (1 + t_i)]$$

Where: TC refers the trade creation, M denotes the initial level of preferences-granting country imports from preferred sources (beneficiaries), η indicates elasticity of import demand, Δt suggests the change in the tariff rate, t is the initial level of tariff, and i stands to a specific group of commodities (Baldwin & Murray, 1977; Ow-Taylor & Hock, 1991).

To estimate trade diversion, Baldwin and Murray (1977) assumed that the donor country's consumers do not alter their saving behavior or their spending over other goods, and substitute one for the other. Hence, the two areas (i.e., druk and qahs) will be equal. So trade diversion (TD) can be measured as:

$$TD_i = w_i Mn_i \qquad (1)$$

Where: w denotes the ratio of reduction in imports from non preferred sources (non-beneficiaries) in the aggregate donor country imports from those nations (i.e., qahs /OahP_n), and Mn refers OahP_n area.

Given that non-preferred countries are often referred to as non-developing countries, Baldwin and Murray (1977) have posed a plausible assumption involving that the substitutability among a product produced in a developing country and a similar product produced in non-preferred countries would be similar to the substitutability among a product produced in a developing country and a similar product produced in the preferences-granting country. The latter substitutability is usually indicated as trade creation, which can be rewritten as:

$$TC_i = cdkj = fgnm = w_i V_i \qquad (2)$$

Where: w represents the ratio of decline in domestic production to the total domestic production of the donor country (i.e.,$fgnm/O''gnP_d$), and V indicates domestic production of similar goods, namely $O''gnP_d$ area.
By substituting w_i in formula (2) into formula (1), they have obtained:

$$TD_i = w_i Mn_i = (TC_i/V_i)Mn_i = TC_i(Mn_i/V_i)$$

3.5 A two-period intertemporal trade model:

3.5.1 The two-period model:

The main notion of the two-period model is dependent on two period lives of an individual , indicating zero for the present and one for the future, so that an individual gains utility through aggregate consumption of goods for each period. Commonly, the utility function can take the following shape: $U(C_0, C_1)$, such that C suggests goods' consumption (Paserman, 2017).

3.5.2 The International real business cycle:

The key measures of business cycles are the economic variables' comovement and their volatilities, where the amounts of investment fluctuations and consumption smoothness have been diagnosed continuously in volatilities matters (Hess & Shin, 1997). The international real business cycle (IRBC) is defined as macroeconomic aggregates comovement among countries, in terms of the main macroeconomic aggregates as output, consumption, investment, real wages and labour tend to increase and decrease conjointly. The study of Backus et al., 1993 is one of the pioneering works that has examined the comovement among the United States of America and nine developed countries by testing the correlation level among the US's real output and the real output of those countries, thereby, they have found correlation magnitude ranges between 0.41 and 0.76 (Bilo, 2018; Jaimovich & Rebelo, 2009). The business cycle at the international level is characterized by three aspects: relative price determination, the current account balance, and international business cycle comovement. Using econometric methods, a business cycle component formula can be given as follows:

$$y_{c,t} = y_t - y_{g,t}$$

Where: $y_{c,t}$ refers business cycle component, y_t denotes real gross domestic product in logarithm term, and $y_{g,t}$ represents the growth trend.

There is a key fashion to assess the international comovement across countries through testing the correlation among the same variables of the home country and other countries. Endogenous propagation and exogenous propagation are prominent channels that drive positive economic comovement to emerge. When a disturbance originating in a given country generates a positive effect on the magnitude outputs of that country and foreign countries, it is called positive endogenous propagation. For example, steadily growing development in China induces economic expansions in oil countries by increasing the China demand for crude petroleum in those countries. The correlation of shocks across countries is indicated as positive exogenous propagation. For example, national output in the majority of industrialized countries has experienced steady growth, as a result of broad government spending in those countries, during the Second World War (Crucini, 2006).

3.5.3 Effect channel on exports, imports and overall trade balance:

Intertemporal substitution by consumers has become the workhorse of the majority of contemporary macroeconomic models, such that the amount of the consumption's intertemporal elasticity of substitution is the main basic element to assess the prominent quantitative changes (Ogaki & Reinhart, 1998). The intertemporal elasticity of substitution is a crucial element in evaluating welfare and saving behavior (Okubo, 2011). The main notion of this theoretical simple model is grounded on the interplays among the effect of intratemporal substitution across exporting and importing goods, the effect of real income, and the effect of intertemporal substitution across time periods. In a home country, a representative consumer has the following life-time utility function:

$$U = u(C_1) + \beta u(C_2), \quad 0 < \beta < 1,$$

Where: $C_1$and C_2 represent consumption in period 1 and period 2, respectively, and β refers to a time-preference factor, the home country specializes in producing solely one good indicated as good 1, in an analogous way, the foreign country specializes in producing solely one good indicated as good 2. The production function for good 1 is a linear homogeneous function that takes the following form: $y_{t1} = \mathrm{F}(\mathrm{k_t}, \mathrm{L})$, such that y_{t1} indicates the output of good 1 in period t, $\mathrm{k_t}$ and L suggest factors of production, so that $\mathrm{k_t}$ denotes capital, and L points out a fixed amount of labor which is normalized with 1 (Ju et al., 2010). Based on the neoclassical model of capital accumulation, the invested commodity would become part of the capital stock in the next period, as input of production, so the capital stock develops as:

$$k_{\mathrm{t+1}} = (1 - \delta)k_{\mathrm{t}} + \mathrm{I_t},$$

Where: $\mathrm{I_t}$ represents the gross investment in period t, δ denotes the capital's depreciation rate in period t (Plosser, 1989). It is presumed that, $\delta = 0$, thus, $k_{\mathrm{t+1}} = k_{\mathrm{t}} + \mathrm{I_t}$.

Investment and consumption are composite of Both goods domestic and foreign as follows:

$$C_t + I_t = G(x_{t1}, x_{t2}).$$

Where: $G(x_{t1}, x_{t2}) = \left(x_{t1}^{\rho} + x_{t2}^{\rho}\right)^{1/\rho}$ denotes an Armington aggregator and $0 < \rho \leq 1$ (Ju et al., 2010). Armington aggregator is also called a constant elasticity substitution production function (Tesar et al., 2006). Ju et al. (2010) have pointed out that by applying a two-stage optimization problem solving, as a first stage, the consumer has chosen $x_{t1} and\, x_{t2}$ to minimize his expenditure for a specific magnitude of investment and consumption, namely, solving as follows:

$$\min_{x_{t1}, x_{t2}} E = \rho_{t1} x_{t1} + \rho_{t2} x_{t2}$$

$$\text{Subject to } G(x_{t1}, x_{t2}) \geq C_t + I_t,$$

By setting, $\rho_{t1} = \rho_{t1}^{*} \; and \; \rho_{t2} = (1 + \tau)\rho_{t2}^{*}$, Where: ρ_{ti} indicates the good i's domestic price and ρ_{ti}^{*} suggests the world price. The expenditure function refers to the solution of this problem

$$E(\rho_{t1}, \rho_{t2}, C_t + I_t) = q_t(C_t + I_t)$$

Where: $q_t = (\rho_{t1}^{1-\sigma} + \rho_{t2}^{1-\sigma})^{1/1-\sigma}$. It is presumed that the world prices do not change. Which signify that, $\rho_{1j=}^{*}\rho_{2j}^{*}$ for j=1,2, thus, $q_1 = q_2 = q$. Employing the envelope theorem:

$$x_{ti} = \frac{\partial E(\cdot)}{\partial \rho_{ti}} = q_t^{\sigma} \rho_{ti}^{-\sigma} (C_t + I_t)$$

The consumer's intertemporal budget constraint can be expressed as follows:

$$q_1(C_1 + I_1) + \frac{q_2(C_2 + I_2)}{1 + r} = \rho_{11} F(k_1) + \tau \rho_{12}^{*} x_{12} + \frac{\rho_{21} F(k_2) + \tau \rho_{22}^{*} x_{22}}{1 + r}$$

Where: r points out the interest rate of the world, so that the small country takes as exogenous. The tariff revenue has been re-allocated by the government in every period, $\tau \rho_{t2}^{*} x_{t2}$, back to the consumer, it is noted, that accumulated capital, k_2 in period 1, will be consumed at the end of period 2, and k_3 will be equal zero, which means that $I_2 = k_3 - k_2 = -k_2$. In the second stage, the consumer will seek to maximize its lifetime utility, through choosing $C_1, I_1, and\ C_2$, subject to the intertemporal budget constraint. Using the formula of intertemporal budget constraint, and substituting C_2 in life-time utility function, the two first order conditions for $C_1\ and\ I_1$ are:

$$\frac{\partial u(C_1)}{\partial C_1} = \beta(1 + r) \frac{\partial u(C_2)}{\partial C_2} \qquad (1)$$

and

$$\frac{\rho_{21}}{Q} \frac{\partial F(k_2)}{\partial k_2} = r, \qquad (2)$$

Where: $Q = q_2 - \tau \rho_{22}^{*} q_2^{\sigma} \rho_{22}^{-\sigma}$ refers the aggregate

price index, as the tariff revenue effect is excluded, and ρ_{21}/Q suggests the domestic product's real price. Equation (1) indicates the standard Euler equation, and equation (2) stipulates that the capital's marginal value product is equal to the interest rate. TB_t points out the trade balance, in which its formula is given as:

$$TB_t = X_t - M_t$$

$$= \rho_{t1}^{*}(y_t - x_{t1}) - \rho_{t2}^{*} x_{t2}$$

$$= \underbrace{\rho_{t1}^{*}[y_t - q_t^{\sigma} \rho_{t1}^{-\sigma}(C_t + I_t)]}_{X_t} - \underbrace{\rho_{t2}^{*} q_t^{\sigma} \rho_{t2}^{-\sigma}(C_t + I_t)}_{M_t}$$

Where: $X_t\ and\ M_t$ denote the value of export and import respectively. It is noted that the intertemporal budget constraint equation implies that:

$$TB_1 + TB_2/(1 + r) = 0$$

We can show that $\partial Q/\partial \tau > 0$. So, when the tariff rate τ declines, the aggregate price index would decrease. Equation (2) denotes that, k_2, thus I_1has to increase. As a result, the ratio of $\rho_{21} to\ Q$ will become higher, and the intertemporal budget constraint can be rewritten as:

$$Q(C_1 + I_1) + \frac{Q(C_2 - k_2)}{1 + r} = \rho_{11} F(k_1) + \frac{\rho_{21} F(k_2)}{1 + r} \qquad (3)$$

As shown in equation (3), an increase of k_2 would lead the right-hand side of that equation to increase, thus $C_1 + I_1$ has to increase. The real income effect is known as the increase in the real income, as a result of the decline of the domestic good's real price, the real income effect is conducive to increasing both investment demand and consumption demand. After tariff reductions, $C_1 + I_1$ have to remain higher albeit C_1 decreases, since the intertemporal substitution effect across time periods is insignificant.

In the current period, the impact of trade liberalization on the value of import is written as:

$$\frac{\partial M_1}{\partial \tau} = \rho_{12}^{*}(C_1 + I_1)\frac{\partial (q_1^{\sigma} \rho_{12}^{-\sigma})}{\partial \tau} + \rho_{12}^{*} q_1^{\sigma} \rho_{12}^{-\sigma} \frac{\partial (C_1 + I_1)}{\partial \tau} \qquad (4)$$

The intratemporal substitution effect is defined as a decline in the import good price, which increases the import demand, resulting from the tariff reduction. As display in equation (4) it seems straightforward $that,\ \partial (q_1^{\sigma} \rho_{12}^{-\sigma})/\partial \tau < 0$, this is known as the intratemporal substitution effect. Depending on the above assumption of the real income effect, and so, the imports value would be increased, as a result of both the intratemporal substitution effect and the real income effect. Indicated that $y_1 = F(k_1)$ does not change, in the current period the trade liberalization affects the exports value as follows:

$$\frac{\partial X_1}{\partial \tau} = -\left[\rho_{11}^{*}(C_1 + I_1)\frac{\partial (q_1^{\sigma} \rho_{11}^{-\sigma})}{\partial \tau} + \rho_{11}^{*} q_1^{\sigma} \rho_{11}^{-\sigma} \frac{\partial (C_1 + I_1)}{\partial \tau}\right] \qquad (5)$$

Equation (5) portrays that the first derivative on the right-hand side is higher than zero, so the value of export would be increased, as a result of the decline of the exportable good's domestic consumption, which owing to the intratemporal substitution effect, while the real income effect yields the opposite. Assuming that the intratemporal substitution effect dominates, so, $\partial X_1/\partial \tau < 0$, thus, trade liberalization has a positive effect on the value of exports. Despite, the increase of X_1 and M_1 , in the current period, the effect of trade liberalization on the balance of payments is ambiguous, since the sign of the right-hand side of equation (6) may be positive or negative as illustrated below :

$$\frac{\partial TB_1}{\partial \tau} = \sigma q_1^{2\sigma - 1} \rho_{11}^{-\sigma} \rho_{12}^{-\sigma} \left(-1 + \frac{\rho_{12}^{*}}{\rho_{11}^{*}(1 + \tau)}\right) \qquad (6)$$

Chapter 4. Empirical study on the effect of trade liberalization on Algeria's balance of payments

4. Empirical study on the effect of trade liberalization on Algeria's balance of payments

4.1Testing degree of Algeria's current account sustainability using the intertemporal approach:

Consider a small open economy with no government that produces and exports a single good, which is used for consumption and investment, the representative consumer can sell and buy goods in the international markets, besides borrowing and lending funds at a given world interest rate (Husted, 1992; Dissou & Nafie, 2019).

The individual current-period budget constraint is:

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

Where: $(1 + r)B_{t-1}$ stands for the initial debt size.

The budget constraint at time t is given as:

$$Y_t + (B_t - B_{t-1}) = C_t + I_t + r_t B_{t-1} \qquad (2)$$

Where: C_t, I_t, Y_t, $B_t$and r_t indicate current consumption, investment, output, international borrowing, and a time-varying world interest rate, receptively.

Hence, the current account at time t could be in deficit or surplus as:

Deficit if $CA_t = \Delta B_t = B_t - B_{t-1} < 0$

Surplus if $CA_t = \Delta B_t = B_t - B_{t-1} > 0$

As the budget constraint must be met in every period, hence iterating equation (2) forward in time gives:

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

$$B_t = -V_t + (1 + r_t)B_{t-1} \qquad (3)$$

Where: $V_t = (Y_t - C_t - I_t) = (EX_t - IM_t)$ refers to the trade balance, EX_t and IM_t suggest exports and imports of goods and services, respectively.

Equation (2) shall be kept for every time period in an intertemporal framework, thus solving equation (3) recursively for n periods.

The forward-looking solution can be given as:

$$B_{t+1} = -V_{t+1} + (1 + r_{t+1})B_t$$

$$B_{t+2} = -V_{t+2} - (1 + r_{t+2})V_{t+1} + (1 + r_{t+1})(1 + r_{t+2})B_t$$

$$\vdots$$

$$B_{t+n} = -V_{t+n} - (1 + r_{t+n})V_{t+n-1} - \cdots - (1 + r_{t+2})..(1 + r_{t+n-1})(1 + r_{t+n})V_{t+1} +$$

$$\cdots + (1 + r_{t+1})..(1 + r_{t+n-1})(1 + r_{t+n})B_t$$

Rearranging for B_t yields:

$$B_t = \frac{V_{t+n}}{(1 + r_{t+n})(1 + r_{t+n-1})..(1 + r_{t+1})} + \frac{W_{t+n-1}}{(1 + r_{t+n-1})..(1 + r_{t+1})} + \cdots + \frac{W_{t+1}}{(1 + r_{t+1})}$$

$$+ \frac{B_{t+n}}{(1 + r_{t+n})(1 + r_{t+n-1})..(1 + r_{t+1})}$$

With n approaching infinity, gives:

$$B_t = \sum_{i=1}^{\infty} \beta_i \, V_{t+i} + \lim_{n\to\infty} \beta_n \, B_{t+n} \quad (4)$$

Where:

$$\beta_i = \prod_{j=1}^{i} \left(\frac{1}{1 + r_{t+j}} \right)$$

Equation (4) points out that net international borrowing at the end of period t is equal to the present value of all future net trade balance surpluses, implying that the expression below shall be equal to zero

$$\lim_{n\to\infty} \beta_n \, B_{t+n} = 0$$

$$(EX_t - IM_t) = (Y_t - C_t - I_t) = -B_t + (1 + r_t)B_{t-1} \qquad (5)$$

$$IM_t + (1 + r_t)B_{t-1} + rB_{t-1} - rB_{t-1} = EX_t + B_t$$

$$IM_t + (1 + r)B_{t-1} + (r_t - r)B_{t-1} = EX_t + B_t$$

Where: $B_t = W_t - EX_t + (1 + r)B_{t-1}$ (6)

$$W_t = IM_t + (r_t - r)B_{t-1}$$

Solving equation (6) iteratively for a forward-looking solution is obtained as follows:

$$B_{t+1} = W_{t+1} - EX_{t+1} + (1 + r)B_t$$

$$B_{t+n} = \sum_{j=0}^{n} (1 + r)^{n-j} \left(W_{t+j} - EX_{t+j} \right) + (1 + r)^{n+1} B_{t-1}$$

Rearranging,

$$(1 + r)^{n+1} B_{t-1} = B_{t+n} - \sum_{j=0}^{n} (1 + r)^{n-j} \left(W_{t+j} - EX_{t+j} \right)$$

$$B_{t-1} = \frac{B_{t+n}}{(1 + r)^{n+1}} - \frac{\sum_{j=0}^{n} (1 + r)^{n-j} \left(W_{t+j} - EX_{t+j} \right)}{(1 + r)^{n+1}}$$

$$B_{t-1} = \frac{B_{t+n}}{(1 + r)^{n+1}} - \frac{\sum_{j=0}^{n} \left(W_{t+j} - EX_{t+j} \right)}{(1 + r)^{1+j}}$$

$$B_{t-1} = \sum_{j=0}^{n} \lambda^{1+j} \left(EX_{t+j} - W_{t+j} \right) + \lambda^{n+1} B_{t+n}, \qquad \lambda = \frac{1}{1 + r}$$

For n periods forward:

$$B_{t-1} = \sum_{j=0}^{n} \lambda^{1+j} \left(EX_{t+j} - W_{t+j}\right) + \lim_{n\to\infty} \lambda^{n+1} B_{t+n} \qquad (7)$$

Further manipulating equation (7):

$$B_{t-1} = \lambda(EX_t - W_t) + \lambda^2(EX_{t+1} - W_{t+1}) + \lambda^3(EX_{t+2} - W_{t+2}) + \cdots$$

$$+ \lim_{n\to\infty} \lambda^{n+1} B_{t+n}$$

$$B_{t-1} = \lambda(EX_t - W_t) + \lambda^2(\Delta\, EX_{t+1} - \Delta W_{t+1}) + \lambda^2(EX_t - W_t) +$$

$$+\lambda^3(\Delta\, EX_{t+2} - \Delta W_{t+2}) + \lambda^3(\, EX_{t+1} - W_{t+1}) + \cdots + \lim_{n\to\infty} \lambda^{n+1} B_{t+n}$$

$$B_{t-1} = \lambda(EX_t - W_t) + \lambda \sum_{j=1}^{\infty} \lambda^j \left(\Delta EX_{t+j} - \Delta W_{t+j}\right) + \lambda \sum_{j=0}^{\infty} \lambda^{1+j} \left(EX_{t+j} - W_{t+j}\right)$$

$$+ \cdots + \lim_{n\to\infty} \lambda^{n+1} B_{t+n} \qquad (8)$$

Rearranging equation (7)

$$\sum_{j=0}^{n} \lambda^{1+j} \left(EX_{t+j} - W_{t+j}\right) = B_{t-1} - \lim_{n\to\infty} \lambda^{n+1} B_{t+n} \qquad (9)$$

Substituting equation (9) into (8) yields

$$B_{t-1} = \lambda(EX_t - W_t) + \lambda \sum_{j=1}^{\infty} \lambda^j \left(\Delta EX_{t+j} - \Delta W_{t+j}\right) + \lambda \left[B_{t-1} - \lim_{n\to\infty} \lambda^{n+1} B_{t+n}\right]$$

$$+ \cdots + \lim_{n\to\infty} \lambda^{n+1} B_{t+n}$$

$$B_{t-1} = \lambda(EX_t - W_t) + \lambda \sum_{j=1}^{\infty} \lambda^j \left(\Delta EX_{t+j} - \Delta W_{t+j}\right) + \lambda B_{t-1} + (1-\lambda) \lim_{n\to\infty} \lambda^{n+1} B_{t+n}$$

$$B_{t-1} - \lambda B_{t-1} = \lambda \left[(EX_t - W_t) + \sum_{j=1}^{\infty} \lambda^j \left(\Delta EX_{t+j} - \Delta W_{t+j}\right) + \frac{1-\lambda}{\lambda} \lim_{n\to\infty} \lambda^{n+1} B_{t+n}\right]$$

$$\frac{1-\lambda}{\lambda} B_{t-1} + W_t = EX_t + \sum_{j=1}^{\infty} \lambda^j \left(\Delta EX_{t+j} - \Delta W_{t+j}\right) + \frac{1-\lambda}{\lambda} \lim_{n\to\infty} \lambda^{n+1} B_{t+n}$$

From this,

$$rB_{t-1} + W_t = EX_t + \sum_{j=1}^{\infty} \lambda^j \left(\Delta EX_{t+j} - \Delta W_{t+j}\right) + r \lim_{n\to\infty} \lambda^{n+1} B_{t+n} \qquad (10)$$

Where:

$$\lambda = \frac{1}{1+r} \quad \Rightarrow r = \frac{1-\lambda}{\lambda}$$

$$EX_t = \alpha_1 + EX_{t-1} + \varepsilon_{1t}, \quad W_t = \alpha_2 + W_{t-1} + \varepsilon_{2t}, \qquad \varepsilon_{1t},\, \varepsilon_{2t} : I(0)$$

Assuming that $0 < \lambda < 1$, equation (10) can be transformed as follows:

$$W_t + rB_{t-1} = EX_t + \sum_{j=1}^{\infty} \lambda^j \left[\alpha_1 - \alpha_2 + \varepsilon_{1,t+j} - \varepsilon_{2,t+j}\right] + r \lim_{n\to\infty} \lambda^{n+1} B_{t+n}$$

$$= EX_t + \frac{\alpha_1 - \alpha_2}{r} + \sum_{j=1}^{\infty} \lambda^j \left(\varepsilon_{1,t+j} - \varepsilon_{2,t+j}\right) + r \lim_{n\to\infty} \lambda^{n+1} B_{t+n} \quad (11)$$

$$W_t = IM_t + (r_t - r)B_{t-1} \qquad W_t + rB_{t-1} = IM_t + r_t B_{t-1}$$

$$IM_t + r_t B_{t-1} = EX_t + \frac{\alpha_1 - \alpha_2}{r} + \sum_{j=1}^{\infty} \lambda^j \left(\varepsilon_{1,t+j} - \varepsilon_{2,t+j}\right) + r \lim_{n\to\infty} \lambda^{n+1} B_{t+n}$$

$$EX_t = IM_t + r_t B_{t-1} + \frac{\alpha_2 - \alpha_1}{r} + \sum_{j=1}^{\infty} \lambda^j \left(\varepsilon_{2,t+j} - \varepsilon_{1,t+j}\right) + r \lim_{n\to\infty} \lambda^{n+1} B_{t+n} \quad (12)$$

$$\alpha = \frac{\alpha_2 - \alpha_1}{r}, \qquad \varepsilon_t = \sum_{j=1}^{\infty} \lambda^j \left(\varepsilon_{2,t+j} - \varepsilon_{1,t+j}\right), \quad MM_t = IM_t + r_t B_{t-1}$$

$$EX_t = \alpha_0 + \alpha_1 MM_t + \varepsilon_t \quad (13)$$

Where: EX_t stands for exports and MM_t indicate imports (including net interest payments) (Garg & Prabheesh, 2021).

