

Assessment of Yemen's macroeconomy performance during 2001-2015 using Kaldor's magic square

Mehmet Hilmi Özkaya^{1,*}, Maeen Alhuwesh²

¹Department of Economics, Faculty of Economics and Administrative Sciences, Uşak University, Uşak, Turkey

²Department of Economics, Faculty Administrative Sciences, Taiz University, Taiz, Yemen

ARTICLE INFO

Article history:

Received 2 December 2020

Received in revised form

26 February 2021

Accepted 2 March 2021

Keywords:

Index of economic welfare

Macroeconomic performance

Magic square approach

Yemen's economy

ABSTRACT

Assessing a certain country's macro-economy performance faces innumerable challenges, of which the most important ones are running counter to the objectives of economic policy. Added to these challenges is the absence of a consensus among economists regarding the identification of variables, which can be taken for granted while assessing a country's macro-economy performance? The present study aims at assessing Yemen's macro-economy performance during the period 2001-2015 using the four economic variables (economic growth, unemployment, inflation, and current account) that constitute Kaldor's Magic Square chart of 1971. To avoid challenges connected with variables' measurement, the economic welfare indicator has been used. The findings show a drastic deterioration in the level of economic welfare during the period mentioned above, with an impressive decrease in the value of economic welfare from 0.36 in 2001 to zero in 2015 as the magic square scale showed. Assessing the economic performance during the period showed that the economic performance in 2001 was better than that of 2015, with a departure of Yemen's economic performance from the performance of the wonderland economy. Hence, Yemen's economy can be described as an ill-performance economy, basically due to the high averages of unemployment and inflation.

© 2021 The Authors. Published by IASE. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

The macroeconomic performance assessment refers to assessing the range of the quality of a country's institutions' performance in achieving the main economic objectives for government policies. The main economic objective represents government policies is usually to improve the real standard of living of the citizens. Economists use a wide group of economic indicators in order to judge whether if economic performance has improved or deteriorated (Daşbaşı et al., 2019; Çiçen, 2017). Yet, assessing a country's macro-economy performance faces many challenges, of which the most significant is the conflicting economic policy objectives (Güran and Tosun, 2005), for the economic policies have different objectives such as economic growth achievement, unemployment reduction, price


stability, and payment balance. Though some of these objectives support each other like economic growth achievement and unemployment reduction, these objectives contradict others such as price stability. Consequently, achieving a certain objective may happen, but at the expense of another objective (Nehme, 2014; Picek, 2017). This is in addition to the absence of consensus among economists as regards the identification of variables to be taken into consideration while assessing a country's macro-economic performance. Although the economic growth rate is used for assessing the macro-economic performance, common practices use an indicator consisting of a weighted average for a number of variables instead of a single variable. This, of course, requires developing indicators that contain a number of variables for obtaining an accurate and objective assessment. It is also required to use a convenient method for assessment containing full-scale data that enables us to measure and assess a country's economic performance through the use and development of economic performance assessment indicators (Al and Yıldız, 2019).

It is important here to indicate the initial attempts of introducing a convenient indicator.

* Corresponding Author.

Email Address: mehmethilmi.ozkaya@usak.edu.tr (M. H. Özkaya)

<https://doi.org/10.21833/ijaas.2021.06.014>

 Corresponding author's ORCID profile:

<https://orcid.org/0000-0001-6617-9259>

2313-626X/© 2021 The Authors. Published by IASE.

This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

Kaldor (1971) included four variables: unemployment, inflation, economic growth rate, and wage raise policy. The dissatisfaction indicator developed by Okun (1970) consists of two variables (unemployment and inflation). The high value this indicator shows means a setback in economic performance. Calmfors and Driffill indicator developed by Calmfors and Driffill (1988) to replace Okun's indicator consists of two variables: Current account ratio to GDP and unemployment. Leuven indicator introduced by Melyn and Moesen (1991) contains variables such as unemployment, the change rate of GDP's inflators, real economic growth rate, and current account ratio to GDP. Lovell et al. (1995) used an indicator containing 4 variables, besides two environmental variables to assess the economic performance of 19 countries of OECD during the period 1970-1990.

