

## Macroeconomic Composite Index for Economic Stability: A Kaldorian Analysis for the Algerian Economy

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### Abstract:

The Algerian economy has known many changes in foreign trade policy and adopted many economic reforms in order to achieve the main goal of the economic policy (Economic Stability). In the present paper, we propose a macroeconomic composite index for economic stability to analyze and evaluate the implications of these changes on the economic stability of the country or the performance of the adopted economic policies since the 1980s, by a single index number per year, which we call the Economic Stability Index (ESI), through Kaldor's four macroeconomic variables (GDP, General level of prices, Employment, and External balances) based on "The Magic Square" and the quantitative formulation of the "Normalized Magic Square" presented by Medrano-B & Teixeira (2013). As a result, the best period that the Algerian economy has known was the period reflected by the highest value of the ESI, through achieving favorable results for the four indicators simultaneously.

**Keywords:** Macroeconomic Stability; Composite index; Kaldor's magic square; Foreign trade policy; Economic reforms.

**JEL classification codes :** E61 ; G18 ; C82 ; C63 ; C43.

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## مؤشر مركب للاستقرار الاقتصادي الكلي في الجزائر: تحليل كالدوري

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### الملخص:

من أجل تحقيق الهدف الرئيسي للسياسة الاقتصادية والمتمثل في تحقيق الاستقرار الاقتصادي الكلي، غير الاقتصاد الجزائري سياسته التجارية وتبنى العديد من الإصلاحات الاقتصادية. من خلال هذه الدراسة سنعرض مؤشرا مركبا للاستقرار الاقتصادي هدفه تحليل وتقييم آثار هذه التغييرات على الاستقرار الاقتصادي الكلي للبلد وقياس مدى فعالية السياسات الاقتصادية المعتمدة منذ الثمانينات والذي نسميه بمؤشر الاستقرار الاقتصادي (ESI)، ويطبق هذا الأخير بالاعتماد على متغيرات الاقتصاد الكلي الأربعة (النمو الاقتصادي، المستوى العام للأسعار، معدل البطالة، والتوازنات الخارجية) والتي وفقا لكالدور هي الأكثر ملاءمة لتحليل ووصف مدى تحقيق أهداف السياسة الاقتصادية، بناء على مفهوم "المربع السحري لكالدور" والصيغة الكمية لـ "المربع السحري المعدل لكالدور" والتي تم تقديمها مؤخرا من طرف Medrano-B & Teixeira سنة 2013. استنادا الى النتائج توصلنا الى أن أفضل فترة مر بها الاقتصاد الوطني هي الفترة التي تعكسها أعلى قيمة للمؤشر من خلال تحقيق نتائج إيجابية للمؤشرات الاقتصادية الأربعة في ان واحد.

**الكلمات المفتاحية:** استقرار اقتصادي كلي؛ مؤشر مركب؛ مربع السحري لكالدور؛ سياسة التجارة الخارجية؛ إصلاحات اقتصادية.

رموز تصنيف JEL: E61؛ G18؛ C82؛ C63؛ C43 .

## **Introduction**

The economic policy reflects through its instruments the ideological orientation of a country, it is considered as the realistic translation of the macroeconomic theory which provide an analytical tools and information that lead the policy makers to investigate the performance of the taken decisions in achieving the economic policy goal of economic stability, and to figure out the growth constraints and the macroeconomic problems such as the level of employment, the general level of prices, the economic growth, the external balances, foreign trade policy and so on. Nicolas Kaldor (1971), considered the achievement and the analyze of the economic policy objectives in his article “Conflicts in National Economic Objectives” is attainable by four macroeconomic variables, namely: GDP growth, employment, inflation, and trade balance all expressed in percentages. However, Kaldor’s first analysis did not present any mathematical nor graphical representation of his instrument called the “Magic Square” (MS), where the four major economic policy goals are to be found at the four corners of the square. after that, Karl Schiller, the German scientist and politician leader of the Social Democratic Party from 1966 to 1972, introduced a graphical representation of these variables which allows a visual diagnosis of the evolution of a country. Later, the economists of the OECD used this instrument with minor modification based on the original MS to analyze the performance of a single country or a set of countries. More recently, Medrano-B & Teixeira (2013) extended the geometrical view of the MS to a numerical evaluation called the “Modified Magic Square” where they presented one composite index computed by Kaldor’s four variables with the same scales to analyze the Economic Welfare of a country or a set of countries.

The 1980s witnessed many changes in the international economic structure, including deterioration in the economic growth rate of the industrialized countries, weak foreign trade, and the collapse of raw materials prices, these changes had a negative impact on developing countries, including Algeria. During this period, the Algerian economy suffered from low economic growth, a public budget deficit, high rates of inflation and unemployment, and a deficit in the balance of payments, theses shocks drive the country to deviate from a Centrally Planned Economy System or a Central Planning system which relies on the strategy of production by the national companies to liberate the foreign trade which rely on the market mechanisms in accordance with the directives and conditions of the International Monetary Fund (IMF), this change had a significant repercussions on the national economy and on the main objectives of the economic policy and its instruments, which obliged the government to take a set of economic reforms since the eighties based on the Keynesian theory, which holds that increasing public spending may increases the total demand, which in turn stimulates the economy and raises production and employment. Nevertheless, these reforms had an adverse effect on the social aspect resulting from the different structural reforms. After that, thanks to the financial comfort generated in the beginning of the 2000s by the improvements known in the oil market, the national authorities have launched a set of programs to deepen the economic reforms during the period 2001 to 2019 in order to catch up on development and relaunch the investment and growth again, in other words, to achieve the economic stability of the country. These programs were embodied in a new economic policy called the “Economic Recovery Policy”.