If EX and MM are not co-integrated, implying that this economy is unable to satisfy its intertemporal budget constraint, yielding: (i) a default on its external borrowings and (ii) an inability to finance its imports bills through its exports revenue (Kouadio & N'Guessan, 2021; Garg & Prabheesh, 2021). Beyond this, current account unsustainability indicates that an economy is unable to satisfy its long-run intertemporal budget constraint, meaning it is forced to act a drastic change in its policy such as a reduction in its government expenditures or a sharp depreciation of its currency (Chen & Xie, 2015).

To test the long-run relationship between exports and imports we used the ARDL model. The ARDL model is applicable even if the series are integrated of order zero, are integrated of order one or a mix of the former and the latter, yet, if any of the variables is integrated of order two, this approach is not applicable (Sahoo et al., 2016).

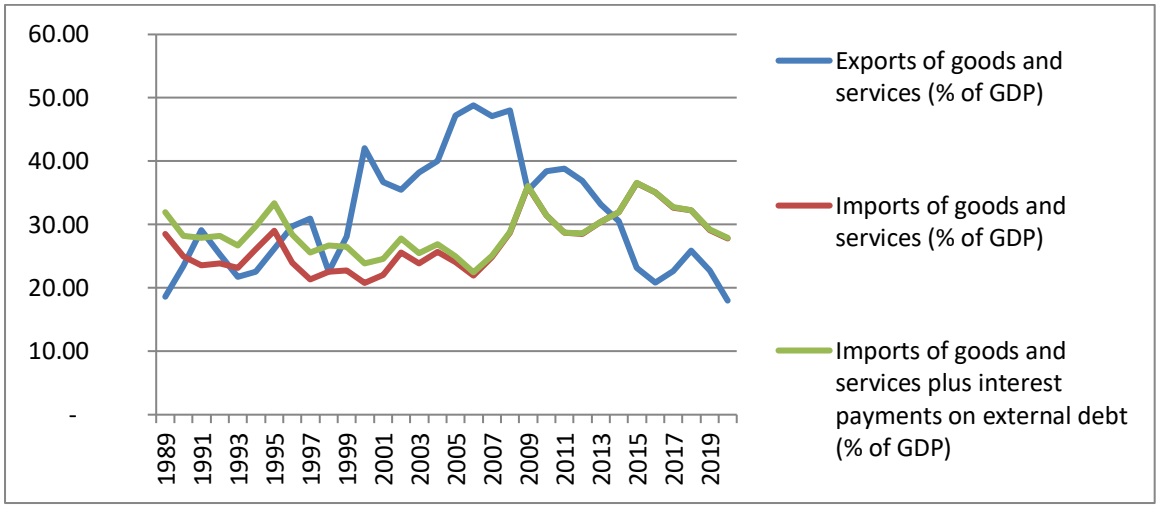
Despite there are many approaches to testing cointegration relation among variables, such as the fully modified ordinary least square (FMOLS) approach, residual based approach, and maximum likelihood based approach, but Autoregressive Distributed lag (ARDL) model outperforms these approaches: (i) by considering all variables to be endogenous, ARDL model minimizes endogeneity problem, (ii) short-run and long-run parameters are estimated simultaneously, which remove omitted variable and autocorrelation problems, and (iii) ARDL model does not require prior knowledge of the variables' order of integration. Equation (13) can be given as an unrestricted error correction representation of the ARDL model as:

$$\Delta EX_t = \gamma_0 + \sum_{i=1}^{n} \gamma_{1i}\, \Delta EX_{t-i} + \sum_{i=1}^{n} \gamma_{2i}\, \Delta MM_{t-i} + \delta_1 EX_{t-1} + \delta_2 MM_{t-1} + \mu_t$$

Where: μ denotes the standard error term.

If $\delta_1 = \delta_2 = 0$, the null hypothesis of no cointegration between EX and MM is accepted and the alternative hypothesis of cointegration is rejected, whereas if $\delta_1 \neq 0 \; and \; \delta_2 \neq 0$, the null hypothesis of no cointegration between EX and MM is rejected and the alternative hypothesis of cointegration is accepted (Hassan et al., 2016).

Figure 4.1. Trends in Algeria's exports, imports and imports plus interest payments on external debt (expressed as a percentage of GDP) from 1989 to 2020



Source:World Bank, 2022

To run unit root test, there are traditional methods such as the Augmented Dickey-Fuller test, and structural break tests such as the Zivot-Andrew break test, which are used to reveal the stationarity and order of integration among the variables series. Usually, traditional methods are not able to capture shocks to the economy that can be resulted from macroeconomic and structural changes such as inflation, unemployment and natural disaster, these conventional methods often account such shocks as stationary, hence, conducting a structural break test is necessary to reveal the date of occurrences of such shocks, the oil shock is the main factor which has triggered bulk of the shocks to Algerian economy (Udemba & SelinYalçıntaş, 2021). Perron tests are the most known methods to test the level of integration of times series in the presence of structural breaks (with one structural break), Perron tests allow for two types of structural breaks:(i) innovative outlier, and (ii) additive outlier (Rybinski, 1997).
It is well recognized that there are two hypotheses to test the stationary or non-stationary of the time series, null against the alternative, if the calculated τ value was upper than the critical τ value in absolute terms, the alternative hypothesis of stationary is accepted and null hypothesis is rejected, while if calculated τ value was lower than critical τ value in absolute terms, the null hypothesis of non-stationary is accepted and the alternative hypothesis is rejected (Cheema, 2006).

Table 4.1. Augmented Dickey-Fuller Unit Root Test

	Level			First Difference		
Variables	t-statistics	t-criticals	Status	t-statistics	t-criticals	Status
EX	-0.433513	-1.952066	non- stationary	-5.240858	-1.952473	Stationary
MM	-2.495934	-2.960411	non- stationary	-5.184459	-1.952473	Stationary

Source: Author's computation using E-views 10

The results of table 4.1 show that both time series are stationary at the first difference.

Table 4.2. Unit Root with break test

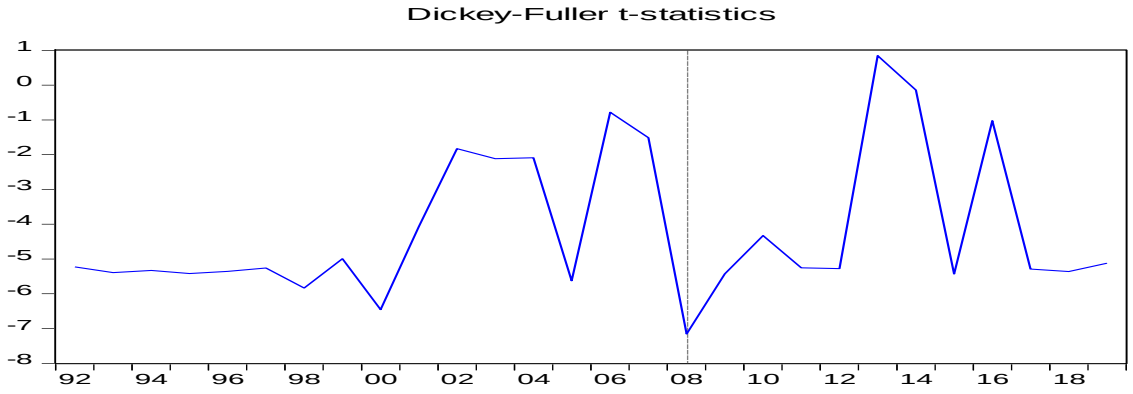
	Level		First Difference	
Variables	t-statistics	Status	t-statistics	Status
EX	-3.951052	non- stationary	-7.157003*	Stationary
MM	-4.699798	non- stationary	-5.492101*	Stationary

Source: Author's computation using Eviews 10

* indicate significance level at p<0.01.

If the p-value is lower than 0.01 the null hypothesis of a unit root is rejected, and vice versa (IHS Markit, 2017). The results of table 4.2 show that both time series are stationary at the first difference. These results are in line with those reported in table 4.1 about the order of integration of variables series.

Figure 4.2. Test statistics graph of EX

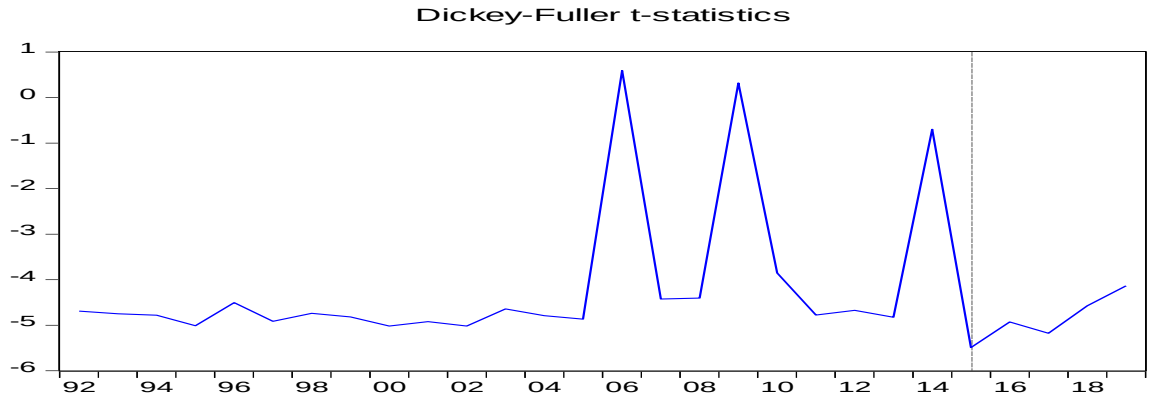


Source: Author's computation using Eviews 10

The results of figure 4.2 point out that the break date on EX is 2008. This break date can be attributed to the global financial crisis fallouts on the Algerian economy.

The global financial crisis has affected both world GDP and world trade negatively; however, the decline in world trade was much worse than the drop in world GDP, for 2009 the downfall in world trade was estimated at 11.6% against a 2.1% decline in world GDP that year (Essers, 2013). For Algeria, its GDP growth at current US$ was estimated by roughly -19.76% in 2009 against roughly 26.69% in 2008, in correspond its exports of goods and services growth at current US$ were estimated by roughly -40.84% in 2009 against 29.12% in 2008 (World Bank, 2022). Induced by postponed consumption and investment (such as investment goods and consumer durables) global demand has obviously declined especially in advanced economies, affecting adversely on oil prices. The divergence between GDP and trade movement explains that postponable goods account for a large share of world trade against a minor share in world GDP (Essers, 2013).

Figure 4.3. Test statistics graph of MM



Source: Author's computation using Eviews 10

The results of figure 4.3 depict that the break date on MM is 2015. This break date can be attributed to austerity spending policy which has been adopted by Algeria to encounter the adverse repercussions of oil shock, where prices were sharply dropped (Driouche et al., 2021). Hydrocarbons exports are the main engine of the Algerian economy, they accounted for 94% of product exports, 19% of GDP, and 40% of budget revenues during the period 2015-2020, the free fall of oil prices in 2014 caused fiscal and current account deficits for years, besides sharp decrease in foreign exchange reserve which it had accumulated over the oil super-cycle of 2008-14 (Serrano, 2022). As a result of Algerian disease (paraphrasing the term Dutch disease), the Algerian economy has suffered from cyclical crises due to low and sudden volatility of oil prices on international energy markets, besides the massive dependence upon international markets to satisfy the domestic demand (Almenar-Llongo et al., 2021).

Induced by the oil prices crisis in 2014, the annual average prices of Algeria's oil dropped from 99.1 US$ per barrel in 2014 to 52.8, 44.8, 53.9, 71.3, 64.4, 42.12 US$ per barrel in 2015, 2016, 2017, 2018, 2019, 2020, respectively, in correspond the current account deficits exacerbated from US$ -9 264.3 million in 2014 to US$ -18 221.4 million in 2020, and the foreign exchange reserve decreased significantly from US$ 186 722.48 million in 2014 to US$ 60 467.24 million in 2020 (i.e., running out of US$ 126 255.24 million) (Ministère des finances:La Direction Générale de la Prévision et des Politiques(DGPP), 2022; IMF, 2022; Algérie presse services, 2022).

Optimal lags for both dependent and independent variables are selected through the results of the majority of six available methods (LL, LR, FPE, AIC, HQIC, SBIC) (Arshed, 2017; Arshed, 2014). LL, LR, FPE, AIC, HQIC and SBIC refer to log-likelihood, likelihood ratio, final prediction error, Akaike information criterion, Hannan-Quinn information criterion and Schwarz Bayesian information criterion (Adu & Denkyirah, 2017; Idrovo-Aguirre & Contreras-Reyes, 2021). SBIC is the most appropriate criterion which is used in selecting the appropriate lag length of an ARDL model, because the model selected by SBIC is a more parsimonious model that saves degrees of freedom, particularly in studies with small sample size (Nagawa et al., 2020).

Table 4.3. Optimal lag period for EX

Lag	LL	LR	FPE	AIC	HQIC	SBIC
0	-101.451		88.2422	7.31793	7.33248	7.36551
1	-84.6212	33.66*	28.4912*	6.18723*	6.21632*	6.28239*
2	-84.475	0.29249	30.3004	6.24821	6.29185	6.39095
3	-83.7234	1.5032	30.878	6.26595	6.32414	6.45627
4	-83.6468	0.15319	33.0462	6.33191	6.40464	6.56981

Source: Author's computation using STATA 15

As shown in table 4.3, the optimal lag period for EX is one.

Table 4.4. Optimal lag period for MM

Lag	LL	LR	FPE	AIC	HQIC	SBIC
0	-76.0481		14.3764	5.50343	5.51798	5.55101
1	-67.4452	17.206*	8.35398*	4.96037	4.98946*	5.05553*
2	-66.441	2.0085	8.35631	4.96007*	5.0037	5.1028
3	-66.181	0.51995	8.81997	5.01293	5.07111	5.20324
4	-66.17	0.02202	9.48359	5.08357	5.1563	5.32146

Source: Author's computation using STATA 15

Similarly, the optimal lag period for MM is one as illustrated in table 4.4.

The bounds test is used to investigate whether there is a long run-relationship between exports and imports, it provides three possible outcomes: (i) no long-run relationship among variables, if the calculated F-statistic lies below the lower bound of the critical value band, meaning that the null hypothesis of no cointegration between exports and imports is accepted, (ii) existence of a long-run relationship among variables, if the calculated F-statistic falls above the upper bound of the critical value band, meaning that the null hypothesis of no cointegration between exports and imports is rejected, and (iii) the test result is inconclusive if the F-statistic lies inside the bounds (Yol, 2009).

Table 4.5. ARDL Bounds Test

F-Bounds Test			
F-Value	Signif.	I(0)	I(1)
1.304418	10%	3.223	3.757
	5%	3.957	4.53
	1%	5.763	6.48

Source: Authors' Computation using eviews 10

The results of table 4.5 depict that the F-statistic is lies below the lower bound of the critical value band at the 5% significance level ($1.304418 < 3.957$), implying no long-run relationship between exports and imports (i.e., the null hypothesis of no cointegration between

exports and imports is accepted), therefore, the current account of Algeria is unsustainable. Thus, we reject the first hypothesis.

4.2 The nexus between Country risk and Algeria's export diversification amid trade openness:

4.2.1 Country risk:

There are several global rating agencies (such as Standard & Poor's, Euromoney, Moody's and Economic Intelligence Unit (EIU)), which provide statements about country risk ratings for many countries, however, the risk ratings data constructed by the International Country Risk Guide (hereafter ICRG) outperform the data provided by previous ratings agencies for several reasons: (i) Country risk constructed by ICRG agency comprises 3 subcomponents, which are: political risk, economic risk and financial risk, rendering the comparative assessments of the fundamentals of a country at international level by investors likely easier, and (ii) the ICRG agency provides detailed monthly data, which rises the time series frequency (Lee et al., 2017). ICRG's country risk comprises 22 components of which 12 components are for political risk, 5 components for economic risk and 5 components for financial risk; each component is assigned points of risk, such that the lowest number of points (i.e., zero) reflecting the highest potential risk, while the highest number of points referring the lowest potential risk (Ramady, 2014).

Composite country risk index = [(political risk + economic risk + financial risk) / 2] (Topal & Gül, 2016).The composite country risk index ranges from 0 to 100 points, which are split into five categories, as shown in table 4.6.

Table 4.6. Composite country risk index: scales and categories

Scale	Category
00.0 to 49.9 points	Very high risk
50.00 to 59.9 points	High risk
60.00 to 69.9 points	Moderate risk
70.00 to 79.9 points	Low risk
80.00 to 100 points	Very low risk

Source: (Arora & Kumar, 2022; Gaillard, 2020)

Based on a specific scale established by ICRG, the performance of each component is transformed into a point score as shown in table 4.6 (Gaillard, 2020).

4.2.1.1 The Economic risk:

The Economic risk index strives to estimate the present level of a country's economic strengths and weaknesses (Kirikkaleli & Onyibor, 2020). Economic risk rating ranges from 0 to 50 (Lee et al., 2017).

Table 4.7. Economic risk index components and their range scale

Economic risk index components	Minimum points (High risk)	Maximum points (Low risk)
GDP per Head	0	5
Real Annual GDP growth	0	10
Annual Inflation Rate	0	10
Budget Balance as a percentage of GDP	0	10
Current Account Balance as a Percentage of GDP	0	15
TOTAL		50

Source: (Hoti & McAleer, 2004)

Country i's GDP per capita = (GDP per capita of country i for a given year, converted into US $, using the average exchange rate for that year/ the average of the estimated total GDP per capita of all the countries).

Country i's real annual GDP growth refers to the annual change (i.e., percentage increase or decrease) in the estimated GDP at constant prices.

Country i's estimated annual inflation rate (the unweighted average of the Consumer Price Index) is measured as a percentage change.

Country i's budget balance as a percentage of GDP = [Budget Balance (government revenue – government expenditure) for a given year with its current local currency / its estimated GDP for that year with current local currency]. It should be noted that grants are taken into consideration in calculating the estimated central government budget balance for each country.

Country i's current account balance as a percentage of GDP = [(Current Account Balance for a given year with its current local currency * the average exchange rate measured with US $) / its estimated GDP with current local currency * the average exchange rate of the concerned country for that year measured with US $] (The PRS GROUP; Rahman & Bristy, 2016).