Recent studies have, wholly or partially, made repeated use of all indicators mentioned above in the assessment of a country's economic performance and in the establishment of comparison among a group of countries' economic performance. Dow and Deeneyr (1998) used an indicator containing seven variables to assess the G7 group's economic performance. Misery indicator developed by Barro (1999) from Okun's. It contains variables such as long-term profit rate and GDP's average value deviations in the long term, besides inflation and unemployment variables of Okun. Aiginger et al. (2011) used an indicator consisting of economic growth rate variable and other four supporting variables to assess economic performance in 37 countries during the economic crisis of 2008. Chattopadhyay and Bose (2015) used an indicator consisting of six variables to assess the economic performance of 48 countries during the period 2000-2012.

With regard to Yemen's economy, since the realization of Yemeni unity in 1990 and up to the present time, it has been facing many changes and fluctuations, most of which are related to the nature of events in Yemen situations in addition to changes and events in the international scene. As Yemen is described by the distortion of its economic structure, weakness of public resource management and the failure to allocate them to the optimal allocation in line with according to economic and social priorities, the simplicity of the financial system and the tightness of the monetary market, the weakness of the volume of savings, dependence on the export of oil and limited types of agricultural products, therefore the general budget and balance of payments status are dependent on the export sector, which is affected by international economic and market conditions (Al-Afandi, 2010; Fahmi, 2014).

Though there were strategies and programs developed by the successive governments as remedies for disorders in economic structure and in order for raising the efficiency of resource mobilization and allocation, with paying attention to the private sector in the purpose of achieving high economic growth rates and reducing unemployment

rates, which contribute to raising living standards (Al-Hawri, 2019). However, the success matter in achieves those objectives remained the subject of theoretical questions by those interested. Unfortunately, these questions were not put into serious study and analysis in accordance with the aforesaid methods of economic performance assessment. Therefore, the aim of this paper is to evaluate the macroeconomic performance of Yemen's economy during the period 2001-2015 using the four variables (economic growth rate, unemployment, inflation, and current account balance) that constitute Kaldor's Magic Square method. In order to avoid problems related to variables' measurement, the economic welfare index established by Medrano-B and Teixeira (2013) was used. We will try through this study to answer the following questions: What's the condition of the Yemeni economy in relation to the indicators of the Kaldor's magic square? What's the condition of the economic welfare level in Yemen's economy? What's the evaluation of Yemeni economic performance in relation to the wonderland economy and the catastrophic economy? Did the Yemeni government's policies and programs succeed in getting rid of Yemeni economy structural distortions and achieving any magic square aims? And for that, this paper proposes to divide the period 2001-2015 into 3 equal time sub-periods; each sub-period consists of 5 years. The first one (2001-2005) is the period that followed the completion of the financial and economic reform program started in 1995 in cooperation with the International Monetary Fund and World Bank. The second period (2006-2010) was characterized by a global economic crisis of 2008. The third period (2011-2015) is characterized by political unrest that greatly affected Yemen's macro-economy performance. The economic welfare index will be counted in per year of the study years as well as the calculation of the index for the three mentioned time stages, and comparing economic performance for every stage to economic one for a wonderland and catastrophic economy. This is based on the Central Bank of Yemen data and the World Bank database.

In order to achieve the objectives of this study, the topic will be discussed through five sections. section one deals with the introduction, section two includes the presentation of literature review, section three is devoted to the study methodology (Magic Square), while section four is devoted to the results and its discussion, and section five includes the conclusion and contains a summary of the conclusions reached.

In line with the aim of this study, we will briefly review the magic square indicators in Yemen's economy during the study period, as shown in Fig. 1.

That the values of the basic economic variables (economic growth, inflation, and payment balance) vary greatly during the period 2001-2015 is obvious. It is also obvious from Fig. 1 that the unemployment rate is relatively stable. However, there is a setback in the values of economic growth

reaching 7.7% in 2010 and -28% in 2015. Inflation values vary between 3.7% at minimum in 2009 and 22% at maximum in 2015. The value of current

account balance to GDP went down to reach a surplus of 6.8% in 2001 and a deficit of -10.1% in 2009.