In the last few years there has been a growing interest in providing a quantitative tool to investigate and analyze the achievement of the principal economic policy objective and the implications of the policy-makers decisions on the economic stability of a country, this becomes an important issue and crucial for any country. With this goal, the present paper aims to establish a new empirical analyzing tool for modelling the results of a complex dynamic economic systems (the attainment of Kaldor’s variables simultaneously) to a comprehensive and tractable index in

Algeria, in other words, a new macroeconomic composite index based on the four Kaldor's variables that compose the "Magic Square" and the Normalized MS proposed by Medrano-B & Teixeira (2013) to achieve the economic performance or the economic stability of a country, which we call the "Economic Stability Index" (ESI). This index enables the policy-makers and researchers in Algeria or around the world to study the performance of the economic policy and the economic reforms perused by the authorities with a single index number per year, as well as we introduce model rates or target values for the four indices that remain the economic situation of the country in an admissible, or in a favorable economic situation for a developing country such as Algeria. Finally, we present an analysis using this approach for a single country in different time periods which to our knowledge, is the first time to deal with a this index for the same country, otherwise, the previous studies were comparative studies (see Medrano-B & Teixeira, 2013 and Couto Firme & Teixeira, 2014), as we present an appropriate methodology to create an economic stability index or as called by Medrano-B & Teixeira (2013) the indicator of economic welfare for the other developing countries.

## **The Magic Square as A Composite Index**

### **The Magic Square**

The main reason for creating one macroeconomic composite index for measuring the economic stability or the economic performance of a country or a set of countries, is to resume the complex of information for different indicators or aggregators into something more comprehensible, and to provide academic researchers with one index to use in their studies as well as providing an tractable index and analyzing tool for policy makers to represent the performance of the decided policy based on a well know concept (the magic square approach). In other words, the Economic stability indices gives a single number to measure the overall "success" of a nation to achieve its macroeconomic goals (Picek, 2017, p. 4).

The principal of the magic square is inspired from the article of (Kaldor, 1971), Actually, he produced an explicit and successful attempt to extend the General Theory of Keynes (1936) to an open economy in which the government's economic policy constitutes a fairly unambiguous component of the decision making within a mixed economy (Saavedra-Rivano & Teixeira, 2017, p. 89). He considered four macroeconomic variables to achieve the economic policy objectives and assumed that a successful management of an open foreign trade policy should attain simultaneously the four macroeconomic following variables: GDP growth, Employment, Trade Balance and Inflation, all of theme expressed in percentages. In this article Kaldor did not present any formulations, mathematical equations nor graphical illustrations to the previous variables. The combination of these variables was exposed in a square form, called "Kaldor's magic square" that simplified the comparison and display of the economy's performance (Dietmar Braun, 2003) (Couto Firme & Teixeira, 2014, p. 531). After that, due to the efforts of the German Minister of the Economy and Finance Karl Schiller (in the early 1970s) who presented a graphical representation of Kaldor's original view, this analytical instrument was called the MS "Magic Square" (Teixeira, Sandi Pinheiro, & Silveira Vilasboas, 2015, p. 147), then the economists of OECD began to use this geometric approach to evaluate economic policies and give the policy-makers and scholars an easy index to deal with the performance of a country (Economic Stability) or set of countries for comparative studies.

The conception of the Economic Stability Indices (ESI) is based on the calculation of the wonderland (the desirable land) introduced by the OECD under the name of the magic diamond (Picek, 2017, p. 7), or the measurement of the quadrangle area under the four macroeconomic

variables (GDP, Trade Balance, Employment and Inflation) expressed in percentages, in specific period of time with different scales, for a given country or a set of countries based on the four goals in the magic square (High and steady GDP growth rate, a low inflation rate, high employment rate, and a balanced current account balance) . It is actually called magic because these four objectives are very hard to be attainable in the real-life, while some are correlated, for example: unemployment and the GDP growth via Okun's law or unemployment and inflation via the Phillips curve. Where a larger size for the "MS" area is more desirable. Hence, the bigger is the area of a country's magic square, the better will be the results of Kaldor's four indicators and the closer this economy will be in relation to wonderland and, consequently, the index will be better (Couto Firme & Teixeira , 2014, p. 532). After that we need to find the limits (bounding conditions), designated as "awful" and "desirable" for each (Teixeira, Sandi Pinheiro, & Silveira Vilasboas, 2015, p. 152). Finally, the present research is restricted to the original magic square (MS).

As a recap, we can say that the Magic Square is a popular representation of the economic policy goals (achieving economic stability) under the main macroeconomic variables at the four corners of the square, or the measurement of the quadrangle area under the four macroeconomic variables (GDP, Trade Balance, Employment and Inflation) expressed in percentages with different scales, where a larger size for the MS area is more desirable.

## **Research Methodology**

### **Variables and Source of Data**

The data used in this paper was obtained from the World Economic and Financial Surveys World Economic Outlook Database, April 2020 by countries (country-level data)<sup>1</sup>, the data was used annually from 1980 to 2019 according to its availability.

In our research we used the Kaldor's macroeconomic indicators based on the magic squares approach, where we note the following variables:

- **GDPPCG**: The real GDP per capita growth rate (annual %) in constant price, it was chosen instead of the GDP growth rate to take into account the population growth as well as the standard of living, and in constant price to avoid the inflation implications;
- **Unmp**: The Unemployment rate, it was used under the definition of the ILO or EOCED in terms of the total work force;
- **Inf**: The inflation rate, it was used with the average consumer prices of year-on-year changes;
- **Cab**: The current account balance (as percentage of GDP), the focus of the BOP is on transaction in goods, services, incomes, and net transfers.

As discussed, to attain the economic stability based on Kaldor's Magic square, the country (or the policy makers) should aim a high economic growth respecting the other three equilibrium constraints: full employment, the stability of prices, and a balanced or a positive current account balance simultaneously. according to Kaldor, it is impossible to achieve these four goals at once. Indeed, for example, it is not possible to have a high unemployment rate and a low inflation rate in the same time (the Philips curve), these two are negatively correlated. Otherwise, growth and unemployment are correlated positively (Okun's low).