Table 4.8 . GDP per capita: point scales

% of average	Points	% of average	Points
≥250.0	5.0	40.0-49.9	2.0
200.0-249.9	4.5	30.0-39.9	1.5
150.0-199.9	4.0	20.0-29.9	1.0
100.0-149.9	3.5	10.0-19.9	0.5
75.0-99.9	3.0	≤ 9.9	0.0
50.0-74.9	2.5		

Source: (Gaillard, 2020)

Table 4.9. Real Annual GDP Growth: point scales

Change (%)	Points	Change (%)	Points
≥6.0	10.0	-0.9 to -0.5	4.5
5.0-5.9	9.5	-1.4 to -1.0	4.0
4.0-4.9	9.0	-1.9 to -1.5	3.5
3.0-3.9	8.5	-2.4 to -2.0	3.0
2.5-2.9	8.0	-2.9 to -2.5	2.5
2.0-2.4	7.5	-3.4 to -3.0	2.0
1.5-1.9	7.0	-3.9 to -3.5	1.5
1.0-1.4	6.5	-4.9 to -4.0	1.0
0.5-0.9	6.0	-5.9 to -5.0	0.5
0.0-0.4	5.5	≤ −6.0	0.00
-0.4 to -0.1	5.0		

Source: (Gaillard, 2020)

Table 4.10. Annual Inflation Rate: point scales

Change (%)	Points	Change (%)	Points
<2.0	10.0	22.0-24.9	4.5
2.0-2.9	9.5	25.0-30.9	4.0
3.0-3.9	9.0	31.0-40.9	3.5
4.0-5.9	8.5	41.0-50.9	3.0
6.0-7.9	8.0	51.0-65.9	2.5
8.0-9.9	7.5	66.0-80.9	2.0
10.0-11.9	7.0	81.0-95.9	1.5
12.0-13.9	6.5	96.0-110.9	1.0
14.0-15.9	6.0	111.0-129.9	0.5
16.0-18.9	5.5	≥ 130.0	0.0
19.0-21.9	5.0		

Source: (Gaillard, 2020)

Table 4.11. Budget Balance as a percentage of GDP: point scales

Ratio (%)	Points	Ratio (%)	Points
≥4.0	10.0	-6.9 to -6.0	4.5
3.0-3.9	9.5	-7.9 to -7.0	4.0
2.0-2.9	9.0	-8.9 to -8.0	3.5
1.0-1.9	8.5	-9.9 to -9.0	3.0
0.0-0.9	8.0	-11.9 to -10.0	2.5
-0.9 to -0.1	7.5	-14.9 to -12.0	2.0
-1.9 to -1.0	7.0	-19.9 to -15.0	1.5
-2.9 to -2.0	6.5	-24.9 to -20.0	1.0
-3.9 to -3.0	6.0	-29.9 to -25.0	0.5
-4.9 to -4.0	5.5	≤ −30.0	0.0
-5.9 to -5.0	5.0		

Source: (Gaillard, 2020)

Table 4.12. Current Account Balance as a Percentage of GDP: point scales

Ratio (%)	Points	Ratio (%)	Points
≥10.0	15.0	-16.9 to -16.0	7.0
8.0-9.9	14.5	-17.9 to -17.0	6.5
6.0-7.9	14.0	-18.9 to -18.0	6.0
4.0-5.9	13.5	-19.9 to -19.0	5.5
2.0-3.9	13.0	-20.9 to -20.0	5.0
1.0-1.9	12.5	-21.9 to -21.0	4.5
0.0-0.9	12.0	-22.9 to -22.0	4.0
-0.9 to -0.1	11.5	-23.9 to -23.0	3.5
-1.9 to -1.0	11.0	-24.9 to -24.0	3.0
-3.9 to -2.0	10.5	-26.9 to -25.0	2.5
-5.9 to -4.0	10.0	-29.9 to -27.0	2.0
-7.9 to -6.0	9.5	-32.5 to -30.0	1.5
-9.9 to -8.0	9.0	-34.9 to -32.5	1.0
-11.9 to -10.0	8.5	-39.9 to -35.0	0.5
-13.9 to -12.0	8.0	≤ −40.0	0.0
-15.9 to -14.0	7.5		

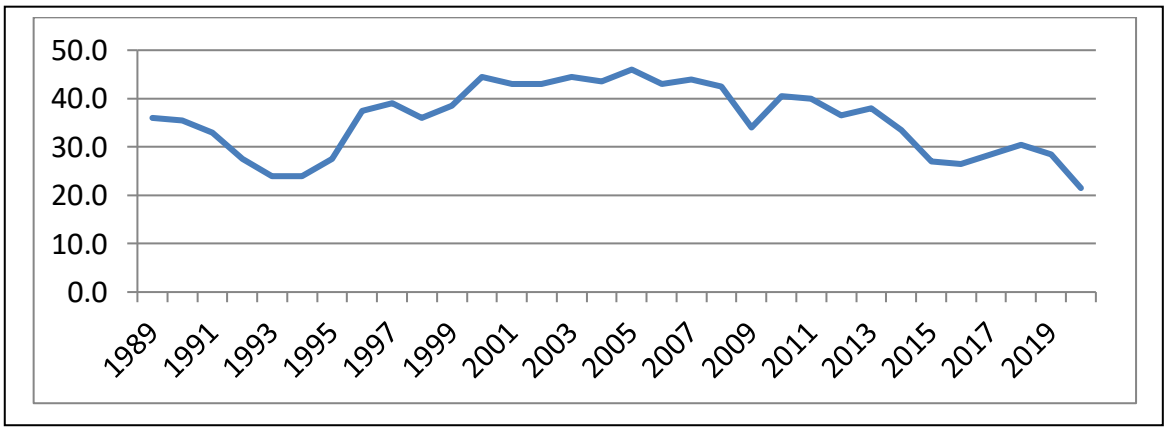
Source: (Gaillard, 2020)

The economic risk level = (earned points/total points)* 50

Where: total points are 50

The economic risk level ranges between 0, 00% and 50% (Rahman & Bristy, 2016). From 0.00% to 24.9% points out a very high risk, from 25.0% to 29.9% indicates high risk, from 30.0% to 34.9% refers moderate risk, from 35.0% to 39.9% indicates low risk and from 40.0% or more refers very low risk (The PRS GROUP)

Figure 4.4. Algeria's economic risk index from 1989 to 2020



Source: Author's calculations based on: IMF, 2022; the World Bank, 2022; Bank of Algeria, 2002, 2003, 2004, 2005, 2006, 2008, 2010, 2012, 2014, 2016, 2017 and 2018; Office National des Statistiques, 2022; Lemya, 2022

It should be noted that GDP per capita (in current US dollars), real annual GDP growth and Algeria's current account balance in current US dollars (from 1989 to 1996, besides 2019 and 2020) were directly sourced from the International Monetary Fund (IMF) database, annual inflation rate were directly taken from the World Bank database. Algeria's current account balances in US dollars (from 1997 to 2001) were directly sourced from the Bank of Algeria database (rapport annuel de la banque d'Algérie 2002).

To investigate the main subcomponents that affect Algeria's economic risk index, we will conduct a correlation matrix. Pearson's correlation is a technique used for testing the strength of statistical association between two quantitative and continuous variables (Ramady, 2014). The formula of Pearson's correlation is given as:

$$r = SP/\sqrt{SSX \times SSY}$$

Where:

$$SP = \sum (X - \bar{X})\,(Y - \bar{Y}) = \sum XY - \frac{(\sum X \sum Y)}{n}$$

$$SSX = \sum (X - \bar{X})^2 = \sum (X)^2 - \frac{(\sum X)^2}{n}$$

$$SSY = \sum (Y - \bar{Y})^2 = \sum (Y)^2 - \frac{(\sum Y)^2}{n}$$

Where : the superscript – refers to the mean.

There are three basic characteristics of a Pearson's correlation:(i) the direction, which could be negative or positive. A negative correlation means that as the X-variable increases, the Y-variable decreases, whereas a positive correlation signifies that as the X-variable increases, the Y-variable increases.(ii) the strength, which extends from -1 through 0 to +1, for example -1 and +1 reflect a perfect negative correlation and a perfect positive correlation, respectively, while 0 indicates no correlation between the variables, and (iii) the linearity (e.i., its form is linear) (Okunev, 2022).

Commonly, when the absolute value of the Pearson correlation coefficient is greater than 0.8, there is a considerable correlation between those variables (Li & Gospodarik, 2022).

Table 4.13. Correlation matrix of Algeria's economic risk index

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) Economic risk index	1.000					
(2) Current Account Balance as a Percentage of GDP	0.831	1.000				
(3) Budget Balance as a percentage of GDP	0.895	0.827	1.000			
(4) Annual Inflation Rate	0.492	0.084	0.226	1.000		
(5) Real Annual GDP growth	0.650	0.307	0.387	0.350	1.000	
(6) GDP per Head	0.097	0.246	0.072	-0.164	-0.062	1.000

Source: Author's preparation using STATA 15

The results of table 4.13 demonstrate a positive correlation between Algeria's economic risk index and its subcomponents, that is, an increase of one subcomponent would lead to an increase in the overall economic risk index. Budget balance as a percentage of GDP and current account balance as a percentage of GDP are the major factors affecting the index, followed by real annual GDP growth and annual inflation rate, respectively.

4.2.1.2 The Financial risk:

The financial risk index seeks to assess the ability of a given country to pay its way, that is, its ability to finance its official, commercial, and trade debt obligations (Ramady, 2014).
Financial risk rating ranges from 0 to 50 (Lee et al., 2017).

Table 4.14. Financial risk index components and their range scale

Financial risk index components	Minimum points (High risk)	Maximum points (Low risk)
Foreign debt as a percentage of GDP	0	10
Foreign debt service as a percentage of exports of goods and services	0	10
Current account as a percentage of exports of goods and services	0	15
Net international liquidity as months of import cover	0	05
Exchange rate stability	0	10
TOTAL		50

Source: (Gaillard, 2020)

Country i's foreign debt as a percentage of GDP = [(its gross foreign debt in current local currency * the average exchange rate of each year measured in US $) / (its GDP in current local currency * the average exchange rate for that year measured in US $)].
Country i's foreign debt service as a percentage of exports of goods and Services = [(its foreign debt service in current local currency * the average exchange rate of each year measured in US $) / (its total value of exports of goods and Services in current local currency * the average exchange rate for that year measured in US $)].
Country i's Current account as a percentage of exports of goods and Services = [(its current account balance in current local currency * the average exchange rate of each year measured in US $) / (its total value of exports of goods and Services in current local currency * the average exchange rate for that year measured in US $)].
Country i's net international liquidity as months of import cover = [(its total estimated official reserves in current local currency * the average exchange rate of each year measured in US $ (in which, official holdings of gold, are converted into US dollars at the free market price, besides excluding both the foreign liabilities of the monetary authorities and the use of IMF credits)) /(its average monthly merchandise import cost in current local currency * the average exchange rate for that year measured in US $)]
Country i's exchange rate stability = [(Country i's domestic currency exchange rate against US $ at the end of the calendar year - Country i's domestic currency exchange rate against US $ at the beginning of that year) / (Country i's domestic currency exchange rate against US $ at the beginning of the calendar year)] (The PRS GROUP; Rahman & Bristy, 2016).

Table 4.15. Foreign debt as a percentage of GDP: point scales

Ratio (%)	Points	Ratio (%)	Points
0.0-4.9	10.0	60.0-69.9	4.5
5.0-9.9	9.5	70.0-79.9	4.0
10.0-14.9	9.0	80.0-89.9	3.5
15.0-19.9	8.5	90.0-99.9	3.0
20.0-24.9	8.0	100.0-109.9	2.5
25.0-29.9	7.5	110.0-119.9	2.0
30.0-34.9	7.0	120.0-129.9	1.5
35.0-39.9	6.5	130.0-149.9	1.0
40.0-44.9	6.0	150.0-199.9	0.5
45.0-49.9	5.5	≥ 200.0	0.0
50.0-59.9	5.0		

Source: (Gaillard, 2020)

Table 4.16. Foreign debt service as a percentage of exports of goods and Services: point scales

Ratio (%)	Points	Ratio (%)	Points
0.0-4.9	10.0	45.0-48.9	4.5
5.0-8.9	9.5	49.0-52.9	4.0
9.0-12.9	9.0	53.0-56.9	3.5
13.0-16.9	8.5	57.0-60.9	3.0
17.0-20.9	8.0	61.0-65.9	2.5
21.0-24.9	7.5	66.0-70.9	2.0
25.0-28.9	7.0	71.0-75.9	1.5
29.0-32.9	6.5	76.0-79.9	1.0
33.0-36.9	6.0	80.0-84.9	0.5
37.0-40.9	5.5	≥ 85.0	0.0
41.0-44.9	5.0		

Source: (Gaillard, 2020)

Table 4.17. Current account as a percentage of exports of goods and Services: point scales

Ratio (%)	Points	Ratio (%)	Points
≥ 25.0	15.0	-54.9 to -50.0	7.0
20.0-24.9	14.5	-59.9 to -55.0	6.5
15.0-19.9	14.0	-64.9 to -60.0	6.0
10.0-14.9	13.5	-69.9 to -65.0	5.5
5.0-9.9	13.0	-74.9 to -70.0	5.0
0.0-4.9	12.5	-79.9 to -75.0	4.5
-4.9 to -0.1	12.0	-84.9 to -80.0	4.0
-9.9 to -5.0	11.5	-89.9 to -85.0	3.5
-14.9 to -10.0	11.0	-94.9 to -90.0	3.0
-19.9 to -15.0	10.5	-99.9 to -95.0	2.5
-24.9 to -20.0	10.0	-104.9 to -100.0	2.0
-29.9 to -25.0	9.5	-109.9 to -105.0	1.5
-34.9 to -30.0	9.0	-114.9 to -110.0	1.0
-39.9 to -35.0	8.5	-119.9 to -115.0	0.5
-44.9 to -40.0	8.0	≤ -120.0	0.0
-49.9 to -45.0	7.5		

Source: (Gaillard, 2020)

Table 4.18. Net international liquidity as months of import cover: point scales

Net liquidity in months	Points	Net liquidity in months	Points
≥ 15	5.0	3.0-3.9	2.0
12.0-14.9	4.5	2.0-2.9	1.5
9.0-11.9	4.0	1.0-1.9	1.0
6.0-8.9	3.5	0.6-0.9	0.5
5.0-5.9	3.0	≤ 0.5	0.0
4.0-4.9	2.5		

Source: (Gaillard, 2020)

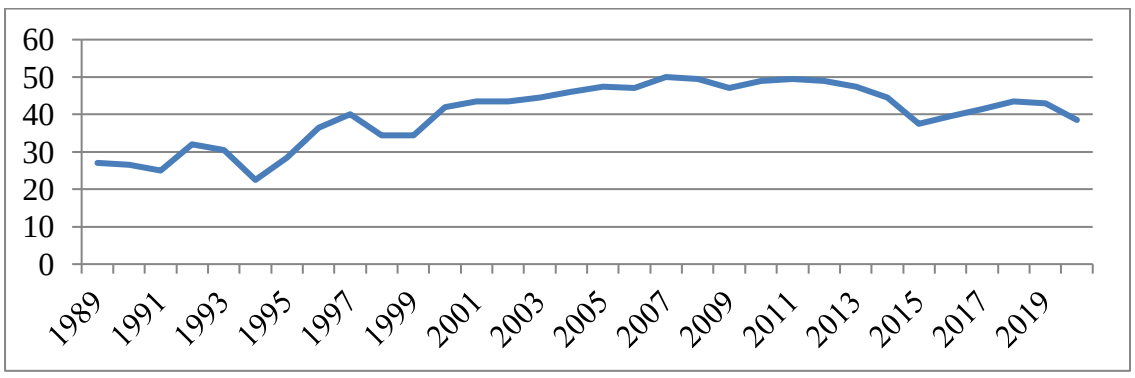
Table 4.19. Exchange rate stability: point scales

Depreciation (%)	Points	Appreciation (%)	Points
0.1-4.9	10.0	0.0-9.9	10.0
5.0-7.4	9.5	10.0-14.9	9.5
7.5-9.9	9.0	15.0-19.9	9.0
10.0-12.4	8.5	20.0-22.4	8.5
12.5-14.9	8.0	22.5-24.9	8.0
15.0-17.4	7.5	25.0-27.4	7.5
17.5-19.9	7.0	27.5-29.9	7.0
20.0-22.4	6.5	30.0-34.9	6.5
22.5-24.9	6.0	35.0-39.9	6.0
25.0-29.9	5.5	40.0-49.9	5.5
30.0-34.9	5.0	≥ 50.0	5.0
35.0-39.9	4.5		
40.0-44.9	4.0		
45.0-49.9	3.5		
50.0-54.9	3.0		
55.0-59.9	2.5		
60.0-69.9	2.0		
70.0-79.9	1.5		
80.0-89.9	1.0		
90.0-99.9	0.5		
100.0	0.0		

Source: (Gaillard, 2020)

The method and scope of the financial risk level are the same as for the economic risk level (Rahman & Bristy, 2016).

Figure 4.5. Algeria's financial risk index from 1989 to 2020



Source: Author's calculations based on: the World Bank, 2022; Ministère des finances, 2022; Office National des Statistiques, 2020; the United States government (Economic Research Service: U.S. Department of Agriculture), 2022; IMF, 2022; Bank of Algeria, 2002, 2003, 2004, 2005, 2006, 2008, 2010, 2012, 2014, 2016, 2017 and 2018.

It should be noted that foreign debt (in current US$), foreign debt service (in current US$) and total reserves (includes gold, current US $) were directly sourced from the World Bank database, merchandise import (in current US dollars, for two years: 2019 and 2020) were directly taken from ministère des finances database. As regards exchange rate stability, we have used the nominal exchange rate (local currency per US $) of January and December of each calendar year from the United States government (Economic Research Service:U.S. Department of Agriculture) database.

Table 4.20. Correlation matrix of Algeria's financial risk index

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) Financial risk index	1.000					
(2) Foreign debt % GDP	0.737	1.000				
(3) Foreign debt service % EGS	0.841	0.825	1.000			
(4) Current Account % EGS	0.262	-0.297	-0.195	1.000		
(5) Net international liquidity as months of import cover	0.881	0.712	0.907	-0.034	1.000	
(6) Exchange rate stability	0.767	0.461	0.535	0.103	0.649	1.000

Source: Author's preparation using STATA 15

As shown in table 4.20, there is a positive correlation between Algeria's financial risk index and its subcomponents. Net international liquidity as months of import cover and foreign debt service as a percentage of exports of goods and services are the salient factors affecting the index, followed by exchange rate stability and foreign debt as a percentage of GDP, respectively.

4.2.1.3 The political risk:

The political risk index is calculated on the grounds of twelve weighted variables, which capture both political and social characteristics of a given country to ensure a more robust coverage of its political risk contents; this index is calculated using expert judgment, weights and casual assumptions (Kirikkaleli & Onyibor, 2020). Furthermore, the major components of the ICRG political risk are split into 15 subcomponents as (Ramady, 2014):

- Government stability
  - Popular support
  - Government unity
  - Legislative strength
- Internal conflict
  - Terrorism
  - Civil war
  - Civil disorder
- Socioeconomic conditions

- Consumer confidence
- Unemployment
- Poverty levels

- External conflict
  - Foreign pressures
  - War
  - Cross-border conflict
- Investment profile
  - Profits repatriation
  - Contract viability
  - Payment delays

Political risk rating ranges from 0 to 100 (Lee et al., 2017).

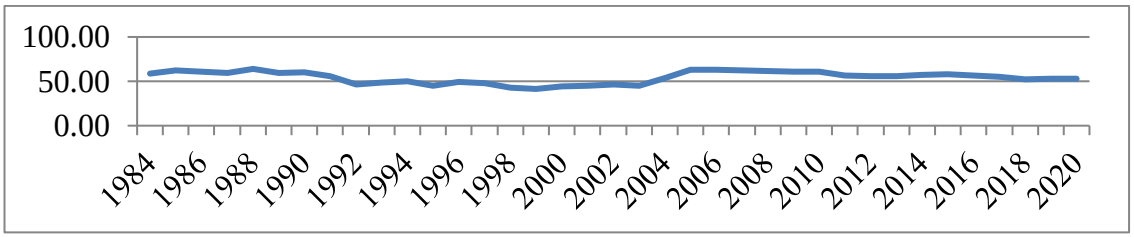
Table 4.21. Components and weights of the Political risk index

Political risk index components	Points (min.) High risk	Points (max.) Low risk
Socioeconomic conditions	0	12
Government stability	0	12
External conflict	0	12
Internal conflict	0	12
Investment profile	0	12
Law and order	0	6
Corruption	0	6
Ethnic tensions	0	6
Military in politics	0	6
Democratic accountability	0	6
Religious tension	0	6
Quality of bureaucracy	0	4
Total		100

Source: (Jiang & Martek, 2021)

Government stability assesses the ability of a country to implement its program and stay in office; socioeconomic conditions assess the satisfaction or dissatisfaction of the general public with the economic policies taken by the government; the investment profile points out four risks: taxation, labor costs, expropriation, and repatriation. The factors measured by the "corruption", "religious tensions", "external conflict", "ethnic tensions", "internal conflict", and "military in politics" components are self-evident. Law and order indicate the legal system's impartiality and strength, besides the extent of popular observance of the law. Democratic accountability concentrates on the responsiveness of the government to its citizens, and bureaucracy quality assesses the strength and expertise of the bureaucracy to govern without interruptions in government services or radical changes in policy (Gaillard, 2020). The main reason for measuring the political risk of any given country is the political stability level (Kirikkaleli & Onyibor, 2020).

Figure 4.6. Algeria's political risk index from 1984 to 2020



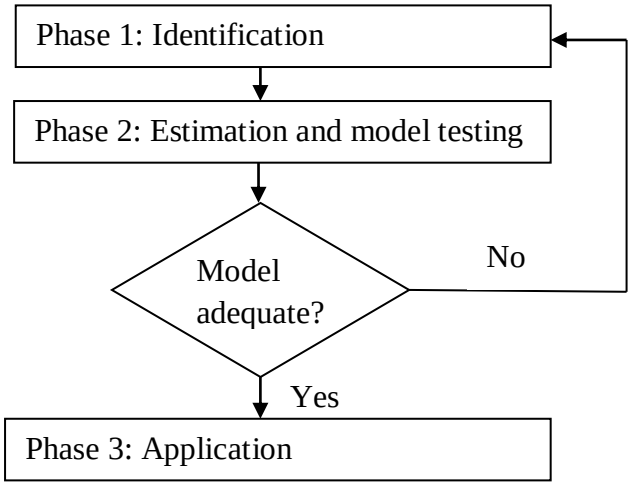
Source: Chibi (2021) and own calculations

As Algeria's ICRG political risk index data are freely available only from 1984 to 2017, we will use the Box-Jenkins approach to estimate the remaining data for 2018, 2019 and 2020.
The missing data could be predicted by implementing the Box-Jenkins approach (BuHamra et al., 2003).
The Box-Jenkins ARIMA methodology is a practical approach to the analysis of the time series and forecasting. In an autoregressive integrated moving average (ARIMA), a variable's future values are modeled as a linear function of previous observations and random errors, hence, the form of the data generating process is as:

$$y_t = \theta_0 + \emptyset_1 y_{t-1} + \emptyset_2 y_{t-2} + \cdots + \emptyset_\rho y_{t-\rho} + \epsilon_t - \theta_1 \epsilon_{t-1} - \theta_2 \epsilon_{t-2} - \cdots - \theta_q \epsilon_{t-q}$$

Where: y_t refers to the variable's actual values, ϵ_t stands for the error terms, ρ points out the order of the autoregressive (AR) term, q suggests the order of the moving average (MA) term, $\emptyset_i (i = 1,2,\ldots, \rho)$ and $\theta_j (j = 0,1,2,\ldots, q)$ indicate the model parameters(Chuku et al., 2019).