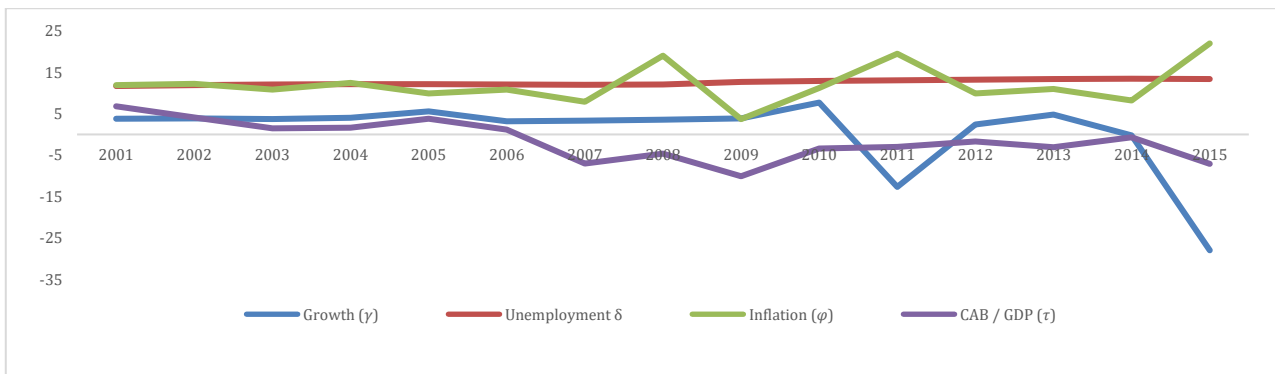


Fig. 1: Kaldor's magic square's variables of Yemen's economy (2001-2015)

2. Literature review

Many economic studies used Kaldor's magic square to assess economic performance either according to different time phases or through establishing comparisons between a country and another/others. Due to the absence of similar studies done on Yemen's economic performance, this study is established. It plans to overview the most significant studies done in the field of economic performance assessment; with a quick mention of countries whose economic structures resemble that of Yemen. Al and Yildiz (2019), aimed at assessing Turkey's macro-economy performance during the period 2006-2017 and investigating the effect of the economic crisis of 2008 on Turkey's macroeconomy using Kaldor's method. The study found that Turkey's best economic performance was in 2012, while 2009 was shown to be the worst in the history of Turkey's economic performance, and that the 2008 crisis had a great negative effect on the country's macro-economy performance. Masoud (2018), using Kaldor's method, aimed at assessing Libya's macro-economy performance during the period 1996-2018 and identifying the role of economic reform as part of institutional reform in the country. The findings showed poor performance of Libya's macroeconomy during this period, and that Libyan economic policy-makers lacked the convenient strategies for economic/institutional reform. Picek (2017), using Kaldor's method, aimed at assessing the macro-economy performance of 21 countries in the Euro Region during the period 1961-2015 and investigating the effect of the economic crisis of 2008. The study found that the countries included in the study experienced poor economic performance during the last decade of the period, and there was no escape from the negative effect of the 2008 crisis on their economic performances. Messaoudi (2017), using Kaldor's magic square, aimed at assessing the macro-economy performance of Algeria during the period 2001-2016. As findings, the best performance of the Algerian economy was during the period of the implementation of economic growth stimulating programs (2001-2005). Algerian

economy started to suffer a setback in performance from 2010. Al-Mamoory (2015), using Kaldor's method, aimed at assessing the macro-economy performance of Iraq during the period 2003-2012. It established a comparison between Iraq's economic performance and that of Brazil and China in accordance with the economic growth rate indicator. It was found that Iraq's economic performance suffered disorders in terms of current account balance and unemployment rates. No significant evidence was available to assure the existence of a clear mutual connection between inflation and economic growth rates. Firme and Teixeira (2014), aimed at assessing the macro-economy performance of a group of countries (America, Brazil, China, Russia, Euro Region, and modern industrial Asian countries) during the period 1997-2012, and investigated the effect of the 2008 crisis on the economies of these countries. The study, using Kaldor's magic square, found that America, Euro Region, and Russia were affected by the crisis, whereas the crisis had the least effect on Brazil. Gress (2014) aimed at assessing the macro-economy performance of 35 countries of OECD including Ukraine in 2011. The study, using Kaldor's magic square, found that Ukraine and Turkey had a similar economic performance. In addition, both of the countries achieved the best economic performance among others as shown by the economic growth rate indicator, but they suffered the worst economic performance in terms of inflation and current account deficit. Medrano-B and Teixeira (2013), aimed at assessing the macro-economy performance of Brazil and Chile during the period 2004-2011, and investigated the effect of the 2008 crisis on the economies of these countries using Kaldor's method. The study found that Chile's economy was more affected by the 2008 crisis than Brazil's. Güran and Tosun (2005), aimed at assessing the macro-economy performance of Turkey during the period 1951-2003 using Kaldor's magic square based on OECD's data analysis method. It was found that Turkey's economy worked better during the period 1951-1960. However, in the opening of the 1980s, Turkey's economy began to suffer a setback in

performance. It suffered more changes in the recent years of the period included in the study.