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<sup>1</sup> The WEO database on: <https://www.imf.org/external/pubs/ft/weo/2020/01/weodata/index.aspx>.

### Definition of the Ideal Country (The Bounding Conditions)

The definition of an ideal country (wonderland) or the bounding conditions for the MS area may vary from a researcher to another (Kučera, 2012), as an example, have used the GDP growth rate of 3%, the unemployment rate of 5.5%, inflation rate of 2% and balanced current account balance (equal to 0%) which is the definition proposed by the OECD. When, (Medrano-B & Teixeira, 2013) have used the GDP growth, inflation and unemployment rates and trade balance based on the maximum and minimum values of their sample. Meanwhile, (Lebza & Difallah, 2016) have used the definition of the central bank of Egypt, where they proposed a GDP growth rate from 5 to 7%, the unemployment rate from 4 to 5%, inflation rate from 2 to 3% and the value of trade balance in terms of GDP equal to 2%. Finally, (Picek, 2017) have used the principle of a standard reference value and the deviation from this value for the measurement of the indicators, where he introduced the growth rate of real GDP per capita, unemployment rate of 0%, 1.9% for the inflation rate, and a current account balance equal to 0%.

To define the ideal country in our research, we used the real GDP per capita growth rate of 6% which was calculated by the method of minimum and maximum values of our sample proposed by Medrano-B & Teixeira (2013), this method was chosen because there is no clear target value for the GDP growth rate and a high target value is always desirable as well as the dependency of the rate calculation on the population size. Consequently, the bounding conditions will be calculated as the following: From the  $Min_{GDPPCG}$  to a target value of 6% (maximum value of the sample).

Furthermore, for the current account balance in percentage of GDP, as a positive value is always desirable, which means a situation where the country earns more than it spends is always favorable, we should be targeting (the target value) the highest value that the country has experienced in the calculation of the bounding conditions. As a result, we use the methodology of the minimum and maximum of the sample. Therefore, the bounding conditions will be calculated as the following: From the  $Min_{Cab}$  to the  $Max_{Cab}$ .

For the inflation and the unemployment rates, as a lower value is more desirable, we propose the following method for the calculation of the bounding conditions: from the maximum value of the sample to a target value. Where the target values chosen for our study are the values proposed by (Lebza & Difallah, 2016) under the definition of the Central Bank of Egypt (CBE), this value seems logic as Algeria and Egypt are both developing countries, situated in north Africa, and members of the African union (similar trade transactions...), the proposed are as follows:

- From the  $Max_{inf}$  value to a target value of 2%. This rate is confirmed by Reifschneider and Williams (2000), where they mentioned that macroeconomic stability would likely deteriorate somewhat if the target rate of inflation were to fall below 1 or 2 percent (Billi & Kahn, 2008, p. 16);
- From the  $Max_{Unmp}$  value to a target value of 5%. This value is considered as a natural rate of unemployment which can vary from a period to another and from a country to another, it is explained by a combination of frictional, structural, and surplus unemployment;

As a recap, the definition of the bounding conditions or the ideal values of each indicator for a developing country such as Algeria, namely: GDP per capita growth rate at  $Max_{value}$  of the sample, the Inflation rate of 2%, Unemployment rate of 5%, and a current account balance in percentage of GDP at  $Max_{value}$  of the sample.

An important note to take into consideration in the calculation of the bounding conditions, is the time periods taking into consideration when defining the maximum and minimum values of the sample used in the calculation of the ideal area, for example if the objective of a study is to compare the economic performance among countries during a special time period (e.g. crisis) the researcher only need to work on this special time period. In one hand, if the research aims at analyzing a common special time period (e.g. crisis) for a set of countries, the index should be recalculated with the values of this specific period to be compared with others countries values. In other hand, if the research aims at analyzing this special time period for a specific country, the index should be calculated under the natural economic situation indexes. Hence, if the objective of the research is to compare the economic performance for a special country during a different time periods, then the researcher needs to exclude the special time periods from its sample to avoid the shocks of the outlier values on the analysis. Nevertheless, these values can't be excluded in the calculation of the Macroeconomic Composite Index. In the present research, we excluded the outlier values during the black decade that Algeria experienced from the year 1991 to 2000 for the calculation of the minimum and the maximum values of the bounding conditions (e.g. 31,7% rate of inflation in the year 1992, and 29,5% rate of Unemployment in the year 2000). The variables used in our study, its target value, and the minimum / maximum values of our sample are presented in table 1.

**Table N°1**  
**The MS variables in Algeria, its target values, and Max / Min values**

<b>Indicator</b>	<b>Target Value</b>	<b>Min Value</b>	<b>Max Value</b>
<b>GDPPCG</b>	6%	-4.749	5.616
<b>Inf</b>	2%	1.382	14.610
<b>Unmp</b>	5%	9.829	27.306
<b>Cab</b>	25%	-16.542	24.738

**Source:** author's computation based on the data of the WEO.

Finally, we can say that the definition of an “ideal country”, although good as a parameter, might be not an easy goal to achieve (Couto Firme & Teixeira , 2014, p. 532). That means it is not easy to elaborate the bounding conditions.

### **Periods of the Study**

The periods of our study are inspired from the economic reforms and the foreign trade policy changes and adjustments that the country had known since its independence, from the year 1963 to 2019 (as discussed in Brief overview: Foreign trade policy and the Economic reforms in Algeria). According to the available data, we divided our study to eight Five-years intervals of time from 1980 to 2019 presented in table 2.