Figure 4.7. Box-Jenkins methodology



Source: (Chuku et al., 2019; Đoković et al., 2019; Dritsakis & Klazoglou, 2018)

The identification phase indicates whether the data follows a pure MA, a pure AR and a combination of ARIMA or ARMA (Ncanywa & Ralarala, 2022).

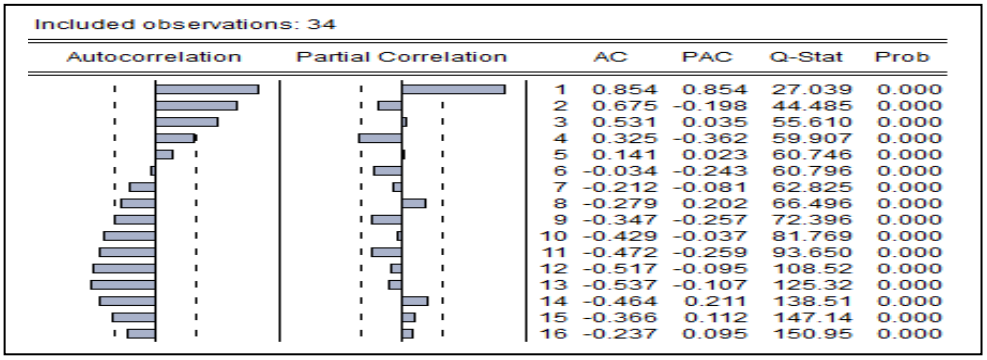
The dentification phase involves two main activities, which are data processing (preparation) and model selection (Chuku et al., 2019). The first phase involves testing whether the time series is stationary, based on a line graph, autocorrelation function and partial autocorrelation

function and Augmented Dickey-Fuller (ADF) test, in which the latter is preferred to detect the stationarity of the time series (Đoković et al., 2019; Dritsaki et al., 2021; Ma et al., 2018).
The parameter "d" stands for the differencing degree, in which the first difference (i.e., d=1) is usually sufficient to eliminate the stochastic trend in the time series (Isikli et al., 2022).
When the stationarity of the time series is achieved, it should be identified ρ and q orders of the ARIMA model(Đoković et al., 2019).
Parameters ρ and q are determined by the partial autocorrelation coefficient and the autocorrelation coefficient of the stationary series, respectively (Dritsaki et al., 2021).
The next phase contains two main activities:(i) estimation and (ii) model checking, to estimate the parameters of the potential models that were identified in the previous phase, non linear estimation methods (such as the maximum likelihood method) is used, thereafter, the best model is selected based on appropriate criteria (Dritsakis & Klazoglou, 2018).
There are several statistics that are used to select the best model that can yield the best forecasts with minimum forecast error, of which the lowest and significant coefficients of autoregressive and moving average, lowest information criterion of Akaike (AIC), lowest Schwarz criterion (SC), highest adjusted R^2 and lowest value of SIGMASQ (Ncanywa & Ralarala, 2022; Ma et al., 2018). However, the model that meets many statistics than the others, especially which has both significant coefficients of autoregressive and moving average is the best model that would be chosen (Ncanywa & Ralarala, 2022).
Diagnostic testing is conducted to investigate whether the estimated model is significant statistically and acceptable using the autocorrelation test of the residuals, normality test (the Jarque-Bera test) and ARCH test (test of the autocorrelation and partial autocorrelation of the squared residuals) (Dritsaki et al., 2021).
The application phase involves forecasting among other things (Chuku et al., 2019). There are several indicators to assess the prediction performance, of which the Theil's inequality coefficient U ($U\ Theil$), which is calculated as:

$$U\ Theil = \frac{\sqrt{\frac{1}{N}\sum_{t=1}^{N}\left(y_{f,t} - y_{a,t}\right)^2}}{\sqrt{\frac{1}{N}\sum_{t=1}^{N}\left(y_{f,t}\right)^2} + \sqrt{\frac{1}{N}\sum_{t=1}^{N}\left(y_{a,t}\right)^2}}$$

Where: N stands for the number of observations, $y_{f,t}$ and $y_{a,t}$ indicate the forecasted and actual values at time t, respectively. $U\ Theil$'s value ranges between 0 and 1, whereby the closer $U\ Theil$'s values to zero, the higher the performance of the model (Faghih et al., 2021; Dritsakis & Klazoglou, 2018).
To check whether the time series is stationary or not, based on the autocorrelation function and partial autocorrelation function, we look at the p-values, where:
If prob < 0.05, the time series is not stationary (Aljandali & Tatahi, 2018).

Figure 4.8. Autocorrelation and partial correlation graphs of political risk index from 1984 to 2017



Source: Author's computation using E-views 10

As shown in figure 4.8, the political risk index time series is not stationary at the level since prob < 0.05.

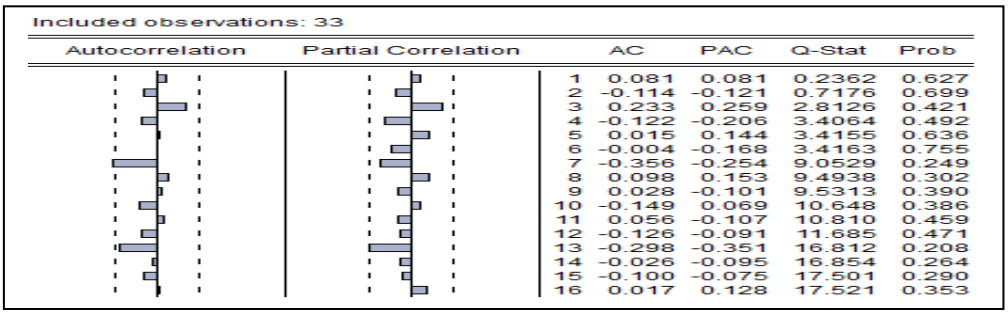
Table 4.22. Augmented Dickey-Fuller Unit Root Test

	Level			First Difference		
Variable	t-statistic	t-critical	Status	t-statistic	t-critical	Status
POLRI	-0.361896	-1.951332	non-stationary	-5.183606	-1.951687	Stationary

Source: Author's computation using E-views 10

The results of table 4.22 depict that the time series is stationary at the first difference.

Figure 4.9. Autocorrelation and partial correlation graphs of political risk index on first differences from 1984 to 2017



Source: Author's computation using E-views 10

ρ and q orders are identified based on the confidence interval formula, which is given as:

$$\mu \pm t_{\frac{\alpha}{2}} SE$$

Based on a 5% level of significance, the above formula becomes:

$$0 \pm 1.96\left(\sqrt{1/n}\right)$$

Where: n points out the sample size and SE refers to the standard error, which is expressed by $\sqrt{1/n}$

The coefficients of correlation lying outside these bounds are statistically significant at the 5% level (Aljandali & Tatahi, 2018)

In our analysis, the confidence interval Based on 5% level of significance is:

$0 \pm 1.96\left(\sqrt{1/34}\right)$, that is: - 0.336 to 0.336. From figure 4.9, $\rho = 13$ and $q = 7$

Table 4.23. Comparison of ARIMA models

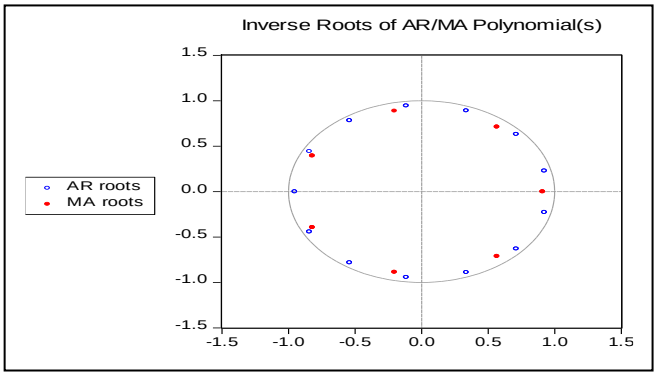
ARIMA (ρ, d, q)	AR(13)	MA(7)	AIC	SC	adjusted R^2	SIGMASQ
ARIMA (13,1,0)	-0.467***		5.483	5.619	0.172	10.666
ARIMA (13,1,7)	-0.521***	-0.516**	5.330	5.511	0.370	7.842
ARIMA (0,1,7)		-0.445**	5.474	5.610	0.138	11.107

Source: Author's computation using E-views 10

***and ** refer significant levels at p<0.01 and p<0.05, respectively. AIC and SC indicate Akaike information criterion and Schwarz criterion, respectively.

Looking at the results of table 4.23, ARIMA (13,1,7) is the best model since it has both significant coefficients of autoregressive and moving average, lowest AIC, SC and SIGMASQ, besides the highest adjusted R^2.

Figure 4.10.Inverse Roots of AR/MA Polynomial (s)

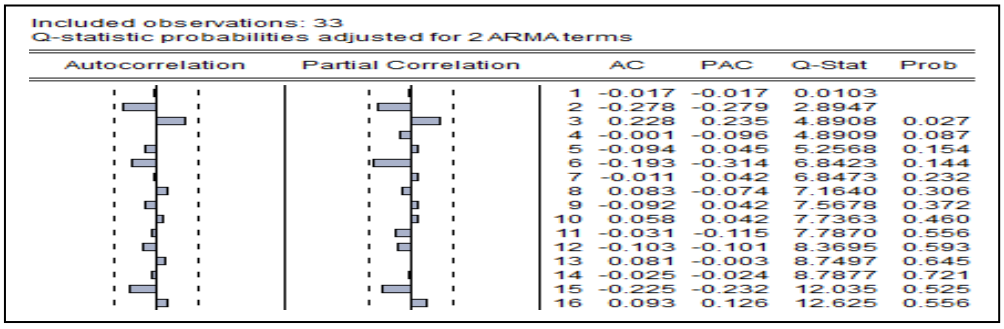


Source: Author's computation using E-views 10

The compatibility of the model with the ARIMA structure is accepted if the unit roots remain in the circle (Suleymanlı & Mammadov, 2021).

In our analysis, the unit roots are in the circle, indicating the compatibility of our model with the ARIMA structure.

Figure 4.11. Correlogram of Residuals


Included observations: 33
Q-statistic probabilities adjusted for 2 ARMA terms

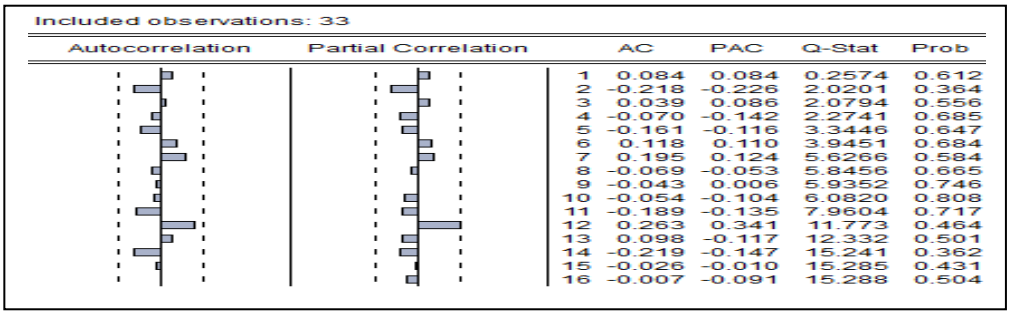
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.017	-0.017	0.0103	
		2	-0.278	-0.279	2.8947	
		3	0.228	0.235	4.8908	0.027
		4	-0.001	-0.096	4.8909	0.087
		5	-0.094	0.045	5.2568	0.154
		6	-0.193	-0.314	6.8423	0.144
		7	-0.011	0.042	6.8473	0.232
		8	0.083	-0.074	7.1640	0.306
		9	-0.092	0.042	7.5678	0.372
		10	0.058	0.042	7.7363	0.460
		11	-0.031	-0.115	7.7870	0.556
		12	-0.103	-0.101	8.3695	0.593
		13	0.081	-0.003	8.7497	0.645
		14	-0.025	-0.024	8.7877	0.721
		15	-0.225	-0.232	12.035	0.525
		16	0.093	0.126	12.625	0.556

Source: Author's computation using E-views 10

If autocorrelation and partial autocorrelation coefficients of the residuals are within the limits, it means no autocorrelation (Dritsaki et al., 2021).

Given autocorrelation and partial autocorrelation coefficients of the residuals are within the limits, there is no autocorrelation.

Figure 4.12. Correlogram of Residuals Squared



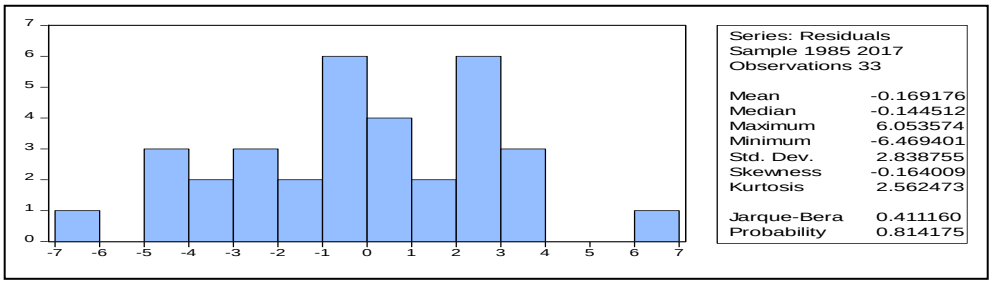
	AC	PAC	Q-Stat	Prob
1	0.084	0.084	0.2574	0.612
2	-0.218	-0.226	2.0201	0.364
3	0.039	0.086	2.0794	0.556
4	-0.070	-0.142	2.2741	0.685
5	-0.161	-0.116	3.3446	0.647
6	0.118	0.110	3.9451	0.684
7	0.195	0.124	5.6266	0.584
8	-0.069	-0.053	5.8456	0.665
9	-0.043	0.006	5.9352	0.746
10	-0.054	-0.104	6.0820	0.808
11	-0.189	-0.135	7.9604	0.717
12	0.263	0.341	11.773	0.464
13	0.098	-0.117	12.332	0.501
14	-0.219	-0.147	15.241	0.362
15	-0.026	-0.010	15.285	0.431
16	-0.007	-0.091	15.288	0.504

Source: Author's computation using E-views 10

If autocorrelation and partial autocorrelation coefficients of the squared residuals are within the limits, it means no ARCH effect (no autoregressive conditional heteroscedasticity on the residuals of ARIMA model in the level of significance of 5%) (Dritsaki et al., 2021).

As autocorrelation and partial autocorrelation coefficients of the squared residuals (except partial autocorrelation coefficient at lag 12) are within the limits, there is no ARCH effect.

Figure 4.13. Normality test

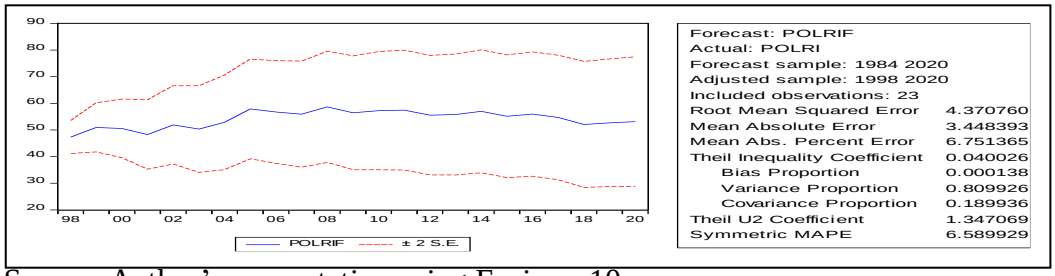


Source: Author's computation using E-views 10

If the probability value is upper than 0.05, indicating that the residuals follow a normal distribution (Aljandali & Tatahi, 2018)

Looking at the results of figure 4.13, the probability value (0.814175) is greater than 5%, meaning that the residuals follow a normal distribution

Figure 4.14. Dynamic forecasting of ARIMA (13,1,7) model



Source: Author's computation using E-views 10

As shown in figure 4.14, Theil's inequality coefficient is closer to zero, indicating high prediction performance of the ARIMA (13,1,7) model.
Thus, the estimated political risk index for 2018, 2019 and 2020 is 52.08, 52.7 and 53.14 respectively.

4.2.2. Algeria's export diversification and trade openness:

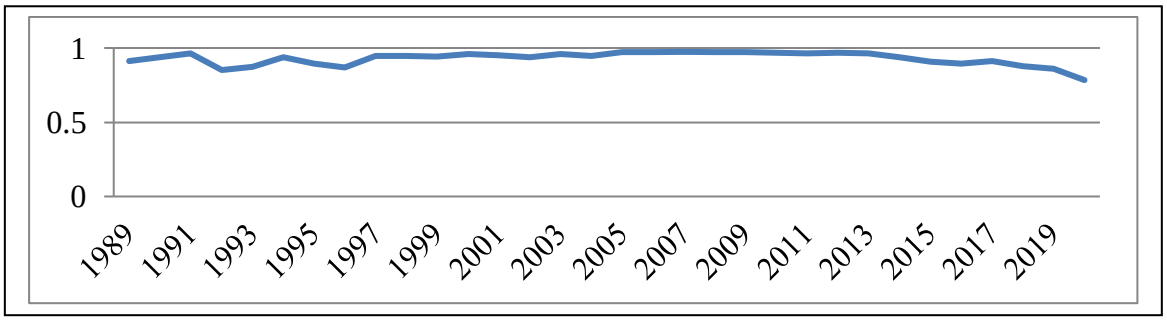
4.2.2.1 The Normalized Herfindahl-Hirschman Index:

It measures the degree of concentration of goods exported by each country. Its formula is given as:

$$\text{NHHI} = \frac{\sqrt{\sum_i^N P_i^2} - \sqrt{\frac{1}{N}}}{1 - \sqrt{\frac{1}{N}}}$$

Where: $P_i = \left(\frac{X_{i,j}}{X_j}\right)$, $X_{i,j}$ indicates the exports value of product i by country j, X_j suggests the total exports value of country j, N stands for the number of products or sectors. Its value ranges between 0 and 1, where zero refers to that goods exports value of country j are distributed homogeneously among them, while one points out that all exports value of country j come from a single good (Haouas & Heshmati, 2014; UNCTAD, 2019b). The main criticism which was addressed to this index is the not distinguish between the rising of new export commodities and the increase of existing product lines (Nathoo et al., 2021).

Figure 4.15. Algeria's NHHI trend from 1989 to 2020



Source: Author's preparation based on WTO database

Note: the value of exports of three sectors were used to calculate Algeria's NHHI, which are: (i) Agricultural products, (ii) Fuels and mining products, and (iii) manufactures.

Looking at the results of figure 4.15, Algeria's NHHI has recorded high values (mostly above 0.9), since the majority of Algeria's exports' value comes from the hydrocarbon sector.

4.2.2.2 The Squalli and Wilson index of trade openness:

Trade share (TS) of country i is given as:

$$TS_{\text{i}} = \frac{(\text{X} + M)_{\text{i}}}{\text{Y}_{\text{i}}}, \quad 0 \leq TS_{\text{i}} \leq \infty$$

Where: X, M and Y refer to total exports, total imports, and gross domestic product respectively.
Its world trade share (i.e., its weight in world trade) is given as:

$$WTS_i = \frac{(\mathrm{X}+M)_\mathrm{i}}{\sum_{j=1}^{n}(\mathrm{X}+M)_\mathrm{j}},\ \ 0 \le WTS_i \le 1,\ \ \mathrm{j} = \{1, 2, \dots \mathrm{i}, \dots \mathrm{n}\}$$

Where: $(\mathrm{X}+M)_\mathrm{i}$ stands for the total trade of country i, and $\sum_{j=1}^{n}(\mathrm{X}+M)_\mathrm{j}$ represents the total trade of the rest of the world (Mignamissi & Nguekeng, 2022; Squalli & Wilson, 2011).

Hence, the total trade of the world is given as:

$$\sum_{j=1}^{n}(\mathrm{X}+M)_\mathrm{j} = (\mathrm{X}+M)_\mathrm{i} + \sum_{j=1}^{n-1}(\mathrm{X}+M)_\mathrm{j} = X_i + M_i + \sum_{j=1}^{n-1}X_j + \sum_{j=1}^{n-1}M_j$$

As the imports (exports) of country i equal the exports (imports) of the rest of the world, then:

$$M_i = \sum_{j=1}^{n-1}X_j \ \ and \ \ X_i = \sum_{j=1}^{n-1}M_j$$

Hence:

$$\sum_{j=1}^{n}(\mathrm{X}+M)_\mathrm{j} = 2(\mathrm{X}+M)_\mathrm{i}$$

i.e.:

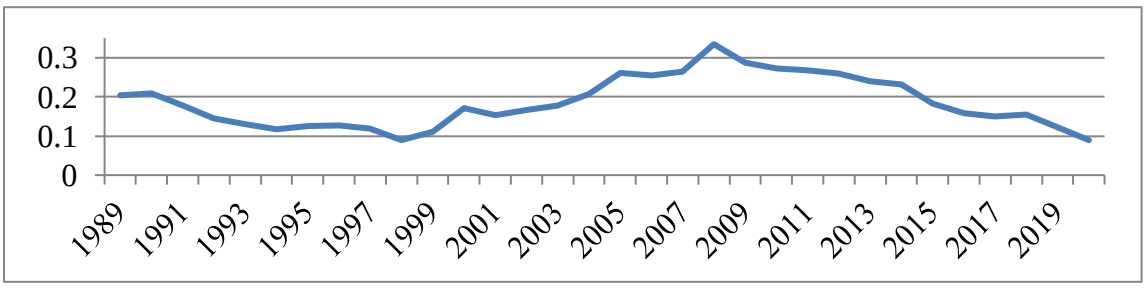
$$(\mathrm{X}+M)_\mathrm{i} = \frac{1}{2}\left[\sum_{j=1}^{n}(\mathrm{X}+M)_\mathrm{j}\right] \quad \text{with} \quad \sum_{\mathrm{i}=1}^{\mathrm{n}}\left[\frac{(\mathrm{X}+M)_\mathrm{i}}{\sum_{j=1}^{n}(\mathrm{X}+M)_\mathrm{j}}\right] = 1$$

Thus, the Squalli and Wilson index of trade openness for country i is given as:

$$CTS_i = \frac{(X+M)_i}{\frac{1}{n}\sum_{j=1}^{n}(X+M)_j}\frac{(X+M)_i}{Y_i},\quad \mathrm{j} = \{1, 2, \dots, \mathrm{i}, \dots, \mathrm{n}\}$$

Where: n represents trading partners (Mignamissi & Nguekeng, 2022).
In our study, data on exports and imports of 115 countries (including Algeria) have been used to calculate the WTS of Algeria, in which data are available during the period of study.