**Table N°2**  
**Periods of the study**

Periods	Foreign Trade Policy	Economic Reforms
1980-1984	Monopoly of foreign trade by the national institutions	The 1st Five-year plan
1985-1989		The 2nd Five-year plan
1990-1994	Gradual liberalization	The Economic stabilization phase
1995-1999	Total liberalization	The Structural adjustment and transitional phase
2000-2004	The market economy	The Economic Recovery Support Program
2005-2009		The Supplementary Growth Support Program
2010-2014		The Five-year Development Program for the Consolidation of Economic Growth
2015-2019		The Economic Growth Consolidation Program

**Source:** Made by authors from the previous sources.

## The Magic Square Application: Case of Algeria

### Medrano-B & Teixeira Normalized Index

As discussed, Kaldor's first analysis did not present any quantitative nor graphical visualizations for the four variables expressed in percentages, after that, Karl Schiller introduced a graphical representation of these variables which allows a visual diagnosis of the evolution of a country. Later, the economists of the OECD used this instrument with minor modification based on the original MS. After these modulations, scholars start using this tool to analyze the evolution of "the macroeconomic performance" or said "the macroeconomic stability" of a country or a set of countries. For example, (Kučera, 2012) used the MS to evaluate the Czech Republic's economic performance between 2006 and 2011 based on the calculation of the MS area using the formulation proposed by (Bokrošová 2005) (Kučera, 2012, p. 87). However, Medrano-B & Teixeira mentioned that economists were able only to take a quick look to the evolution of the economic situation of a country by joining adjacent indexes with straight lines where the economy would then be related to the size "area" of the resulting quadrangle, as well as all four variables are at different scales and expressed in percentages. They proved that the area of the quadrangle cannot be calculated, because of the non-uniform scales of the axes. As a result, the researchers re-define the axes of the MS as to make them uniform and make possible the computation of the quadrangle area. In the present application, we used the methodology proposed by Medrano-B & Teixeira (2013) for the calculation of the index of economic stability in Algeria.



### Application of the Modified MS Approach

As presented in the definition of the ideal country, our bounding conditions or the wonderland intervals which was defined by the methodology of the Min / Max values of the sample to the target value (presented in table 1), and the principal proposed by (Couto Firme & Teixeira, 2014, p. 532) which says: Since the definition of an ideal country (wonderland) involves the establishment of unattainable goals, it is advisable that the targets should be above the verified maximum and below the verified minimum. It is time to define the “awful” and “desirable” for each indicator. Consequently, our ideal intervals are defined as the following:

$$-5 \leq \text{GDPPCG} \leq 6; \quad -17 \leq \text{Cab} \leq 25; \quad 15 \geq \text{Inf} \geq 2; \quad 28 \geq \text{Unmp} \geq 5.$$

The original area, the bleu area presented in figure. 1 (bleu area) noted  $W_A$ , cannot be calculated due to the non-uniform scales of the axes, in other words, analyzing the macroeconomic stability based only on this area has no longer a useful meaning. Otherwise, to construct a proper MS, all four scales must be redefined to be uniform from 0 to  $\alpha$  (Teixeira, Sandi Pinheiro, & Silveira Vilasboas, 2015, p. 153), where  $\alpha$  is numerical constant to be evaluated by normalizing the modified MS to a unit area (Medrano-B & Teixeira, 2013, p. 3). The new four indexes are presented as the following:

$$0 \leq \text{GDPPCG}' \leq \alpha; \quad 0 \leq \text{Cab}' \leq \alpha; \quad 0 \leq \text{Inf}' \leq \alpha; \quad 0 \leq \text{Unmp}' \leq \alpha.$$

This new transformation realizes a perfect square with uniform axes rotated to 45 degree. Moreover, the corresponding wonderland area noted  $W'_A$ , is presented by the area of a square using the length of its diagonal, which equal to one ( $= 1$ )<sup>4</sup>, knowing that the internal area represents the country's stability or performance of the real-world economy using Kaldor's variables. The wonder-land area is calculated as the following:

$$W'_A = 2 \times \alpha^2 = 1 \quad (2)$$

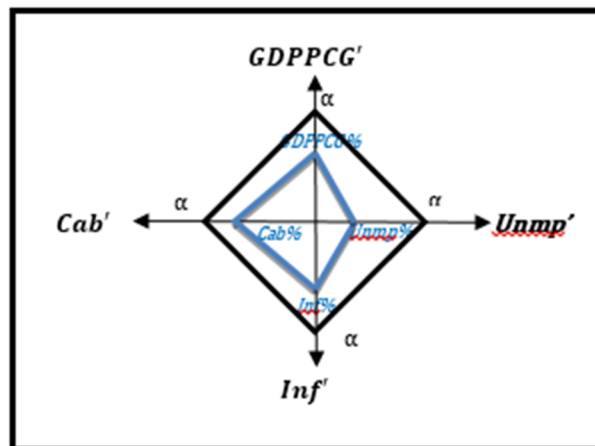
Consequently, the maximum of the numerical value  $\alpha$ , is equal to square root of 2 divided by 2 or  $\alpha^2 = \frac{1}{2}$ .

The ‘Normalized Magic Square’ (NMS) or as called by Medrano-B & Teixeira (2013) the ‘Primed MS’ is presented in figure 1.

<sup>3</sup> The area of a square using the length of its diagonal  $= \frac{1}{2} \times (\text{diagonal} = 2 \alpha) \times (\text{diagonal} = 2 \alpha)$ .

<sup>4</sup> The value 1 of the Wonder-land area is proposed by (Medrano-B & Teixeira, 2013, p. 5). It represents the one hander percent of macroeconomic stability of a country or the ideal country.

Figure N° 1  
The Normalized / Original MS



Source: Medrano-B & Teixeira, 2013, 5. With author's adaptation.

This After the redefinition of the four different scales macroeconomic indexes, we shall now define the transformation relation between the original variables and the new ones.

As mentioned by Medrano-B and Teixeira's (2013), as well as all original variables have linear scales, the new ones should also be linear. In other words, we can define a linear combination between these variables.

We start for example by the GDPPCG: we have,  $-5 \leq \text{GDPPCG} \leq 6$  and;  $0 \leq \text{GDPPCG}' \leq \alpha$ .