Figure 4.16. Evolution of Algeria's trade openness index from 1989 to 2020



Source: Author's preparation based on the World Bank database

4.2.3. The effect of Country risk on Algeria's export diversification within trade openness:

To investigate the relationship between trade openness and export diversification, we employed the ordinary least squares (OLS) estimation technique. The linear regression model is given as:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_n X_{ni} + u_i$$

Where: Y_i indicates the dependent variable, β_i stands for the parameters of the corresponding independent variables, and u_i refers to the error term (Mamo, 2022).
Based on the modeling framework of Lee & Wang (2021) and Rehman et al. (2020), our model can be specified as follow:

$$NHHI = \beta_0 + \beta_1 ERI + \beta_2 FRI + \beta_3 PRI + \beta_4 TOI + u_i$$

Where: $NHHI$ is the Normalized Herfindahl-Hirschman Index as a proxy for export diversification; ERI, FRI, PRI and TOI are the economic risk index, the financial risk index, the political risk index and the trade openness index, respectively.

Table 4.24. Analysis of Variance (ANOVA) test

Model	Sum of Squares	df	Mean Square	F	Sig
Regression	0.045	4	0.011	15.813	0.000
Residual	0.019	27	0.001		
Total	0.064	31			

Source: Author's preparation using SPSS version 22

The overall significance of a regression model at a 5% significance level (i.e., at least there is one independent variable in the regression model that can determine the dependent variable) is checked by the P-value indicated in the ANOVA table, which should be less than 0.05 (Mamo, 2022; Dukuly & Huang, 2020).
As shown in table 4.24, the P-value (0.000) is less than 0.05, meaning that the model as a whole is significant at a 5% significance level.

Table 4.25. Model summary

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
0.837	0.701	0.657	0.02668	1.831

Source: Author's preparation using SPSS version 22

The value of adjusted R square stands for the variation percentage in the dependent variable that is explained by the independent variables included in the model (Mamo, 2022).
As shown in table 4.25, the value of adjusted R square is 0.65, means that 65.7% variation in NHHI is explained by our explanatory variables.
A linear regression model should provide four assumptions which are:(i) Linearity, (ii) Homoscedasticity and no autocorrelation, (iii) Normal distribution, and (iv) No strong multicollinearity (Backhaus et al., 2021). The linearity can be checked by plotting the dependent variable against each explanatory variable (Backhaus et al., 2021). Ramsey Regression Equation Specification Error Test (RESET) *is a way of testing omitted variables and whether there exists some significant nonlinear relationships in order to validate our*

linear regression model or not (Nguena, 2019).The Ramsey Reset test indicates that if the P-value of the F-statistic is higher than 5%, the model was properly specified (Tahir et al., 2018).

Table 4.26. Ramsey Reset specification result

F (3,24)	2.29	Prob. F	0.1042

Source: Author's computation using STATA 15

As shown in table 4.26, the P-value of the F-statistic is higher than 5%, indicating that our model is properly specified.

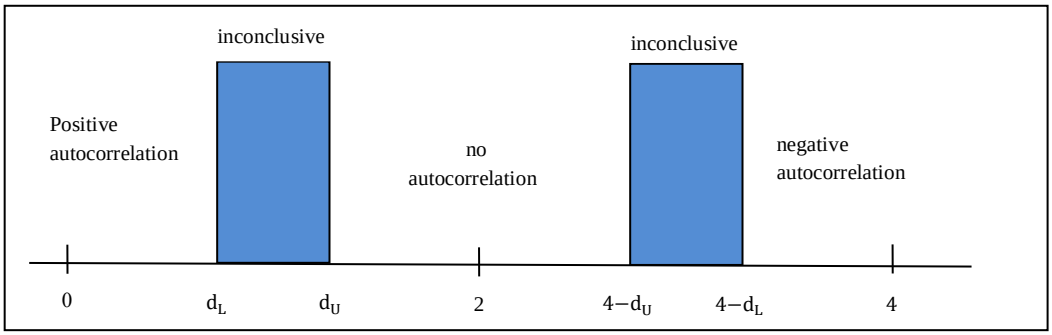
Table 4.27. Heteroskedasticity ARCH Test

F-statistic	0.186717	Prob. F(1,29)	0.6689
Obs*R-squared	0.198317	Prob. Chi-Square(1)	0.6561

Source: Author's preparation using E-views 10

If the p-value of the heteroskedasticity ARCH test is greater than 5%, the estimated model is, therefore, homoscedasticity (Aslam & Sivarajasingham, 2020).
Looking at the results of table 4.27, 0.6689>0.05, our model is, therefore, homoscedasticity

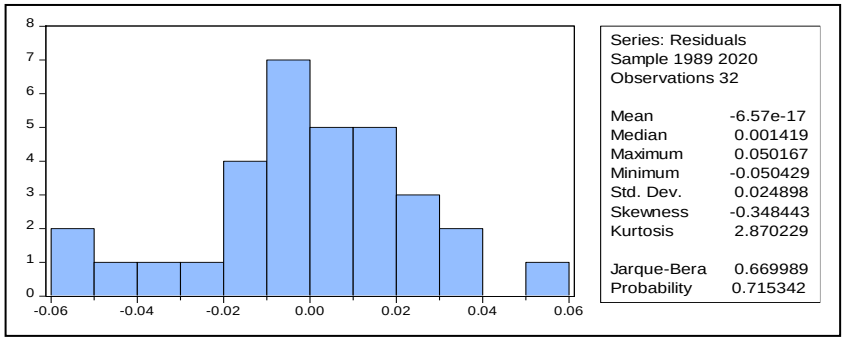
Figure 4.17. Regions of the Durbin-Watson statistic



Source: (Backhaus et al., 2021).

To detect autocorrelation, we used the Durbin-Watson test
As shown in figure 4.17, if DW< d_L or DW>$4-d_L$, it indicates the existence of autocorrelation; if $d_U < DW < 4-d_U$, it indicates no autocorrelation; while in all other cases, the test is inconclusive. The critical values d_U (upper limit) and d_L (lower limit) are derived from a Durbin-Watson table, in which for a given significance level (e.g., α =5%) the value of d_U and d_L vary based on the number of regressors and the number of observations (Backhaus et al., 2021). For 32 observations and 4 regressors, d_U = 1.732 at a 5% significance level (Savin & White, 1977).
As $1.732 < 1.831 < 2.268$, it indicates no autocorrelation

Figure 4.18. Normality Test



Source: Author's preparation using E-views 10

The residuals of the estimated model are normally distributed, if the p-value of the Jarque-Bera test was greater than 5% (Aslam & Sivarajasingham, 2020).

Looking at the results of figure 4.18, 0.715342>0.05, meaning that the residuals of our model are normally distributed.

The variance inflation factor (VIF) method is used to detect the absence (if VIF $<$ 10) or presence (if VIF $>$ 10) of multicollinearity (Priyono, 2018).

As shown in table 4.28, the VIF values of all explanatory variables are lesser than 10 (i.e., the absence of a multicollinearity problem.

Through the above tests, our model satisfies the four assumptions of a linear regression model.

Table 4.28. Estimated coefficients

Model	Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig	VIF
	B	Std. Error				
Constant	0.858	0.071		12.149	0.000	
ERI	0.004	0.001	0.557	3.677	0.001	2.074
FRI	-0.002	0.001	-0.271	-1.895	0.069	1.848
PRI	-0.002	0.001	-0.236	-1.206	0.238	3.450
TOI	0.497	0.169	0.705	2.945	0.007	5.171

Source: Author's preparation using SPSS version 22

The Sig column is used to check whether the coefficients of independent variables are statistically significant (if p-value$<$ 0.05) or not (if p-value$>$ 0.05) (Dukuly & Huang, 2020; Midoun & Zairi, 2014).

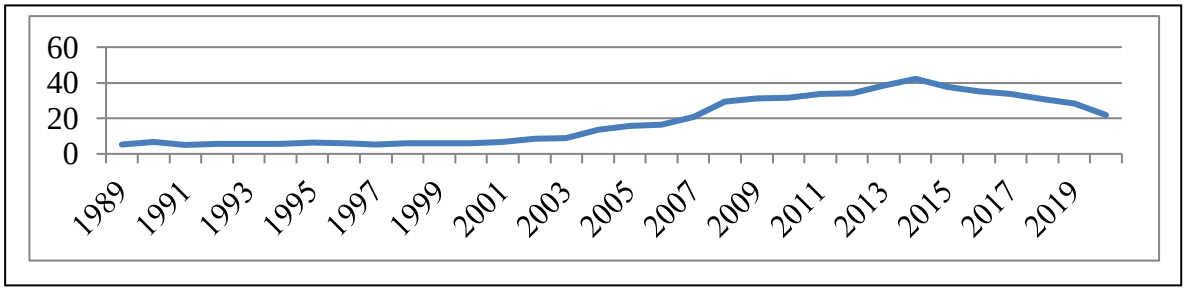
Based on the results of table 4.28, our regression model is specified as:

$$NHHI = 0.858 + 0.004\ ERI - 0.002\ FRI - 0.002\ PRI + 0.497\ TOI$$

Trade openness is the main factor negatively affecting export diversification, in which a 1% increase in the trade openness index will lead NHHI to increase (i.e., a decline in export diversification) by 0.497%. This result is in line with that concluded by Khobai and Moyo (2021) who indicated that trade openness is detrimental to the manufacturing sector in the African countries due to the lack of competitiveness of their manufacturing products. As a result of this weakness, the value of manufactured products imported by Algeria experienced

steady growth from US$ 6.822 billion in 2001 to US$ 42.192 billion in 2014 as shown in figure 4.19. According to Asiedu (2002), the lack of credibility of trade liberalization is the prominent reason for that weakness. Asiedu (2002) opines that foreign investors perceive trade liberalization as transitory reform and hence subject to reversal, for instance, trade policy is used by African countries to manage their payments balance (i.e., tightening trade restrictions when terms of trade deteriorate, and slackening those restrictions when terms of trade improve). Thus, we reject the second hypothesis.

Figure 4.19. Evolution of Algeria's manufacturing imports from 1989 to 2020



Source: Author's preparation based on WTO database

This result is opposite to that reported by Mignamissi and Nguekeng (2022), who argue that trade openness is a prominent positive determinant of industrialization in 53 African countries, of which Algeria, during the period from 1990 to 2019.

Counter-intuitive relationship between economic risk and export diversification, in that, an increase of Algeria's economic risk index (i.e., a decrease in economic risk) by 1% will result in a decline in export diversification by 0.004%. This result can be explained by the undesirable side effects of Dutch disease, especially, the impact of crowding-out of manufacturing as mentioned by Fankem & Feyom (2023) and Frankel (2012). They argue that booms in a particular sector (such as the natural resource sector) can harm the manufacturing sector, by attracting more investments and resources for the former. Thus, we reject the third hypothesis.

A Subdued response of export diversification to the financial risk index, due to the weak coefficient of Algeria's financial risk index that is significant at the 10% level. A 1% increase for FRI (i.e., a decline in financial risk) will lead NHHI to decrease (i.e., rising in export diversification) by 0.002%. This so little impact can be interpreted by the competitive diffusion, as indicated by Neumayer et al. (2016). Thus, we reject the third hypothesis.

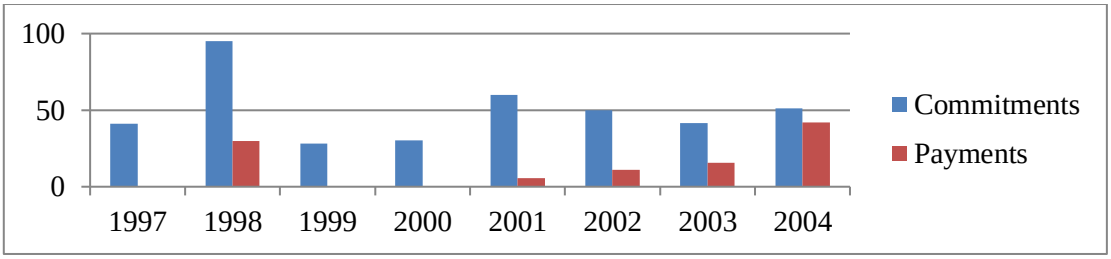
Algeria's political risk index has no effect on export diversification. This result is in line with that reported by Elhannani et al. (2018). In addition, Midoun & Zairi (2014) argue that the political risk variable has no effect on FDI flows into Algeria from 1990 to 2012. This result can be interpreted by the fact that resource-seeking FDI (e.g., oil sector), is highly profitable even in the highly unstable country (i.e., the returns on investment are adequately high to more than compensate the political risk), as mentioned by Ali et al. (2010), and Asiedu (2002). As resource-seeking FDI accounts for an important share of FDI inflows to Algeria, hence political risk does not play any role in diversifying its exports basket. Thus, we reject the third hypothesis.

4.3 The MEDA program, an initiative to the Algeria-European Union association agreement:

4.3.1 The MEDA program:

Induced by the steady growth of globalization, the European Union (EU) sought to enhance and maintain its strong economic position in the region of its traditional partners' regions on the southern and eastern shores of the Mediterranean by launching a new initiative called the Euro Mediterranean Partnership (EMP), which is ratified by both parties in 1995 at the Barcelona Conference. The MEDA (hereafter mésures d'accompagnement financière et techniques) program is the primary instrument for managing European aid under the EMP, which aims to contribute to the restructuring of Algeria's economy, promote the private investment, enhance activities creating jobs and the gradual formation and implementation of an FTA. In 2000, Algeria's government established the Fund for the Promotion of Industrial Competitiveness (Fonds de Promotion de la Compétitivité Industrielle) to upgrade its local companies, in which its allocation for the period 2001-2004 reached 5,651 Algerian Dinars billion (about $70 million). Among 293 companies which were requested financial assistance from this fund, just 191 companies were judged eligible. The amount of financial aid under MEDA is conditioned by the pace and the extent of reforms embraced by each Mediterranean partner country including Algeria (Aghrout, 2007).

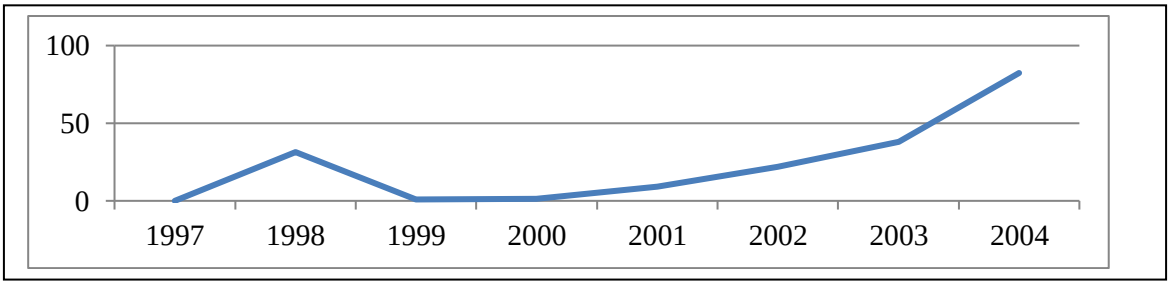
Figure 4.20. Commitments and payments for Algeria under the MEDA program during the period 1995-2004



Source: Author's elaboration based on Pasimeni et al. (2007)

As shown in figure 4.20, the aggregate commitments and payments for Algeria are 396.8 € million and 104.9 € million, respectively. Interestingly, despite that the total commitments in 2004 (51 € million) are lesser than total commitments in 2001(60 € million) and 1998 (95 € million), yet, the total payments in 2004 (42 € million) are higher than total payments in 2001(5.5€ million) and 1998 (30 € million).

Figure 4.21. Ratio of payments to commitments for Algeria under the MEDA program over the period 1995-2004



Source: Author's elaboration based on Pasimeni et al. (2007)

- As shown in figure 4.21, the Ratios of payments to commitments for Algeria under the MEDA program over the period 1995-2004 are characterized as: (i) mixed, among 0.00% in 1997 and 82.35% in 2004, and (ii) the weak of these ratios which didn't surpass 38% in the best of conditions, except in 2004.

4.3.2 The Algeria-European Union association agreement:

After lengthy negotiations, Algeria and the European Union signed an association agreement on April 22, 2002, in Valencia, Spain, which was entered into force in September 2005 (Aghrout, 2007). This agreement seeks to exemplify five aims, of which: (i) enhance trade and the enlargement of harmonious economic between the contracted parties, besides gradual liberalization of trade in goods, services and capital. (ii) triggering economic cooperation. However, one of the primary targets of Algeria is to increase foreign direct investment flows from European Community member states. Algeria and the European Community are bind to establish a free trade area through a gradual process, which doesn't exceed 12 years beginning from the date this agreement's entry into force. Title II of the agreement addresses the free movement of goods from article 6 to article 29 in three subdivided chapters :(i) Industrial products, (ii) Agricultural, fisheries and processed agricultural products, and (iii) Common provisions. Concerning industrial products, their provisions are conditioned with products originating in Algeria and the European Community, which fall within chapters 25 to 97 of the combined nomenclature and the Algerian customs tariff excluding the following products (Official Journal of the European Union, 2005):

Table 4.29. List of products excluded from industrial products' provision

HS code/HS heading	Designation
2905 43	Mannitol
2905 44	Sorbitol
2905 45	Glycerol
3301	essential oils
3302 10	odoriferous substances
3501 to 3505	albuminoidal substances, modified starches, glues
3809 10	finishing agents
3823	Industrial fatty alcohols
3824 60	sorbitol other than sorbitol of 2905 44
4101 to 4103	hides and skins
4301	raw furskins
5001 to 5003	raw silk and silk waste
5101 to 5103	wool and animal hair
5201 to 5203	raw cotton, waste and cotton carded or combed
5301	raw flax
5302	Raw hemp

Source: (Official Journal of the European Union, 2005)

The Harmonized System (HS) code is an international numerical code involving 6 digits to identify and represent the goods for international trade. Yet, each country can extend the code to 8, 10 or 12 digits to meet its statistics purpose (Ding et al., 2015). The HS nomenclature is structured in 21 sections referred to as Roman numbers, which in turn have been rearranged in

96 chapters referred to as Arabic numbers (from 01 to 97), with the exception of chapter 77, because it isn't in use. The first four-digit code indicates the heading, in which the first two digits denote the chapter, whereas the latter two point out the position of the heading in the chapter. Moreover, most of the headings are decomposed into two digits (dash subheadings) (Weerth, 2008; World Customs Organization, 2022). EU's combined nomenclature is a vehicle for classifying goods; it involves eight digits, based on 6 digits of the Harmonized System (HS) (Pohlová et al., 2018).

Concerning Agricultural products, Puigcerver (2019) argues that the association agreement of 2005 was more fruitful for Algeria in agricultural products, such that 123 products benefited from free access to European markets (i.e., they are subject to 0% tariff), despite 23 of them have been faced quotas.

4.3.2.1 The economic reality and the negotiation performance assessment:

Through two economic decisions that have been taken by the Algerian government, which had a spread-reaching effect on the Algerian economy on the one hand, and on the external credibility of the country on the other hand, it could be obviously inferred the weakness of the Algerian authorities' negotiation performance. Those decisions are:

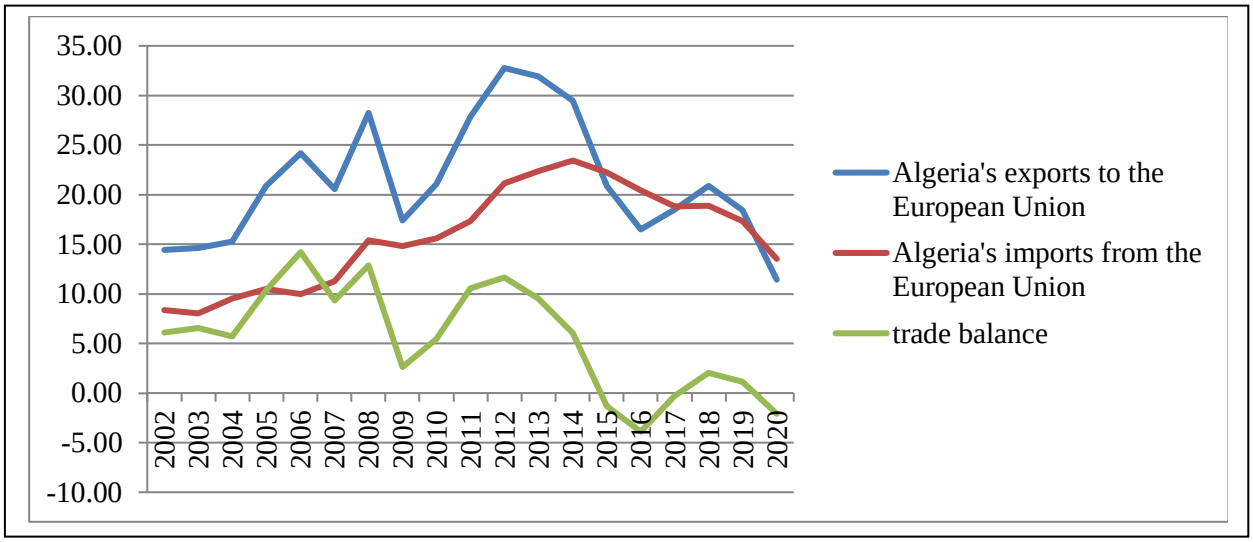
(i) Adopting the hydrocarbons law without accurate economic study, and then rescinding that decision by President Bouteflika. This procedure has damaged the credibility of Algeria in world energy circles.

(ii) Adopting to use US dollar as a basis of the currency basket, despite its value depreciated by a significant margin against the euro, in which Algeria has lost more than 15 US Billion $ concomitantly to a big increase in the oil price on international markets during the period 2003-2008.

It is well recognized that there are two main measures for the good governance of public administration, which are: (i) efficiency and (ii) subject matter competence. These two measures are irreplaceable at the negotiation table, as they enable to set of both the weak points (even if they are many) and the strong points (even if they are few) since the eventual objective is to maximize gains and minimize losses. However, the Algerian state is still not open to those measures, since that would necessitate the system to open the door wide for the elite rotation principle. The Algerian economic dossier has been characterized by the following deficiencies :(i) the absence of sound management and (ii) the dominance of structural imbalances over most of its sectors. Thus, the weakness in negotiation management of this dossier. The investment of Renault (a French automotive company) in Oran is an evident example of this devastating failure, in which the French have exerted a pressure on Algerian negotiation team without considering the Algeria's national sovereignty, the core elements of this investment were:(i) the location for the company was designated in Oran by the French strategic choice, located 500 km from the investment headquarters of Renault company in eastern Morocco, (ii) Algeria shall satisfy two main conditions: firstly, for a period of three years, Algeria does not conclude investment agreement with other companies, and secondly, the degree of integration is limited without transfer of technology, in which the French company has exclusively free choice the handling companies, and (iii) the production is mainly allocated to domestic consumption, given the number and type of cars, which was lower compared to the Maghreb side, implying the absence of any intention on the part of the French to contribute in establishing a national industrial base (Bachir, 2015).

4.3.2.2 Bilateral goods trade between Algeria and the European Union:

Figure 4.22. Bilateral goods trade between Algeria and the European Union from 2002 to 2020



Source: Author's elaboration based on the European Commission database

The results of figure 4.22 depict that Bilateral goods trade balances between Algeria and the EU were in favor of the former (except in 2015, 2016, 2017 and 2020, in which Algeria recorded deficits accounted for 1.35, 3.89, 0.31 and € 2.07 billion, respectively.

At first glance, it appears that this association is more fruitful for Algeria, but, interestingly, Algeria's imports from the EU have generally recorded continuous growth from € 8.34 billion in 2002 to € 22.25 billion in 2015, before decreasing back to €13.50 billion in 2020. From 2006 (by roughly 4 months after the association agreement entered into force) to 2020, the total trade value between Algeria and the EU was estimated at € 602.69 billion (€ 262.49 billion for exports to Algeria, and € 340.20 billion for exports to the EU, i.e., € 77.71 billion surplus for Algeria). However, France and Germany have registered significant surpluses (€ 23.82 billion and € 9.88 billion, respectively), other than other European trading partners as illustrated in table 4.30.

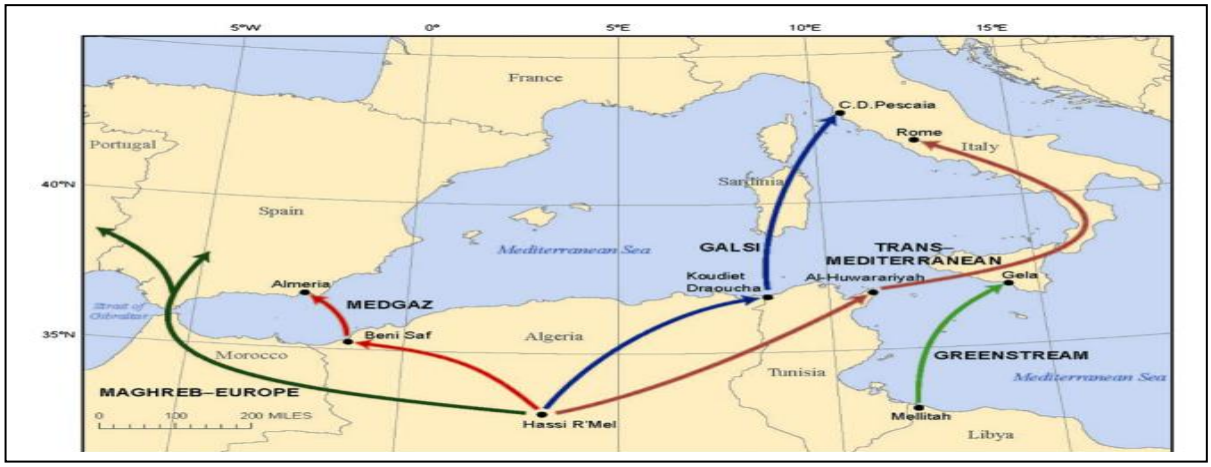
Table 4.30. Total bilateral goods trade between Algeria and the main European trading partners from 2006 to 2020

European trading partners	EU's exports to Algeria	Algeria's exports to EU	Trade balance
EU28	262,49	340,20	77,71
Of which			
Belgium	14,45	19,58	5,13
France	79,18	55,36	-23,82
Germany	29,32	19,43	-9,88
Italy	46,23	89,71	43,47
Netherlands	9,97	28,49	18,51
Spain	39,32	81,04	41,72

Source: Author's elaboration based on the European Commission database

Until the 2000s, North America was a very important market for Algeria's high-quality Sahara Blend, which is *a light crude oil with low sulfur content*; where its oil exports to the United States of America peaked at 443 000 b/ d in 2007, thereafter, a significant share of Algeria's oil has been reoriented to Europe due to the rise in the production of US shale, in which Algerian oil exports to the EU accounted $ 6 billion in 2017, a remarkable drop from the 2013-2014 peak due to price and volume reasons (Franza et al., 2020). The gas sector is a strategic issue within economic relations between Algeria and the EU, Algeria is the third gas supplier to the EU behind Russia and Norway, and the first supplier to Spain (by more than 60% of the gas that Spain imports), this strategic partnership is based on Algeria as a reliable provider, given :(i) the large size of the Algerian gas reserves, estimated by roughly 4.5 trillion cubic meters that have been discovered, and 1.5 trillion to be discovered, and (ii) more importantly, the price of Algerian gas, which is considerably lower compared to the one of Russia or Norway, more specifically, the cost of technical supply via Galsi and Medgaz gas pipelines is nearly 50% lower than Russia or Norway, giving Algeria a considerable competitive advantage over the countries suppliers mentioned above (Puigcerver, 2019).
Currently, Algeria exports natural gas to Europe by pipeline, while liquefied natural gas (LNG) by vessels to EU terminals (Aczel, 2022; Benali, 2018).
The Algerian natural gas is supplied to Europe through four pipelines (Maghreb-Europe, MEDGAZ, Trans-Mediterranean, and GALSI) (Attanasi & Freeman, 2012).

Figure 4.23. The approximate location and routes of the gas pipelines from Africa to Europe



Source: (Attanasi & Freeman, 2012)

Table 4.31. Annual capacities of pipelines originating in Algeria

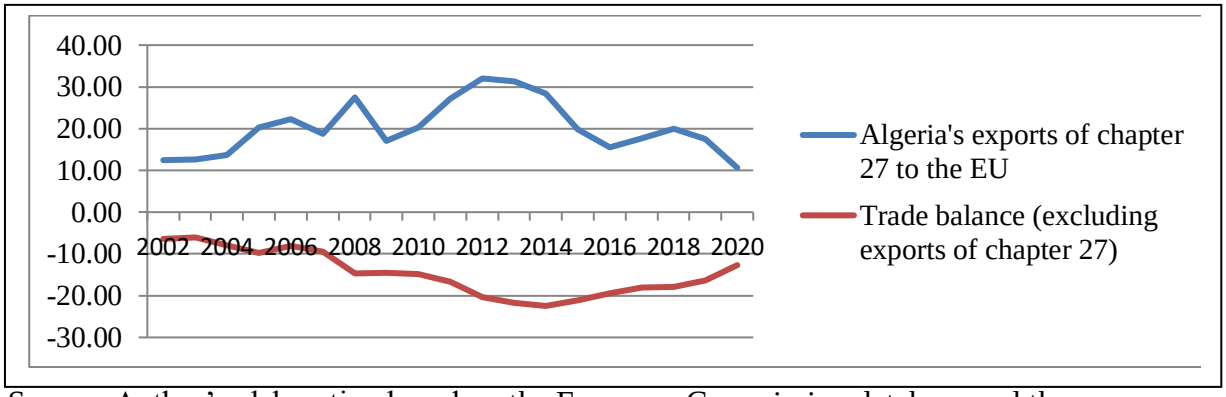
Pipelines	Deliverability (BCF/D)
Trans-Mediterranean	2.9
Maghreb-Europe	1.2
MEDGAZ	0.8
GALSI	1.0
Total	5.9

Source: (Attanasi & Freeman, 2012)

Note: BCF/D represents billions of cubic feet per day

The Galsi project was launched by the Galsi company in 2003, and was established with the participation of the German Wintershall (13.5%); the Italian Edison (18%), Ente Nazionale Energia Elettrica (13.5%) and Hera (9%); Sardinian region, via its financial company Sfirs (10%); and the Algerian Sonatrach (36%). On 16 November, 2007, after negotiations, the Algerian and the Italian governments signed an intergovernmental agreement that asserts the strategic importance of the pipeline, which satisfies two requirements:(i) improving the Italian energy security of supply, and (ii) ensuring the commercialization of the Algerian gas (Prontera, 2018). The pipelines linking Algeria and Europe are governed by long-term contracts indexed to oil prices (Achy, 2013).

Figure 4.24. Bilateral goods trade (excluding exports of chapter 27) between Algeria and the European Union from 2002 to 2020



Source: Author's elaboration based on the European Commission database and the International Trade Centre database

It should be noted that Algeria's exports of chapter 27 to the EU from 2002 to 2008 are taken directly from the International Trade Centre database measured by US dollars, then multiplied by the official exchange rate (€ per US$, period average) which was sourced from the World Bank database.

Looking at the results of figure 4.24, Algeria's exports of chapter 27 (mainly hydrocarbons exports) to the EU from 2006 to 2020 hit € 326.11 billion, which represents 95.86% of its total exports to the EU (€ 340.20 billion) over the same period. Trade balance (excluding exports of chapter 27) has generally recorded continuous deterioration, which was estimated at € 248.40 billion during the same period, indicating the weakness of foreign direct investment flows of European Community member states into Algeria outside the hydrocarbons sector, which are considered as a main key to support Algeria's exports diversification.

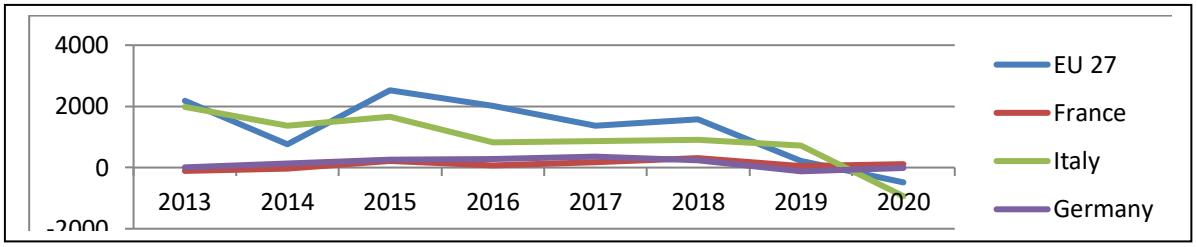
This result is similar to that reported by Dadush and Myachenkova. (2018), in which they showed that bilateral trade balances (oil and gas are excluded) within the EU-Algeria association agreement have significantly been in favor of the former; they illustrated that Algeria's exports are mainly subjected to the world energy market conditions, not to its trade agreements.

Due to unbalanced gains (in favor of the EU), Algeria demanded to extend the full entry of such agreement for three years (Nouibat, 2020). Because of the free drop of oil prices since 2014, the scourge of extra-billing, and other illicit practices, Algeria reestablished its import

structure by implementing measures to control and clean up its foreign trade, by the finance law of 2018, Algeria introduced provisional additional duties of between 30% and 200%, this transitional and non-discriminatory adjustment of the imports structure is concerned a tiny fraction of imports from EU of € 1 billion out of more than € 20 billion (Afrique - Asie). The Algerian authorities have indicated that those duties will provide additional protection to national production, promoting the development of new industrial units and contributing to the rationalization of imports (chems-eddine.hafiz, 2019).

4.3.2.3 EU's foreign direct investment flows toward Algeria:

Figure 4.25. EU's foreign direct investment flows toward Algeria from 2013 to 2020 (in Million Euro)



Source: Eurostat, 2023

Note: Data are available from 2013 onwards, on the Eurostat database
Data on the United Kingdom's foreign direct investment flows toward Algeria are not available
EU 27 indicates the European Union excluding the United Kingdom

As shown in figure 4.25, the value of EU's foreign direct investment flows toward Algeria was timid, which didn't exceed € 2525.1 million in the best circumstances; in which its value dropped from € 2192.5 million in 2013 to € -484.4 million in 2020. Italy was the main contributor to the EU's foreign direct investment flows toward Algeria from 2013 to 2020, with 1981.7, 1361.3, 1654.8, 831.9, 870.3, 898, 721.8, -936.2 million euro, in 2013, 2014, 2015, 2016, 2017, 2018, 2019 and 2020, respectively. France and Germany recorded modest flows, interestingly the former recorded negative values (-110 and -35 million euro in 2013 and 2014, respectively), also the latter recorded -123 and -24 million euro in 2019 and 2020, respectively. These results reflect a stark contrast between EU commitments towards Algeria and the flows achieved, which remain disappointing.

There are three reasons why financial transactions of FDI may be negative:(i) disinvestment in assets, (ii) *if the parent borrowed money from its affiliate or if the affiliate paid off a loan from its direct investor*, and (iii) *If reinvested earnings are negative* (OECD).

As a result of 'revolution model' adopted by the Algerian government for the industrialization process during the 1970s and 80s, the weight of FDI continued to decline (Aldasoro & Pérez, 2017).

According to Alaya et al. (2009) and Menna & Mehibel. (2018), two reasons had been an adverse effect on FDI inflows into Algeria: (i) preferring the strategy of "des industries industrialisantes " versus discouraging FDI, which led to weak international integration, and (ii) the Algerian economy has long suffered from the weakness of the productivity of factors of production, especially the physical capital's productivity, besides, macroeconomic and institutional instability. Almenar-Llongo et al. (2021) argue that the import substitution policy embraced by Algeria has tamed FDI flows (i.e., Algeria has remained isolated compared to

other countries such as Morocco and Turkey). FDI inflows have been prompted to a certain extent by the Algerian authorities through an institutional support framework more convenient and a new fiscal legislation more attractive (investment code of 1993, amended and complemented by the order of 2001) (Brahim & Djamel, 2021). Legislative decree 93-12 of 5 October 1993, referred to "as investments code" granted a set of guarantees to foreign investors of which: (i) non-discrimination between Algerian and foreign legal or natural persons, subject to the agreements' provisions concluded by the Algerian state with states of which investors are nationals, and (ii) settlement any dispute between the foreign investor and the Algerian state before the competent courts, except specific provisions in multilateral or bilateral agreements concluded by the Algerian state. Furthermore, this code grants fiscal, quasi-fiscal and customs reductions for a specific period for investors. Ordinance 01-03 of August 20, 2001, relating to the investment development, which complemented and improved the investment code of 1993, extended the intervention scope of private investment (national and foreign) to certain sectors which were exclusively reserved for the state, and organized the privatizations legal framework: it, therefore, recognizes "the freedom invest" principle (Lamia, 2018). As a result of those efforts, the value of the world's FDI flows toward Algeria went from US$ 280.1 million in 2000 to US$ 2754.12 million in 2009 (United Nations Conference on Trade and Development). The structure of foreign direct investment in 2006 indicates a new phenomenon, where the relative share of these investments in the non-hydrocarbon sectors (53.02%) overtook that of the hydrocarbon sectors (46,97%) (Bank of Algeria, 2006). Motivated by an excessive rate of benefits transferred to countries of origin, and high level of imports which weakened algerian balance of payments amid the international financial crisis, the Algerian authorities introduced new regulatory framework for governing FDI in 2009, in a nutshell, this regulatory identified requisites in four fields: (i) introducing so-called 51/49 restriction, on the grounds that joint-ventures can facilitate transfers of external technology, (ii) application of a national taxation on profits, (iii) the effect of transnational companies on balance of payments should be positive, and (iv) Algerian banking capital is responsible for financing the investment project (i.e., international financing of projects is prohibited); by this regulatory the Algerian authorities sought to achieve three goals:(i) balance of payments equilibrium, (ii) structural change (transfer of technology and productive diversification), and (iii) the contribution to local public goods (through taxation of companies) (Aldasoro & Pérez, 2017). *Local public goods are a set of the public goods that are largely provided by local governments/ authorities, which are at the lower tiers of government, for the consumption of local population* (Nallathiga, 2017). In 2015, the value of the world's FDI flows toward Algeria collapsed, moving from a net foreign investment in 2014 (US$ 1506.73 million) to a divestment in 2015 (US$ -584.54 million), which is explained by an exceptional operation taken by the Algerian state in January 2015, in which the latter acquired the majority of Djezzy's actions owned by VimpelCom for an amount of U$ 2.6 billion (Brahim & Djamel, 2021; United Nations Conference on Trade and Development). According to Chaplyuk et al. (2022), Algeria has not fared well in attracting FDI despite its large capabilities such as large stocks of raw materials and water and the low cost of human capital, in which they argue that the lack of adequate conditions to attract FDI such as the weakness and difficulty in the process of obtaining building permits, the property registration process, the process of business registration, taxation, lending, international trade,

investor protection, the enterprises liquidation process and the enforcement of contracts are the main common impediments facing FDI for Algeria. The weakness of the EU's member states foreign direct investments into Algeria is attributed to capital constraints on foreign investors, such that any FDI for Algeria is only carried out through the partnership that varied among the activities in terms of the share of the national capital as: (i) the national resident shareholding for productive activities constitutes at least 51% of the social capital, (ii) the national resident shareholding for activities associated to foreign trade represents at least 30% of the social capital, and (iii) 40% for maritime transport (Puigcerver, 2019; Journal Officiel de La République Algérienne, 2009). Puigcerver (2019) argues that improvement of the economic situation is necessary for Algeria to attract more FDI (e.g., high and extremely volatile inflation associated with a drop in GDP per capita are factors discouraging investment).

Michelin Company is among the main EU greenfield FDI non-hydrocarbon in Algeria, whereas FERTIAL Company is among the main EU brownfield FDI (Kasmi & Herizi, 2017).

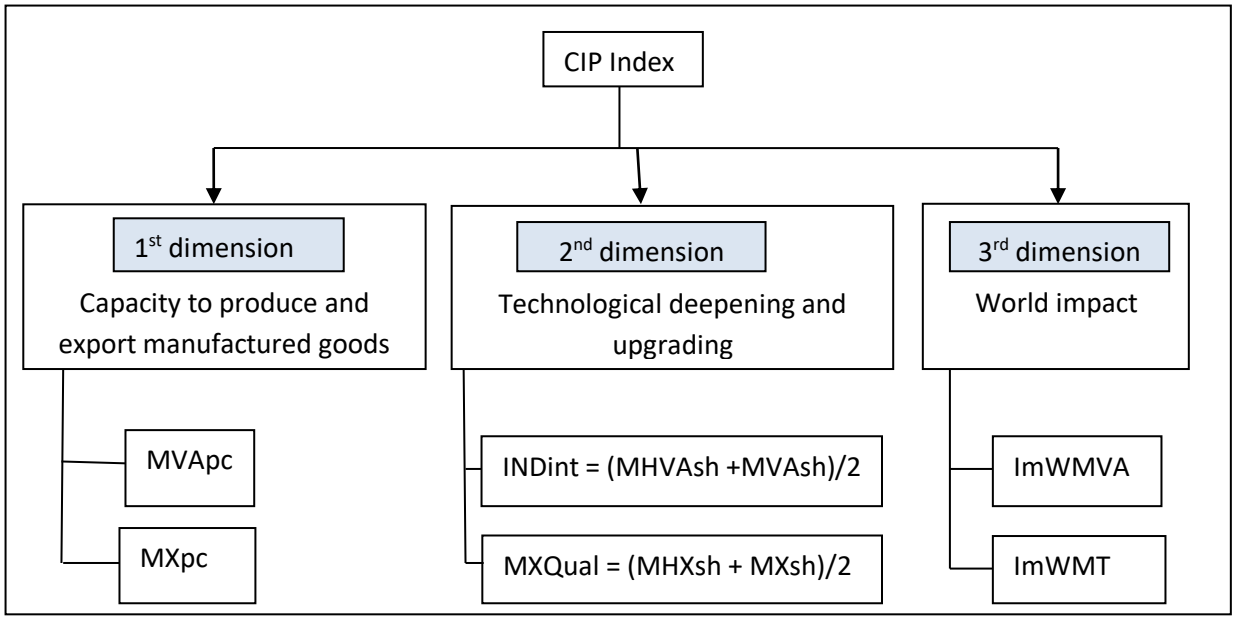
Greenfield investments are a form of FDI, in which a new venture is launched in a foreign country by a parent company constructing new operational facilities from the ground up (stanbic, 2023). Brownfield investments are also termed Mergers and acquisitions, where a foreign firm buys out a share or the entire company in a host country (Makhavikova, 2018).