To define the transformation relation between the GDPPCG and the GDPPCG', we end up with the solution of a simple algebraic linear combination between two points, Alternatively, as said Medrano-B and Teixeira, the problem reduces to finding the straight-line equation between the two points  $(-5,0)$  and  $(6, \alpha)$ , in an orthogonal coordinate system  $(\text{GDPPCG}, \text{GDPPCG}')$ .

In mathematics, any straight-line equation between two points  $(x_0, y_0)$  and  $(x_1, y_1)$  in an orthogonal coordinate system  $(x, y)$  is written as follows:  $y = m(x - x_0) + y_0$  (3) \  $m$ : is the slope of the linear equation; where  $m = \frac{\text{change in } y}{\text{change in } x}$ .

Applying this methodology to calculate the linear combination in our case, we obtain:  $m = \frac{\alpha - 0}{6 - (-5)}$  or  $m = \frac{\alpha}{11}$ . After replacing  $m$  by its value and the point  $(-5,0)$  in equation 3 we obtain the following transformation relation:  $\text{GDPPCG}' = \frac{\alpha}{11}(\text{GDPPCG} + 5)$ .

Meanwhile, for the Unemployment, we have:  $28 \geq \text{Unmp} \geq 5$  and;  $0 \leq \text{Unmp}' \leq \alpha$ .

To define the linear combination between the Unmp and the Unmp', we simply solve the straight-line equation between the two points  $(28,0)$  and  $(5, \alpha)$ , in an orthogonal coordinate system  $(\text{Unmp}, \text{Unmp}')$ . Using the mathematical methodology present previously we obtain the following result:  $\text{Unmp}' = \frac{\alpha}{23}(28 - \text{Unmp})$ .

Using the same logic, we define the normalized transformation of the remain variables.

As a recap, the four-scale transformation based on the linear transformation proposed by Medrano-B and Teixeira for Kaldor's variables and the methodology proposed above for designation of the desirable-land in Algeria from the year 1980 to 2019 are presented Table 3.

**Table N°3**  
**Normalization of the Original Kaldor's variables.**

Index:	Transformation Equation:
GDP per capita Growth rate	$\mathbf{GDPPCG}' = \alpha/11 (\text{GDPPCG} + 5)$
Current Account balance in percentage of GDP	$\mathbf{Cab}' = \alpha/42 (\text{Cab} + 17)$
Unemployment rate	$\mathbf{Unmp}' = \alpha/23 (28 - \text{Unmp})$
Inflation rate	$\mathbf{Inf}' = \alpha/13 (15 - \text{Inf})$

**Source:** author's computation based on the data of the WEO.

As discussed, the real-world economy is represented by the internal area of the Normalized Magic Square  $W'_A$ , which is calculated by the formula:  $\frac{1}{2} \times (\text{diagonal}) (\text{diagonal})$ .

After replacing the variables of the Normalized Magic Square (NMS) represented in figure .1 by its values as shown in table 3, and as the weighting scheme is equal to one for each index, we obtain the following results:

$$W'_A = \frac{1}{2} (\text{GDPPCG}' \text{ Cab}' + \text{Inf}' \text{ Cab}' + \text{GDPPCG}' \text{ Unmp}' + \text{Inf}' \text{ Unmp}') \quad (4)$$

Testing the “awful” and “desirable” values in the index, we obtain the following:

For the “awful” values or the minimum values of the sample:  $\text{GDPPCG} = -5\%$ ;  $\text{Cab} = -17\%$ ;  $\text{Inf} = 15\%$ ;  $\text{Unmp} = 28\%$  we obtain:

$$W'_A = 0.$$

For the “desirable” values or the “model” values:  $\text{GDPPCG} = 6\%$ ;  $\text{Cab} = 25\%$ ;  $\text{Inf} = 2\%$ ;  $\text{Unmp} = 5\%$  we obtain:

$$W'_A = 1; \text{Consequently: } 0 \leq W'_A \leq 1.$$

According to the previous considerations, we introduce a new macroeconomic composite index for Algeria.  $\mathbf{ESI}_t$ : The index of “Economic Stability” given by the following equation:

$$\mathbf{ESI}_t = \frac{1}{4} \left[ \frac{1}{11} (\text{GDPPCG}_t + 5) + \frac{1}{13} (15 - \text{Inf}_t) \right] \left[ \frac{1}{23} (28 - \text{Unmp}_t) + \frac{1}{42} (\text{Cab}_t + 17) \right] \quad (5)$$

$$\text{With: } 0 \leq \mathbf{ESI}_t \leq 1.$$

Where the value 0 represents a catastrophic economic situation of the country, contrary, the value 1 models as said Medrano-B and Teixeira's (2013): the wonder-land economy or said a perfect economic situation of a country.

The Interpretation of the Economic Stability Index for a country is proposed as follows:

- If the  $0 \leq \mathbf{ESI}_t < 0,2$ : The country is in a Catastrophic Economic Situation;
- If the  $0,2 \leq \mathbf{ESI}_t < 0,6$ : The country is in a Difficult Economic Situation;
- If the  $0,6 \leq \mathbf{ESI}_t < 0,8$ : The country is in Acceptable Economic Situation;
- If the  $0,8 \leq \mathbf{ESI}_t < 0,9$ : The country is in a Favorable Economic Situation;
- If the  $0,9 \leq \mathbf{ESI}_t < 1$ : The country is in a Perfect Economic Situation.

An important note to take into consideration when calculating the indices, if the country has experienced a crisis or a special time period, the values of the four indexes were not taken into consideration during the computation. Consequently, a very high values “outliers” out the bounding conditions (BC) could lead to a negative value of the index. To avoid this issue, we propose to take the Max / Min value of the variable out the BC that keep the indices between zero and one.