The annual production capacity of Michelin company is 250000 tires for heavy weights; roughly one third is destined for export; however, the aggregate amount of raw material used is imported from Spain, France and Italy (Benlahrech, 2013; Le Temps d'Algérie, 2010).To re-launch its plant in Algeria in 2002, which was suspended for nine years, the French company invested more than € 40 million to modernize the tool of production; in which its exports in 2009 to Africa-Middle East region (Tunisia, Libya, Nigeria and Saudi Arabia) were accounted between 10 and 15 million €, which represent 15.38% and 23.07% out of its turnover achieved that year (€ 65 million) (Lamriben, 2010; Le Temps d'Algérie, 2010). FERTIAL is a company created in 2005, from a partnership between the public company ASMIDAL and the company FERTIBERIA, owned by the Spanish group VILLAR MIR (Kasmi & Herizi, 2017).

It is an important producer of fertilizer, and a major contributor to Algeria's non-hydrocarbon exports (the second exporter in 2013 and 2014, and the third exporter in 2017) (Kasmi & Herizi, 2017; Agence Nationale de Promotion du Commerce Extérieur, 2019). In 2017, FERTIAL exported US$ 332 million, mainly to the EU; Spain is the first customer with 47%, followed by France, Portugal, Italy and Turkey with 31%, 11%, 5% and 2% respectively (Agence Nationale de Promotion du Commerce Extérieur, 2019). However, the Spanish group benefited from a crucial comparative advantage (a very cheap gas) over other competitors such as Russia and Ukraine, the price of gas accounts for 85% of the manufacturing process of ammonia; furthermore, 600 000 tons of ammonia were sold to FERTIBERIA, which transformed in Spain into profitable products such as Di ammonium Phosphate and ammonium nitrate (i.e., earning significant margins at the cost of Algerians) (MEBTOUL, 2014). In 2020, the Algerian authorities scrapped the so-called 51/49 restriction, except strategic sectors which were identified as hydrocarbons, defence, mining and pharmaceutical production (stanbic, 2023).

The association agreement between Algeria and the European Union had not improved the competitive industrial performance of the former. According to Almenar-Llongo et al. (2021), the Algerian manufacturing industry has mostly characterized by three features: (i) low technology, (ii) labor intensity, and (iii) low value added, which affected negatively the competitiveness of the Algerian products on both international and domestic markets.The competitiveness industrial performance index (CIP) is an output oriented composite index, in which countries are able to industrialize more effectively by enhancing their competitiveness, it was constructed by the United Nations Industrial Development Organization (UNIDO) to measure the industrial competitiveness performance of countries (Cantore & Cheng, 2021). The CIP measures the ability of countries to produce and export manufactured goods; it consists of eight sub-indicators grouped in three dimensions as summarized in figure 4.26 (Halkos et al., 2021).

Figure 4.26. UNIDO's CIP index



Source: (Halkos et al., 2021; United Nations Industrial Development Organization, 2013)

Where: INDint and MXQual are industrialization intensity and manufactured exports quality, respectively (Boudt et al., 2020). These eight indicators are summarized in table 4.32 as follows:

Table 4.32. UNIDO's CIP sub-indicators

Sub-indicator	Definition	Motivation
MVApc	Manufacturing value added per capita	Represents the industrialization level of country
MXpc	Manufactured exports per capita	measures the trade ability of the manufacturing sector
MHVAsh	Value added share of the Medium-and high-tech manufacturing in total manufacturing value added (%)	Represents the technological complexity of manufacturing. The lower the MHVAsh, the less technologically complex the industrial structure of a given country and its overall industrial competitiveness are.
MVAsh	Value added share of Manufacturing in GDP (%)	Presents the manufacturing sector contribution to total production
MHXsh	Share of medium-and high- tech manufactured exports in total manufactured exports (%)	Refers the complexity and technological content of exports
MXsh	Share of manufactured exports in total exports (%)	Indicates the importance of manufacturing in the export activity of a country
ImWMVA	Share of value added in world manufacturing value added (%)	Indicates the effect of a country on world manufacturing value added.
ImWMT	Share of manufactured exports in world manufacturing trade (%)	Reflects the country's effect on world manufacturing trade. The higher the ImWMT, the more competitiveness in world market.

Source: Boudt et al., 2020

technology exports, low technology exports and high technology exports (United Nations Industrial Development Organization, 2017). As shown in table 4.33

Table 4.33. Technology classification of manufacturing exports

Type of export	SITC Rev. 3
Resource-based	016, 017, 023, 024, 035, 037, 046, 047, 048, 056, 058, 059, 061, 062, 073, 098, 111, 112, 122, 232, 247, 248, 251, 264, 265, 281, 282, 283, 284, 285, 286, 287, 288, 289, 322, 334, 335, 342, 344, 345, 411, 421, 422, 431,511, 514, 515, 516, 522, 523, 524, 531, 532, 551,592, 621, 625,629, 633, 634, 635, 641, 661, 662, 663, 664, 667, 689
Low technology	611, 612, 613, 642, 651, 652, 654, 655, 656, 657, 658, 659, 665, 666, 673, 674, 675, 676, 677, 679, 691, 692, 693, 694, 695, 696, 697, 699, 821, 831, 841, 842, 843, 844, 845, 846, 848, 851, 893, 894, 895, 897,898, 899
Medium technology	266, 267, 512, 513, 533, 553, 554, 562, 571, 572, 573, 574, 575, 579, 581, 582, 583, 591, 593, 597, 598, 653, 671, 672, 678, 711, 712, 713, 714, 721, 722, 723, 724, 725, 726, 727, 728, 731, 733, 735, 737, 741, 742, 743, 744, 745, 746, 747, 748, 749, 761, 762, 763, 772, 773, 775, 778, 781, 782, 783, 784, 785, 786, 791, 793, 811, 812, 813, 872, 873, 882, 884, 885
High technology	525, 541, 542, 716, 718, 751, 752, 759, 764, 771, 774, 776, 792, 871, 874, 881, 891

Source: (United Nations Industrial Development Organization, 2019; United Nations Industrial Development Organization, 2017)

Where: SITC stands for the Standard International Trade Classification (United Nations, 1990).

Table 4.34. Medium-high tech manufacturing categories

Description	ISIC Revision 3
Manufacture of chemicals and chemical products	24
Manufacture of machinery and equipment	29
Manufacture of office, accounting and computing machinery	30
Manufacture of electrical machinery and apparatus	31
Manufacture of radio, television and communication equipment and apparatus	32
Manufacture of medical, precision and optical instruments, watches and clocks	33
Manufacture of motor vehicles, trailers and semi-trailers	34
Manufacture of other transport equipment, excluding: ISIC Revision 3: • 351=Building and repairing of ships and boats ISIC Revision 4: • 3011=Building of ships and floating structures • 3012=Building of pleasure and sporting boats • 3315=Repair of transport equipment, except motor vehicles	35

Source: (United Nations Industrial Development Organization, 2017; United Nations, 1990; United Nations, 2008)

Where: ISIC refers to the International Standard Industrial Classification of all economic activities (United Nations, 1990).

The CIP index is calculated as a non-linear combination of the eight indicators mentioned above (Halkos et al., 2021). UNIDO's CIP method is expressed as follows:

$$\mathrm{CIP} = \mathrm{h}_1(\mathrm{g}(\mathrm{ImWMT}), \mathrm{g}(\mathrm{ImWMVA}), \mathrm{h}_2(\mathrm{g}(\mathrm{MHVAsh}), \mathrm{g}(\mathrm{MVAsh})), \mathrm{h}_2(\mathrm{g}(\mathrm{MHXsh}), \mathrm{g}(\mathrm{MXsh})),$$

$$\mathrm{g}(\mathrm{MXpc}), \mathrm{g}(\mathrm{MVApc})),$$

Where: $\mathrm{h}_1(\cdot)$,$\mathrm{h}_2(\cdot)$ and $\mathrm{g}(\cdot)$ stand for geometric aggregation, linear aggregation and min-max standardization functions, respectively. The aggregation functions $\mathrm{h}_1(\cdot)$ and $\mathrm{h}_2(\cdot)$ take equal weights (Boudt et al., 2020).

By applying the weighted geometric average of the q sub-indicators, the CIP formula is given as:

$$\mathrm{CIP}_{\mathrm{jt}} = \prod_{\mathrm{i}=1}^{\mathrm{q}} \mathrm{I}_{\mathrm{ijt}}^{\mathrm{w_i}}$$

Where: $\mathrm{w_i}$ stands for the weight of indicator i (i = 1,..,q), I_{ijt} refers to the index value i for country j in period t.

$$\mathrm{I}_{\mathrm{ijt}} = \frac{\mathrm{X}_{\mathrm{ijt}} - Min_{\mathrm{j}}(\mathrm{X}_{\mathrm{ijt}})}{Max_{\mathrm{j}}(\mathrm{X}_{\mathrm{ijt}}) - Min_{\mathrm{j}}(\mathrm{X}_{\mathrm{ijt}})}$$

Where: $\mathrm{X}_{\mathrm{ijt}}$ suggests the indicator value i for country j in period t, and min (resp. max) are the minimum (resp. maximum) operators returning the smallest (resp. largest) value in the sample (United Nations Industrial Development Organization, 2013).

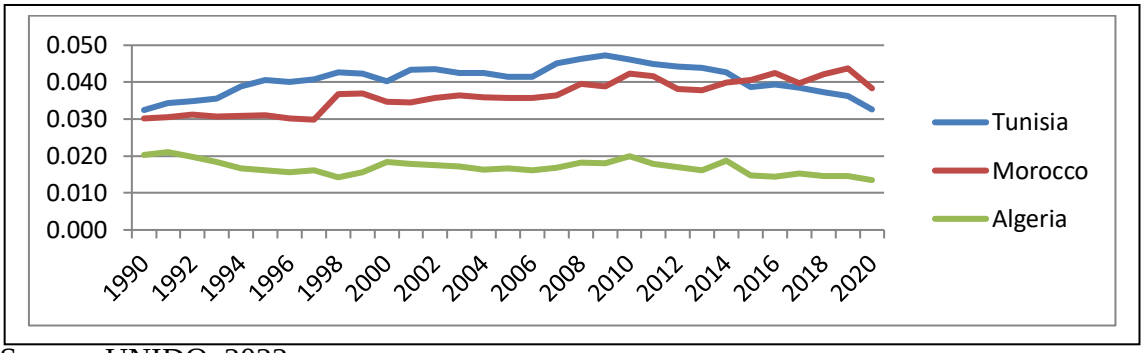
The value of CIP and its sub-indicators ranges from o to 1, in which the value 1 reflects the best performing country, while the value zero reflects the weakest performing country (Micic, 2015; Upadhyaya, 2013). A negative change in the CIP value of a given country stands for decreased productive capacity and deteriorated products quality with a worse chance of realization in international markets, and vice versa (Upadhyaya, 2013).
A closer CIP value to zero reflects an inefficient of the countries' manufacturing sectors in the allocation of factors of production, such as capital and labor (United Nations Industrial Development Organization, 2019)

Table 4.35. Breakdown of weights by CIP's indicators

Indicators	MVApc	MXpc	MHVAsh	MVAsh	MHXsh	MXsh	ImWMVA	ImWMT
weight	1/6	1/6	0.5x1/6	0.5x1/6	0.5x1/6	0.5x1/6	1/6	1/6

Source : Upadhyaya, 2013

Figure 4.27. CIP scores of Algeria, Tunisia and Morocco during the period 1990-2020



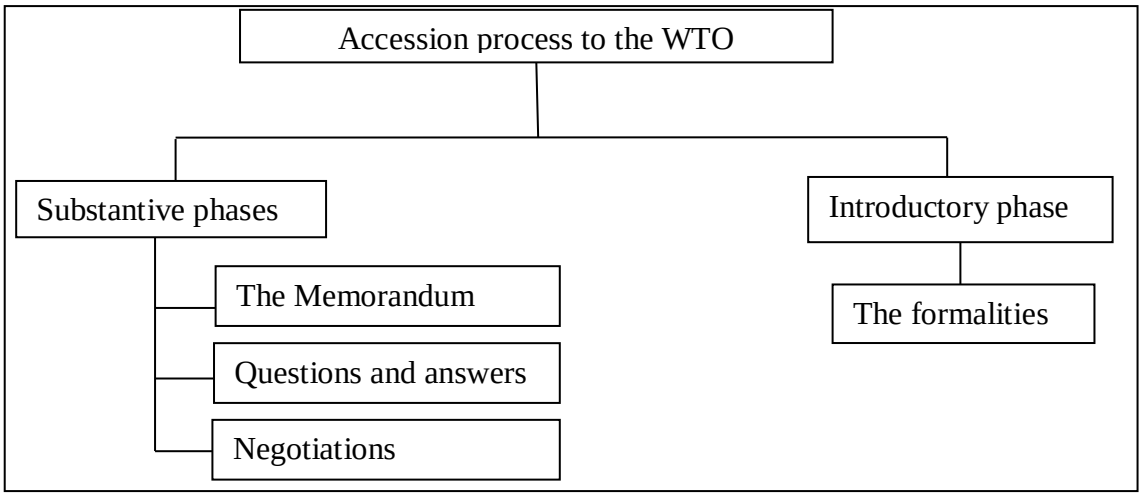
Source: UNIDO, 2022

The result of figure 4.27 depicts that Algeria's CIP index has recorded weak values over the period 1990-2020, in which the worst value hit 0.013 in 2020, meaning more degradation of Algeria's industrial competitiveness performance. Furthermore, Algeria is still trailing behind Tunisia and Morocco, such that Algeria ranked 96th on a world level in 2020, while Tunisia and Morocco ranked 70th and 61th, respectively on a world level in the same year.
This result is consistent with that concluded by Gasmi and Laourari. (2017), they argue that Algeria's manufacturing sector performance has recorded low levels, despite Algeria having taken advantage of high oil prices over the last decades and performing several economic reforms, implying that Algeria has failed to diversify its economy. Thus, we reject the fourth hypothesis.

4.4 Algeria and WTO:

It is well recognized that the accession process to the WTO is very lengthy and onerous for most countries; it involves four phases as shown in figure 4.28.

Figure 4.28. Accession phases to the WTO



Source: (Michalopoulos, 2000)

4.4.1 Introductory phase:

At this stage, a country sends a letter to the WTO director general illustrating its desire to join the WTO, its request is addressed by the General Council of the WTO, which comprises representatives of all members

4.4.2 Substantive phases:

4.4.2.1 The Memorandum:

The applicant shall prepare a memorandum on foreign trade regime explaining its institutions and policies, the memorandum must include a wide and detailed range of issues much more than just trade in goods and services, particularly those associated with investment and competition policy, foreign exchange management and controls, privatization of enterprise and protection of intellectual and other property rights. It should be recalled that in the case of Algeria, its application for accession to the WTO was submitted in 1987, but its memorandum was produced in 1996.

4.4.2.2 Questions and answers:

Usually, this phase is referred to as a protracted process, in which the WTO's members ask questions to obtain explanations on the institutions and policies of the applicant, based either on the memorandum or on independent proof collected by the members about the situation. The salient challenge experienced by each country in the accession process is the extent of congruence and compatibility of the applicant's institutions and legislations with the WTO's provisions.

4.4.2.3 Negotiations:

Although this phase is conceptually separate from the questions and answers phase, it tends to overlap. Negotiation is only in one direction. At this stage, the applicant is requested to present its initial schedule of offers in services and goods, which comprises: (i) the tariffs detailed schedule that the applicant would impose on goods and the level of tariffs bound, which cannot transcend by the potential member except under specific circumstances. For example: in the emergency of a payments balance or as a temporary safeguard, and (ii) the commitments (and limitations) that the applicant must bind to keep free access to its market for services. Besides, the applicant must bind the support level that it plans to provide to its

Agriculture based on a base reference period (ordinarily three representative years before offering the application of accession) (Michalopoulos, 2000).

Among thorny issues that have impeded Algeria's accession to the WTO, is it flat refusal to deal with Israel (Echoroukonline, 2016). despite the EU-Algeria association agreement was associated with the assistance of the European Community and its member states for rapid accession of Algeria to the World Trade Organization (WTO), this support still has not occurred, implying that the EU desires to earn more concessions through more reduction in tariff barriers by the Algerian authorities (Bachir, 2015; Official Journal of the European Union, 2005).

4.4.3 Algeria and WTO accession within trade openness:

4.4.3.1 The duration models:

Duration models and survival analysis emanate from biostatistics, in which *survival time is the time until death or relapse of an illness* (Boršič & Kavkler, 2009). The duration (survival, time-to-event) model is used to specify those factors that either shorten or lengthen the time to a specific event (Jones & Gai, 2013).

4.4.3.2 The duration model versus the OLS model:

To determine the factors which affect time to event, the duration model is more appropriate than the OLS model, due to, the former can address several problems the latter cannot, such as: violation of the assumption of normal distribution, right censoring, left truncation and time varying covariates.

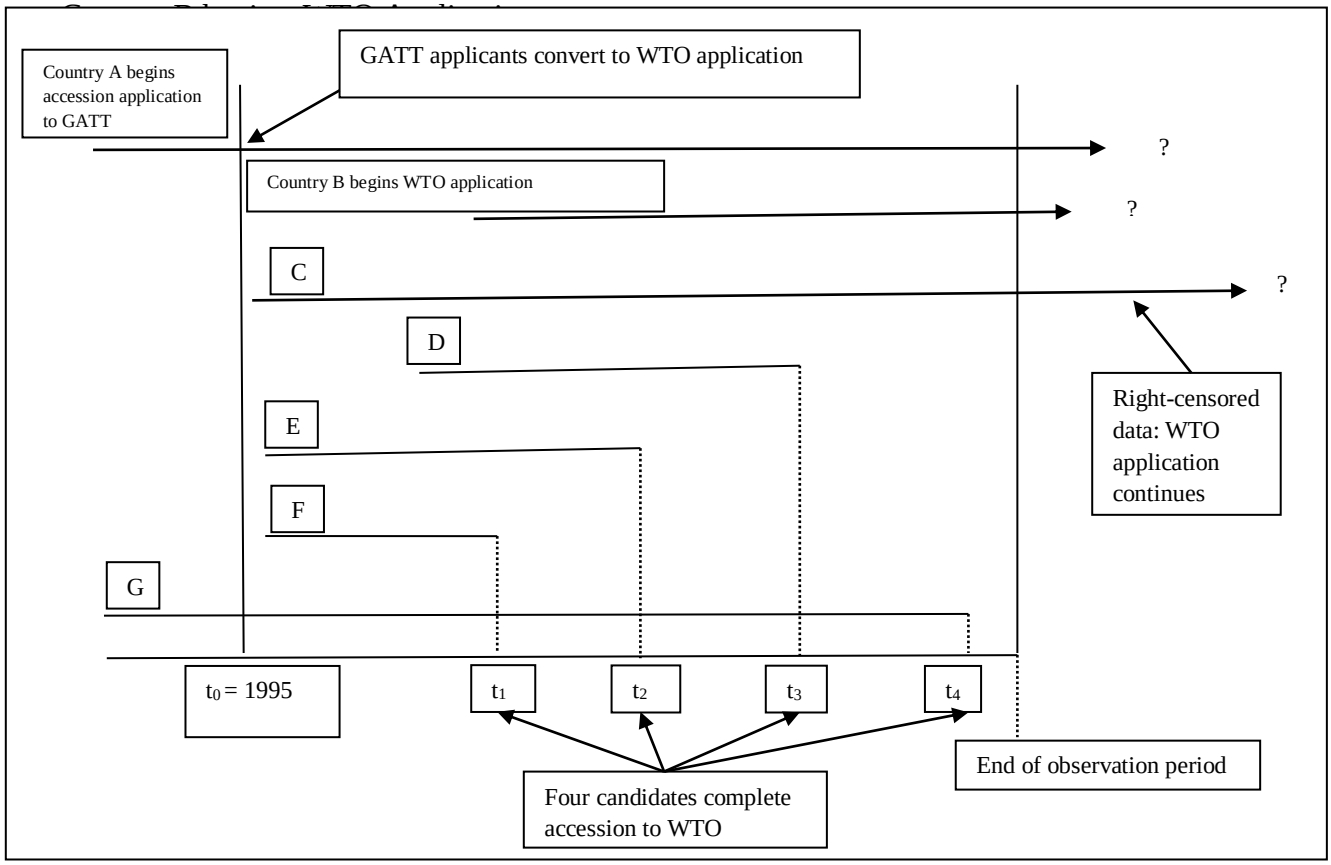
Suppose that the time to event is final accession to WTO, a simple model of the length of negotiation duration to WTO accession is given as:

$$time_i = \beta_0 + \beta_1 x_i + \varepsilon_i$$

Where: $time_i$ stands for the length of time of the WTO final accession for country i, x_i denotes a vector of factors, and ε_i indicates the error term, which is assumed to follow a normal distribution.

Using the OLS model involves violating the assumption of normal distribution, because assuming a normal distribution of survival time implies that it can take negative values. The time to WTO accession is becoming longer and longer which obviously violates the normal distribution assumption.

Figure 4.29.Schematic presentation of right censoring and left truncation in duration model



Source: (Jones & Gai, 2013)

As illustrated in figure 4.29, only four countries (F, E, D and G) complete accession to WTO at t_1, t_2, t_3, and t_4 respectively. For other applicants (i.e., A, B, and C) their path toward the WTO accession continues beyond the end of the observation period, in which accession possibly taken up at a future date; the latter group is said to be "right censored".

The third problem is "left truncation", it occurs in case of limited data which is a common problem in social science studies; countries A and G fall into this category since we don't have information for them before 1995 despite, they began accession application before 1995 (Jones & Gai, 2013). The fourth problem is time-varying covariates, which are covariates whose value can change during follow-up (Austin et al., 2019).

Typically, there are three methods to address these problems: (i) parametric models, where: Weibull, Gamma, Rayleigh, log-logistic, Gompertz, and log-normal are among some popular parametric duration models, (ii) nonparametric models, and (iii) semi-parametric models (Jones & Gai, 2013).

4.4.3.3 The Cox proportional hazards model:

The survival function stands for the complement of the distribution function, it is given as:

$$S(t) = P(T > t) = 1 - F(t)$$

Where: $F(t) = P(T \leq t)$, indicates cumulative distribution function, T is a random variable that points out survival time.

The probability density function is written as:$f(t) = dF(t)/dt$

The (instantaneous) hazard function or the failure rate is expressed as:

$$h(t) = \lim_{\Delta t \to 0} \frac{P[(t \leq T < t+\Delta t) | T \geq t)}{\Delta t}$$

The hazard function is identified as the function which estimates the sudden risk of failure at time t, in which greater values of the hazard function imply higher potential for the event to take place (Puttachai et al., 2019; Boršič & Kavkler, 2009).
The relationship between $h(t), S(t)$ and $f(t)$ is expressed as:

$$h(t) = \frac{f(t)}{1 - F(t)} = \frac{f(t)}{S(t)} = \frac{-d \log S(t)}{dt} \quad (*)$$

where $f(t)$ can also be expressed as:

$$f(t) = -S(t)'$$

From $(*)$, $S(t)$ can be expressed as:

$$S(t) = exp\left[-\int_0^t h(u)\, du\right] = exp[-H(t)]$$

Where $H(t)$ is the cumulative hazard function, which is obtained by integrating the hazard function over the interval $[0, t]$ (Janurová & Martínek, 2016; Boršič & Kavkler, 2009).
The Cox proportional hazards model was introduced in 1972; it is among the most used survival analysis methods (Kuitunen et al., 2023). Estimating hazard ratios (HRs) is usually the main focus of the model, in which HRs *compare the hazard of event occurrence between groups defined by predictor variables* (Grant et al., 2014). Compared to the other regression methods, the Cox's model employs the time to an outcome event Y, not the Y itself, besides, it can deal with missing values of the Y (Chen X. , 2021).
The Cox proportional hazards model can be expressed as:

$$h(t) = h_0(t) e^{(b_1 X_1 + b_2 X_2 + \cdots + b_p X_p)}$$

Where: h represents the expected hazard at time t, $h_0(t)$indicates the baseline hazard (i.e., when $X_1 = X_2 = \cdots X_p = 0$) (Deo et al., 2021; Jones & Gai, 2013).
This model is called semi-parametric since it does not impose a statistical distribution of $h_0(t)$, and $h_0(t)$ is nonparametric, besides, it comprises a parametric component, exp (x,b) (Bille & Jensen, 2018).
The multiplicative relationship between $h_0(t)$ and the hazards generated from influential factors gives the Cox regression model, the name proportional hazards regression model, that is, changes in an influential factor X lead to proportional changes in $h(t)$.
The effect of an influential factor X_i can be evaluated as:

- No impact of this factor on the hazard $h(t)$, if HR=1 or not considerably different from1;
- Reduce the hazard $h(t)$, if HR < 1 at least at $p < 0.05$ level; and
- Increase the hazard $h(t)$, if HR > 1 at least at $p < 0.05$ level (Chen X. , 2021).

The Cox proportional hazards model grounded on certain important assumptions:(i) the proportional hazards (i.e., the hazard ratio remains constant throughout the follow-up), and (ii) *the independence of survival times between distinct individuals in the study population* (i.e., the survival time of one patient does not rely upon the survival time of another); this criterion (assumption of independence) is also applied to other statistical methods (e.g., logistic and linear regression) (Deo et al., 2021).

4.4.3.4 The effect of trade openness on Algeria's accession to GATT/WTO using the Cox proportional hazards model:

To investigate the effect of trade openness on Algeria's accession to GATT/WTO (the General Agreement on Tariffs and Trade/ the World Trade Organization), we will run the Cox proportional hazards model. Our model is given as:

$$h(t) = h_0(t)e^{(b_1 TOI)}$$

Where: TOI represents trade openness indices for three countries: Algeria, Saudi Arabia, and Jordan. they are calculated based on the index Squalli and Wilson. (2011), from the application dates of these countries to GATT/WTO, to 2020.

Table 4.36. Application and accession dates to GATT/WTO for three countries: Algeria, Saudi Arabia, and Jordan

Country	Application date	Accession date
Algeria	June 1987	-
Saudi Arabia	January 1994	December 2005
Jordan	June 1993	April 2000

Source: (Jones & Gai, 2013 ; WTO , 2023)

The output of the estimated model is given as:

Table 4.37. Regression results

Hazard ratio	P-value	prob > chi2
2.415	0.634	0.624

Source: Author's computation using STATA 15

The entire model is statistically significant at the 95% confidence level if the p-value (referred to as prob > chi2) is less than 5% (Deo et al., 2021).

The proportional-hazards assumption is satisfied if the p-values of predictors and global test are greater than 0.05(Deo et al., 2021).

Looking at the results of table 4.37, the effect of trade openness on Algeria's accession to WTO is insignificant, because the P-value is greater than 5%. This result is opposite to that reported by Copelovitch & Ohls. (2012), in which they indicated that trade openness had a significant and positive effect on GATT/WTO accession for 61 countries (i.e., higher levels of trade openness hastened accession to the GATT/WTO for those countries). The varying results can be explained by the difference in sample size (3 countries against 61 countries) used in the analysis. Thus, we reject the fifth hypothesis.

Conclusion and suggestions for future research:

We have tried across this study to highlight the relationship between foreign trade liberalization and Algeria's balance of payments over the period from 1989 to 2020. As a first step, we have used an intertemporal approach for testing the degree of Algeria's current account sustainability amid trade openness; to this end, an Autoregressive Distributed lag (ARDL) model was employed to test the long-run relationship between exports and imports (including net interest payments). As a second step we have run the ordinary least squares (OLS) estimation technique to investigate the effect of Country risk on Algeria's export diversification within trade openness, the dependent variable (export diversification)is proxied by the Normalized Herfindahl-Hirschman Index, while the independent variables are proxied by Country Risk subcomponents (political risk, economic risk and financial risk) and Squalli and Wilson's index of trade openness. Due to Algeria's political risk index data are freely available from 1984 to 2017; we have used the Box-Jenkins approach to estimate the remaining data for 2018, 2019 and 2020. As a third step, we have diagnosed the repercussions of the Algeria-European Union association on Algeria's balance of payments via bilateral goods trade between Algeria and the European Union from 2002 to 2020, Bilateral goods trade (excluding exports of chapter 27) between them during the same period, and EU's foreign direct investment flows toward Algeria from 2013 to 2020. Given the latter, we have assessed the implications of that association agreement on the competitiveness industrial performance index of Algeria. As a fourth step, we have investigated the impact of trade openness on Algeria's accession to WTO using the Cox proportional hazards model.

We have concluded the following results:

- Algeria's current account is unsustainable due to no long-run relationship between exports and imports (including net interest payments). Means that the Algerian economy is unable to meet its intertemporal budget constraint, yielding: (i) a default on its external borrowings and (ii) an inability to finance its imports bills through its exports revenue (Kouadio & N'Guessan, 2021; Garg & Prabheesh, 2021). Therefore, it is forced to act a drastic change in its policy such as a reduction in its government expenditures or a sharp depreciation of its currency (Chen & Xie, 2015).
- Trade openness is the main factor negatively affecting export diversification, in which a 1% increase in the trade openness index will lead NHHI to increase (i.e., a decline in export diversification) by 0.497%. This result is in line with that concluded by Khobai and Moyo (2021) who indicated that trade openness is detrimental to the manufacturing sector in the African countries due to the lack of competitiveness of their manufacturing products. As a result of this weakness, the value of manufactured products imported by Algeria experienced steady growth from US$ 6.822 billion in 2001 to US$ 42.192 billion in 2014. According to Asiedu (2002), the lack of credibility of trade liberalization is the prominent reason for that weakness. Asiedu (2002) opines that foreign investors perceive trade liberalization as transitory reform and hence subject to reversal, for instance, trade policy is used by African countries to manage their payments balance (i.e., tightening trade restrictions when terms of trade deteriorate, and slackening those restrictions when terms of trade improve).

- Counter-intuitive relationship between economic risk and export diversification, in that, an increase in Algeria's economic risk index (i.e., a decrease in economic risk) will result in a decline in export diversification. This result can be explained by the undesirable side effects of Dutch disease, especially, the impact of crowding-out of manufacturing as mentioned by Fankem & Feyom (2023) and Frankel (2012). They argue that booms in a particular sector (such as the natural resource sector) can harm the manufacturing sector, by attracting more investments and resources for the former.
- A Subdued response of export diversification to the financial risk index, due to the weak coefficient of Algeria's financial risk index that is significant at the 10% level. A 1% increase for FRI (i.e., a decline in financial risk) will lead NHHI to decrease (i.e., rising in export diversification) by 0.002%. This so little impact can be interpreted by the competitive diffusion, as indicated by Neumayer et al. (2016).
- Algeria's political risk index has no effect on export diversification. This result can be interpreted by the fact that resource-seeking FDI (e.g., oil sector), is highly profitable even in the highly unstable country (i.e., the returns on investment are adequately high to more than compensate the political risk), as mentioned by Ali et al. (2010), and Asiedu (2002). As resource-seeking FDI accounts for an important share of FDI inflows to Algeria, hence political risk does not play any role in diversifying its exports basket.
- A positive correlation between Algeria's economic risk index and its subcomponents, that is, an increase of one subcomponent would lead to an increase in the overall economic risk index. Budget balance as a percentage of GDP and current account balance as a percentage of GDP are the major factors affecting the index, followed by real annual GDP growth and annual inflation rate, respectively.
- A positive correlation between Algeria's financial risk index and its subcomponents. Net international liquidity as months of import cover and foreign debt service as a percentage of exports of goods and services are the salient factors affecting the index, followed by exchange rate stability and foreign debt as a percentage of GDP, respectively.
- Ratios of payments to commitments for Algeria under the MEDA program over the period 1995-2004 are characterized as: (i) mixed, among 0.00% in 1997 and 82.35% in 2004, and (ii) the weak of these ratios which didn't surpass 38% in the best of conditions, except in 2004.
- The weakness of the Algerian authorities' negotiation performance, which is obviously appeared through two economic decisions that have been taken by the Algerian government: (i) adopting the hydrocarbons law without accurate economic study, then rescission of that decision by President Bouteflika, this procedure has damaged the credibility of Algeria in world energy circles, and (ii) Adopting to use US dollar as a basic of the currency basket, despite its value depreciated by a significant margin against the euro, in which Algeria has lost more than 15 US Billion $ concomitantly to a big increase in the oil price on international markets during the period 2003-2008; Furthermore, The investment of Renault (a French automotive company) in Oran is an evident example of this devastating failure, in which the French have exerted pressure on Algerian negotiation team without considering Algeria's national sovereignty (Bachir, 2015).

- At first glance, it appears that bilateral goods trade between Algeria and the European Union within the Algeria-European Union association agreement was in favor of the former since Algeria accounted for a € 77.71 billion surplus. However, France and Germany have registered significant surpluses (€ 23.82 billion and € 9.88 billion, respectively), other than other European trading partners. Interestingly, Algeria's imports from the EU have generally recorded continuous growth from € 8.34 billion in 2002 to € 22.25 billion in 2015, before decreasing back to €13.50 billion in 2020.
- Algeria's exports of chapter 27 (mainly hydrocarbons exports) to the EU from 2006 to 2020 represent 95.86% of its total exports to the EU. Trade balance (excluding exports of chapter 27) has generally recorded continuous deterioration, which was estimated at € 248.40 billion during the same period, indicating the weakness of foreign direct investment flows of European Community's member states into Algeria outside the hydrocarbons sector, which are considered as a main key to support Algeria's exports diversification.
- The weakness of EU's foreign direct investment flows toward Algeria, which didn't exceed € 2525.1 million in the best circumstances. This result reflects a stark contrast between EU commitments towards Algeria and the flows achieved, which remain disappointing. Although France and Germany have recorded significant surpluses, Italy was the main contributor to the EU's foreign direct investment flows toward Algeria from 2013 to 2020. France and Germany recorded modest flows, interestingly the former recorded negative values (-110 and -35 million euro in 2013 and 2014, respectively), also the latter recorded -123 and -24 million euro in 2019 and 2020, respectively. The association agreement between Algeria and the European Union had not improved the competitive industrial performance of the former. Algeria's CIP index has recorded weak values over the period 1990-2020, in which the worst value hit 0.013 in 2020, meaning more degradation of Algeria's industrial competitiveness performance. Furthermore, Algeria is still trailing behind Tunisia and Morocco, such that Algeria ranked 96th on world level in 2020, while Tunisia and Morocco ranked 70th and 61th, respectively on a world level in the same year.
- Trade openness has no impact on Algeria's accession to the World Trade Organization (WTO). Despite the EU-Algeria association agreement being associated with the assistance of the European Community and its member states for rapid accession of Algeria to the World Trade Organization (WTO), however this support still has not occurred, implying that the EU desires to earn more concessions through more reduction in tariff barriers by the Algerian authorities.

Based on the above results we propose the following recommendations:

- The Algerian authorities should establish a bilateral investment treaty with the European Union, which offers more guarantees for European investors.
- The Algerian authorities should Simplify and facilitate customs and tax procedures, besides, establishing a double tax treaty, which will help Algeria to attract many foreign investors
- Algeria's government should strengthen its efforts to improve its international transparency index status by fighting corruption, especially economic corruption.
- Algeria's government should provide stability to investment laws to attract foreign investors.

- Algeria's government should reactivate the Algerian stock exchange for two reasons: firstly to provide more funds to economic agents, and secondly to give a real assessment of the Algerian companies' assets, which provides an incentive for the investors.
- Improving and modernizing the financial banking system, for example through encouraging e-commerce and e-payment.
- It should be activating economic diplomacy to promote Algeria's potentials.
- Removing bureaucratic obstacles by focusing on digitization.
- The Algerian authorities should build an international network between the distinctive centers of research and the Algerian research Laboratories to benefit from the large experience of the international centers of research.

For a deep assessment of the effect of the current PTA (i.e., the Algeria-European Union association agreement) and the potential PTA (i.e., the Algeria-BRICS group association agreement) on Algeria's balance of payments, we suggest the following topics:

The impact of the Algeria-EU association agreement on intensive and extensive margins of trade using propensity score matching with difference in differences.

Optimal tariff rates amid the Algeria-BRICS group association agreement using the theory of games.

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Appendix 1. The Harmonized System (HS)'s sections and chapters.

Section	Main category	Chapter	Scope
I	Live animals ;animal products	1	Live animals.
		2	Meat and edible meat offal.
		3	Fish and crustaceans, molluscs and other aquatic invertebrates.
		4	Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included.
		5	Products of animal origin, not elsewhere specified or included.
II	Vegetable products	6	Live trees and other plants; bulbs, roots and the like; cut flowers and omamental foliage.
		7	Edible vegetables and certain roots and tubers.
		8	Edible fruit and nuts; peel of citrus fruits or melons.
		9	Coffee, tea, mate and spices.
		10	Cereals.
		11	Products of the milling industry; malt; starches; inulin; wheat gluten.
		12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal plants; straw and fodder.
		13	Lac; gums, resins and other vegetable saps and extracts.
		14	Vegetable plaiting materials; vegetable products not elsewhere specified or included.
III	Same designation as corresponding chapter	15	Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes.
IV	Prepared foodstuffs ; beverages, spirits and vinegar ; tobacco and manufactured tobacco substitutes	16	Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates.
		17	Sugars and sugar confectionery.
		18	Cocoa and cocoa preparations.
		19	Preparations of cereals, flour, starch or milk; pastrycooks' products.
		20	Preparations of vegetables, fruit, nuts or other parts of plants.
		21	Miscellaneous edible preparations.
		22	Beverages, spirits and vinegar.
		23	Residues and waste from the food industries; prepared animal fodder.
		24	Tobacco and manufactured tobacco substitutes.
V	Mineral products	25	Salt; sulphur; earths and stone; plastering materials, lime and cement.
		26	Ores, slag and ash.
		27	Mineral fuels, mineral oils and products of their distillation; bituminous substance; mineral waxes.
VI	Products of the chemical or allied industries	28	Inorganic chemicals: organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes.
		29	Organic chemicals.
		30	Pharmaceutical products.
		31	Fertilisers.
		32	Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other colouring matter; paints and vamishes; putty and other mastics; inks.
		33	Essential oils and resinoids; perfumery, cosmetic or toilet preparations.
		34	Soap, organic surface-active agents, washing preparations, lubricating preparations, artificial waxes, prepared waxes, polishing or scouring preparations, candles and similar articles, modeling pastes, ' dental waxes' and dental preparations with a basis of plaster.
		35	Albuminoidal substances; modified starches; glues; enzymes.
		36	Explosives; pyrotechnic products; matches; pyrophoric alloys; certain combustible preparations.
		37	Photographic or cinematographic goods.
		38	Miscellaneous chemical products.
VII	Plastics and articles thereof ; rubber and articles thereof	39	Plastics and articles thereof.
		40	Rubber and articles thereof.
VIII	Raw hides and skins, leather, furskins and articles thereof ; saddlery and harness ; travel goods, handbags and similar containers; articles of animal gut	41	Raw hides and skins (other than furskins) and leather.
		42	Articles of leather; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silkworm gut).
		43	Furskins and artificial fur; manufactures thereof.

Section	Main category	Chapter	Scope
IX	Wood and articles of wood ; wood charcoal ; cork and articles of cork; manufactures of straw, of esparto or of other plaiting materials; basketware and wickerwork	44 45 46	Wood and articles of wood; wood charcoal. Cork and articles of cork. manufactures of straw, of esparto or of other plaiting materials; basketware and wickerwork
X	Pulp of wood or of other fibrous cellulosic material; waste and scrap of paper or paperboard; paper and paperboard and articles thereof.	47 48 49	Pulp of wood or of other fibrous cellulosic material; waste and scrap of paper or paperboard. Paper and paperboard; articles of paper pulp, of paper or of paperboard. Printed books, newspapers, pictures and other products of the printing industry; manuscripts, typescripts and plans.
XI	Textiles and textile articles	50 51 52 53 54 55 56 57 58 59 60 61 62 63	Silk. Wool, fine or coarse animal hair; horsehair yarn and woven fabric. Cotton. Other vegetable textile fibres; paper yarn and woven fabrics of paper yarn. Man-made filaments. Man-made staple fibres. Wadding, felt and nonwovens; special yarns; twine, cordage, ropes and cables and articles thereof. Carpets and other textile floor coverings. Special woven fabrics; tufted textile fabrics; lace; tapestries; trimmings; embroidery. Impregnated, coated, covered or laminated textile fabrics; textile articles of a kind suitable for industrial use. Knitted or crocheted fabrics. Articles of apparel and clothing accessories, knitted or crocheted. Articles of apparel and clothing accessories, not knitted or crocheted. Other made-up textile articles; sets; worn clothing and worn textile articles; rags.
XII	Footwear, headgear, umbrellas, walking-sticks, seat-sticks, whips, riding-crops and parts thereof ; prepared feathers and articles made therewith; artificial flowers; articles of human hair	64 65 66 67	Footwear, gaiters and the like; parts of such articles. Headgear and parts thereof. Umbrellas, sun umbrellas, walking-sticks, seat-sticks, whips, riding-crops and parts thereof. Prepared feathers and down and articles made of feathers or of down; artificial flowers; articles of human hair.
XIII	Articles of stone, plaster, cement, asbestos, mica or similar materials, ceramic products; glass and glassware	68 69 70	Articles of stone, plaster, cement, asbestos, mica or similar materials. Ceramic products. Glass and glassware.
XIV	Same designation as corresponding chapter	71	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal, and articles thereof; imitation jewellery; coin.
XV	Base metals and articles of base metal	72 73 74 75 76 77 78 79 80 81 82 83	Iron and steel. Articles of iron or steel. Copper and articles thereof. Nickel and articles thereof. Aluminium and articles thereof. (Reserved for possible future use in the harmonized system). Lead and articles thereof. Zinc and articles thereof. Tin and articles thereof. Other base metals; cermets; articles thereof. Tools, implements, cutlery, spoons and forks, of base metal; parts thereof of base metal. Miscellaneous articles of base metal.

Section	Main category	Chapter	Scope
XVI	Machinery and mechanical appliances ; electrical equipment ; parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles	84 85	Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof. Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles.
XVII	Vehicles, aircraft, vessels and associated transport equipment	86 87 88 89	Railway or tramway locomotive, rolling-stock and parts thereof; railway or tramway track fixtures and fittings and parts thereof; mechanical (including electro-mechanical) traffic signalling equipment of all kinds. Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof Aircraft, spacecraft, and parts thereof. Ships, boats and floating structures.
XVIII	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; clocks and watches; musical instruments; parts and accessories thereof.	90 91 92	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; parts and accessories thereof. Clocks and watches and parts thereof. Musical instruments; parts and accessories of such articles.
XIX	Same designation as corresponding chapter	93	Arms and ammunition; parts and accessories thereof.
XX	Miscellaneous manufactured articles	94 95 96	Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; lamps and lighting fittings, not elsewhere specified or included; illuminated signs, illuminated name-plates and the tike; prefabricated buildings. Toys, games, and sports requisites; parts and accessories thereof. Miscellaneous manufactured articles.
XXI	Same designation as corresponding chapter	97	Works of art, collectors' pieces and antiques.

Source: (Official Journal of the European Communities, 1987; World Customs Organization , 2018)