**Results and Discussions**

Through this application we aim at analyzing the value of the Economic Stability Index (ESI), or said the “Economic Stability” of the country, during the period from 1980 to 2019 using the available data of the WEO, to evaluate the achievement of the economic policy goals (performance of the economic policy) through its instrument, the trade policy changes and adjustments from a Centrally Planned Economy to the Market Economy, and the applied Economic Reforms that Algeria experienced during this period (as presented in table 2).

The values used in the estimation of the index were calculated by the average value of the four indexes during the time interval period (5 years), the average values for Kaldor’s variables in Algeria and its substitution in equation 5, are presented in Table 4 as the following:

**Table N°4**

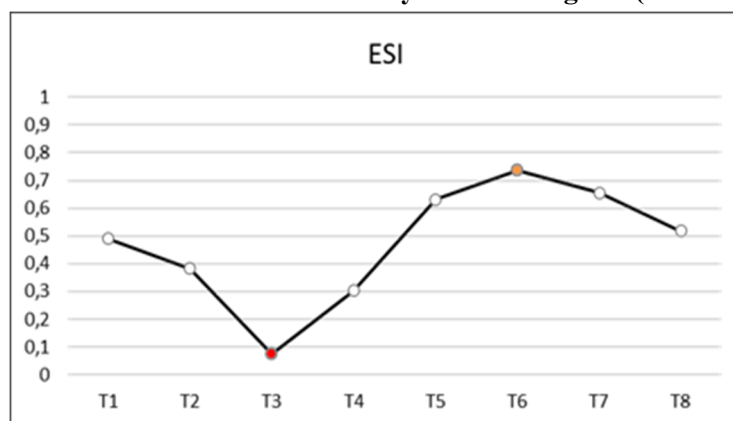
**Average value of indexes associated with the Modified Magic Square**

Index / Period	80-84 T1	85-89 T2	90-94 T3	95-99 T4	00-04 T5	05-09 T6	10-14 T7	15-19 T8
<b>GDPPCG</b>	1.0263	-1,5686	-2,4718	1,6458	3,1776	1,2386	1,1700	-0,0462
<b>Unmp</b>	15,3992	19,0428	21,7804	28,2732	24,7676	12,6160	10,2660	11,3070
<b>Inf</b>	9,0032	9,0812	23,2740	12,3500	2,8322	3,5938	4,7002	4,5990
<b>Cab</b>	-0,1818	-1,4766	1,4356	0,5308	12,6564	17,6762	3,8590	-13,079
<b>ESI<sub>t</sub></b>	<b>0.4893</b>	<b>0.3815</b>	<b>0.0756</b>	<b>0.3033</b>	<b>0.6315</b>	<b>0.7347</b>	<b>0.6552</b>	<b>0.5173</b>

**Source:** The data of the WEO with authors computation.

Based on the normalized magic square computations of the Economic Stability Index (ESI), presented in table 3. The Figure .2 plots the ESI values in Algeria during the period 1980 to 2019 (T1 to T8).

**Figure N° 2**  
**Evolution of the Economic Stability Index in Algeria (1980-2019).**



**Source:** Made by authors using equation (5).

From the first visual analysis of figure 2, it can be seen that during the period 1980 to 2019 Algeria has experienced the worst comparative index with a value of 0.07 (7%) in the period T3 (1990 to 1994) which reflects a catastrophic economic situation for the country. However, Algeria reached the best comparative index in all the periods of the study during the period T6 (2005 to 2009), with a value of 0.73 (73%) reflecting an acceptable economic situation of a country.

As discussed, the trade policy was divided to two time periods. Firstly, before the year 1990, the Planned Economy period, during this decade (1980 to 1989) the Economic Stability Index did not exceed the value of 0.5, in other words the country was in a difficult economic situation. More precisely, from the analysis of the ESI during this period (T1 to T2) the Index value decreased from 0.49 (close to 0.5) to 0.38 which mean that the economic situation of the country is getting worst, from a close to an acceptable economic situation to a difficult situation. This result is explained by the Algerian economy reliance on the hydrocarbon sector by 98% of total export, in the beginning of the 1980s, Algeria began to take a set of measures aimed at rebalancing the distribution of investments in favor of the non-industrial sectors (hydrocarbon sector), these measures taken under an appropriate international conditions - high oil prices - allowed to achieve a significant results, an improvement in the economic growth, and an acceptable growth outcome was achieved (Bouhafs & Darbal, 2007, p. 331). However, the disadvantages of this dependence were in fact hidden by the big financial resources that the hydrocarbons sector was generating, nonetheless the oil prices fall in the beginning of march 1983 with the accompanying sharp drop in the prices curve for the year 1986, the fragility of the national economy exposed, as a result, an external debt crisis emerge from 14 billion dollars in 1984 to 24.6 billion dollars in 1987 and the debt service ratio to exports rose to 75 percent. This growth in the volume of debt is due to the negative growth of the GDP that characterized the second half of 1980s, the deterioration of Algeria's solvency in the international money market, and for the internal balances, a fiscal deficit was recorded in the 1985 budget of 14 billion dinars and 15 billion dinars in 1987, thus the Algerian economy after the year 1986 faced great problems and a continuous deficit in the public budget, and a deficit in the external balances (Krouch & Ratoul, 2015, p. 271). Finally, we can say that the monopoly of foreign trade by the national institutions as a foreign trade policy within the framework of the first and second five-year plans produced several results, most of them negative. In other words, the Algerian economic policy did not achieve its objective of economic stability during the Planned Economy System (before the 1989). The failure of the economic policy were reflected by the low growth rates, the increase of inflation rate, the rise in unemployment, the continuing decrease of the balance of payments, in addition to the high rates of debt service and the pressures that burden the economic and social progress, which was the result of several factors, including: economic dependency, steadily increasing demographic growth and dependence on the hydrocarbon sector (Mihoub & Berkan, 2016, p. 14).

Secondly, after the year 1990, the Algerian authorities changed the foreign trade policy from a Planned Economy System to a gradual liberalization policy, then to a liberal trade policy or as known by the Market Economy System.

In the beginning of the 1990s (period T3), Algeria experienced the worst ESI value which was close to zero, which reflect a catastrophic economic situation of the county. This situation is explained in one hand, by the non-stable security situation that the country known during this period, the starting of the black decade or the Algerian civil war, where Algeria experienced the worst indicators rates: 31.7% for the inflation rate which leads to purchasing power deterioration, 29% for the unemployment rate or said about more than a quarter of the active population were not employed, -4.4% for the GDP per capita growth rate, and a negative current account balance (-4.33%). These catastrophic results for the indicators lead the index to be close to zero. In other

hand, by the crises of payments generated by the continuing fall of oil prices which leads to the signature of the three agreements of credit standing with the International Monetary Fund (Standby 1, Standby 2, and Standby 3) from 1989 to 1995 (Mihoub & Berkan, 2016, p. 18) as well as the Structural adjustment program Known as the Extended Financing Facilitation Agreement from 1995 to 1998 (Fard & Masar, 2017, p. 221) to correct the situation of the macroeconomic stability indicators, these agreements came under a harsh conditions characterized by an austerity fiscal policy with a strict monetary policy, in parallel with price liberalization and a gradual decrease in the exchange rate with the beginning of the liberalization of foreign trade.

For the period T4, from 1995 to 1999 which is the period of the Structural adjustment and transitional phase or the second generation of the structural adjustment in cooperation with the IMF, the ESI value increased from 0.07 to 0.3, which means the economic situation improved from a catastrophic to a difficult situation. These results were achieved thanks to the rebounds in oil prices, which reached 21.70\$ in 1996, growth in the hydrocarbons sector with 7% for the same year, in addition to the growth outside the hydrocarbon sector, mainly the agricultural sector with 5.1% in 1998 (Hadjene, 2012, p. 196), as well as the increase in the volume of imports by 17.29% to cover the increasing domestic demand while the inflexibility domestic

production, which eventually led to a decline in the inflation rate in the same year (Mihoub & Berkan, 2016, p. 20). Despite these positive results of the reform in the financial and monetary fields, the conditions related to the labor market had known a significant deterioration as unemployment rates increased to 29.3% in 1999 (Bouhafs & Darbal, 2007, p. 337). Finally, we remark that the Algerian economy had known the lowest values for the ESI during this decade since 1980.

For the third millennium (T5, T6, T7, and T8), the ESI had known the highest values from 0.51 to 0.73 where Algeria had known an acceptable economic situation for the first time since the 1980s, these results are explained by the relatively continuous improvement in oil prices in light of previsions that it will not decline in the short or the medium term, led the national economy to a financial comfort in the beginning of the year 2000, and after two years of the end of the structural reforms programs came a set of investment programs (Fard & Masar, 2017, p. 223), as presented in table 2 from 2000 to 2019, to push up the national economy.

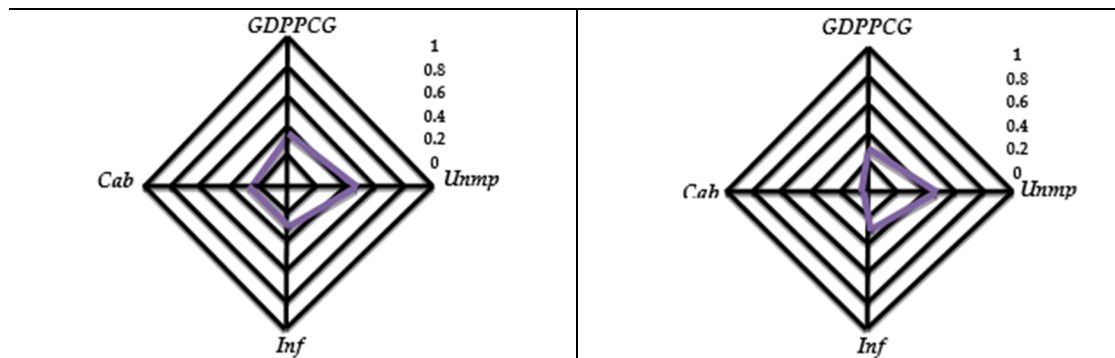
The periods T5, T6 and T7, from 2000 to 2014 which is the period where the economic policy was known as the Economic Recovery policy. This policy aims to re-launch the economic machine using the parallel deficit in the era of investment (wages and consumption, loan facilities ..., and this policy was inspired by the Keynesian thought (Messaoudi, 2017, p. 219). The improvement on the macroeconomic indexes during this period is due to the achievement of the Economic Recovery program objectives of creating jobs and improving purchasing power (decreasing the inflation rate), domestic and foreign investments especially during the period 2005-2009 which creates more employment, the improvement in oil prices and the value of exports between 2005 and 2008 (Messaoudi, 2017, pp. 222-224) which explain the high value of the ESI (0.73) during the period T6. The acceptable economic situation is achieved by the expansive growth resulting from the relative increase in the labor and capital stock components using the financial surpluses achieved in the hydrocarbons sector, which remains uncontrollable outside of the scope of local control. As said (Mihoub & Berkan, 2016) the achieved growth is circumstantial and not sustainable, which is confirmed by the decrease of the ESI value after 2014 from 0.65 to 0.51 or the economic situation from an acceptable to a difficult situation. This degradation is explained by the adopted policy which has raised the effective demand for consumer goods due to increased volume of public investment while the inability of the national

productive device to increase its capacity of production, which led to a satisfaction of that demand through imports without any rationalization controls. The significant volume of imports in reversal of oil prices after 2014 engender an imbalance in the structure of the productive system, and as a result a negative impact on the national economy after 2014.

Modified Magic Square results for the Algerian economy during the period 1980 to 2019 are presented below:

**Table N°5**  
**Results of the Kaldor’s Modified Magical Squares during the period 1980 to 2019.**

Algeria’s Modified Magic Square for T1	Algeria’s Modified Magic Square for T2
Algeria’s Modified Magic Square for T3	Algeria’s Modified Magic Square for T4
Algeria’s Modified Magic Square for T5	Algeria’s Modified Magic Square for T6
Algeria’s Modified Magic Square for T7	Algeria’s Modified Magic Square for T8



Source: authors computation using equations in table 3.

For the interpretation of the normalized magic square, if one of the real economy square rips calculated by the equations in table 3 is close to zero, the indices is in undesirable value. For example, in the Algeria’s Modified Magic Square for the period T8, we remark that the Cab is close to zero, in this period the value of the Cab was -13.07 which is a far value from a balanced or positive current account balance (desirable value). Finally, we can say that this area of the modified magic square is embodied by the  $ESI_t$  values.

## Conclusion

The main concern of the paper was to propose a new macroeconomic composite index for a developing country such as Algeria, the Economic Stability Index (ESI), that summarize the four macroeconomic variables proposed by N. Kaldor which compose the MS to achieve the main economic policy objective through its instruments, foreign trade policy, and the different policy-makers decisions taken during the period of the study, the economic reforms adopted by the Algerian authorities, and to analyze the national and international changes implications on the economic stability situation of the country by a single index number per year.

The Economic Stability Index is very useful in analyzing the achievement of the main goal of the economic policy, achieving the macroeconomic stability, and the different decisions (economic reforms, structural adjustments...), we can’t say in a detailed manner (for example: by policy, by sector...) but an easy and tractable macroeconomic indicator for the policy-makers, academic researchers, and even for the simple readers, based on a simple, yet well-known concept “The Magic Square” that has strong roots in policy-making (Picek, 2017, p. 3). However, an important note to take into consideration, the ESI is restricted to the bounding conditions (BC) taken into the computation of the index, the period of the study (if the country has known a crisis...) to elaborate the target values in the sample, as well as the source of data. The ESI values alter from 0 to 1, that is from a catastrophic, difficult, acceptable, favorable, and a perfect economic stability situation (the Wonderland) as discussed in the interpretation of the ESI.

For the Algerian economy, to our knowledge, this is the first study to deal with a macroeconomic composite index for economic stability, that we call the Economic Stability Index.

From the evolution of the economic policy through the analysis of the Economic Stability Index we come up that the Algerian economic crisis is a structural, circumstantial crisis appropriate to the oil market which is the main factor responsible for the fluctuation of the macroeconomic indices in Algeria (Krouch & Ratoul, 2015, p. 274) which means that the value of the index or the Modified (Normalized) MS area changes by the fluctuations in this sector (hydrocarbons sector), and the Algerian authorities did not benefit from the previous experience in evaluating its achievements and not repeating the same mistakes since the application of the



Planned Economy or the Central Planning to the liberalization of the trade policy as the economic stability index did not achieve a favorable situation and remain under an acceptable situation where the ESI value of 0.73 which is an admissible economic situation close to a favorable one, that is the best period of the Algerian economy (period T6), which coincide with a favorable oil prices and the implementation period of the Supplementary Growth Support Program from 2005 to 2009 through achieving a favorable results for the four indicators simultaneously (not a very close matching with the bounding conditions, otherwise an acceptable closeness) , i.e. the widening of the modified square area and its nearness to a favorable square shape, in other words, the closeness of ESI value of 0.73 to a favorable value of 0.8. However, we come up that the level of economic stability (or said the economic performance) decline during the other periods of implementation of other programs, which is primarily due to the fall in oil prices in the global market, this means that the determinants of economic stability in the Algerian economy are all linked to external factors. Finally, we can say that a good performance may appear but it hides the fragility of the Algerian oil-dependent economy.

From the outcome of our performed study, we present the following propositions: for the policy makers or scholars we propose the following target rates or “model rates” to be attainable in a developing country such as Algeria that remain the Economic Stability Index between 0.7 and 0.9, in other words, remain the economic situation between an admissible situation and a favorable situation because the achievement of a perfect economic situation is very hard to be attainable in the real life. The bounding values are as the following:

- For the GDPPCG:  $3 \leq \text{GDPPCG} \leq 6$ ;
- For the Inflation rate:  $5 \geq \text{Inf} \geq 2$ ;
- For the Unemployment rate:  $8 \geq \text{Unmp} \geq 5$ ;
- For the current account balance in percentage of GDP:  $\text{Cab} \geq 0$ ; at least a balanced or a positive Cab is always desirable, or from zero to the maximum value of the sample.

Finally, also for scholars interested in studies of the Economic Stability or the economic performance in Algeria, we extend the ESI values computed by the equation 5 (5) from 1980 to 2019 in table 4 as follows:

**Table N°6**  
**The Economic Stability Index in Algeria from 1980 to 2019.**

Period	ESI <sub>t</sub>	Period	ESI <sub>t</sub>	Period	ESI <sub>t</sub>	Period	ESI <sub>t</sub>
1980	0,403073521	1990	0,4162652	2000	0,625179815	2010	0,704705915
1981	0,354273245	1991	0,038132333	2001	0,541119985	2011	0,688716767
1982	0,582239871	1992	0,004827924	2002	0,639030332	2012	0,580264587
1983	0,547205952	1993	0,071893413	2003	0,672842066	2013	0,655276687
1984	0,559998972	1994	0,004953818	2004	0,679386165	2014	0,647145711
1985	0,449649796	1995	0,002018232	2005	0,835586667	2015	0,52989858
1986	0,252956332	1996	0,204214778	2006	0,778276065	2016	0,494615671
1987	0,404556243	1997	0,423835543	2007	0,763482146	2017	0,475055732
1988	0,32665183	1998	0,47508426	2008	0,715234917	2018	0,526209626
1989	0,474043303	1999	0,476364442	2009	0,581218741	2019	0,561173053

**Source:** Authors computation using equation 5.

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