3. Methodology

3.1. Kaldor's magic square

Kaldor's Magic Square is a method used for assessing a country's macro-economy performance. In this square, 4 fundamental economic variables (economic growth, inflation, unemployment, and payment balance) are combined in a single diagram divided into four parts with vertical and horizontal axes passing through the midpoint. The four parts are designed in a way that allows axes to be in line with the aforesaid economic variables (Savoie et al., 2017). In the upper part of the vertical axis, the economic growth variable is located, whereas inflation is located in the lower part of the same axis. The payment balance variable is located on the right of the horizontal axis, and the unemployment variable is on the left. Identifying the numeral values of every axis's variables and connecting them to each other constitute a quadrangle through which area a country's/countries' macro-economy performance is compared during a given period of time (Al and Yildiz, 2019; Medrano-B and Teixeira, 2013). Theoretically, economic performance can be identified through the performance of economic indicators by calculating the quadrangle's area formed by variables. When the quadrangle is in the east-north part of the diagram and gets larger in area, a country's macro-economy performance is good, and vice versa (Moesen and Cherchye, 1998).

However, using MS's method faces problems connected with the diverse measures of variables included in the square. Hence, we should first get equal measurements of variables. There are various ways to do so. However, Medrano-B and Teixeira (2013) are used to make measures equal and obtain a convenient method to calculate the square's area, thus calculating the indicator's value of Yemen's economic welfare. Fig. 2 shows Kaldor's magic square.

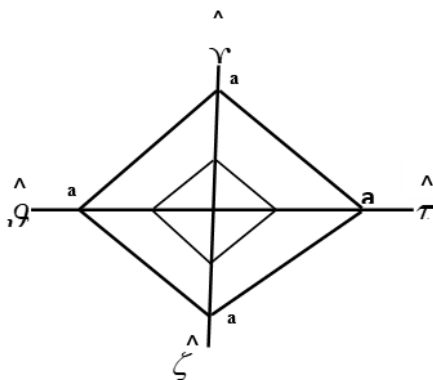


Fig. 2: Kaldor's magic square (Medrano-B and Teixeira, 2013)

MS's axes should be redefined to make them aligned and possible for measuring the quadrangle's area through identifying the parameters of the basic

variables. These obligatory conditions are to be given through chronic data that constitute a type of wonderland macro-economic configuration. As economic performance is identified by quadrangle's area, economic welfare indicator's values will range between 0 and 1, as shown in the following pages.

$$0 \leq \gamma \leq 10 \quad -2 \leq \tau \leq 4 \quad 10 \geq \phi \geq 0 \quad 12 \geq \delta \geq 0 \quad (1)$$

3.2. Normalize the magic square variables

The four variables will be normalized so that each new variable is supposed to have values ranging between (0), the fixed value (a), and the maximum value (in the case of a perfect economy). Hence, the area of the magic square will be 1.

$$0 \leq \hat{\gamma} \leq a \quad 0 \leq \hat{\tau} \leq a \quad 0 \leq \hat{\phi} \leq a \quad 0 \leq \hat{\delta} \leq a \quad (2)$$

Following this step is working on changing basic variables into the new normalized ones that should have the same linear measurements. Fig. 3 shows the normalized economic variables:

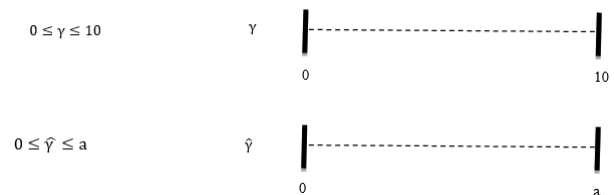


Fig. 3: The normalized economic variables, Prepared by researcher based on Medrano-B and Teixeira (2013)

A point on one side of the axis γ will be in a linear reconciliation with $\hat{\gamma}$ on the other side. Taking γ on axis X and $\hat{\gamma}$ on-axis Y will result in obtaining a straight line as shown in Fig. 4, thus enabling us to get the equation of the straight line which passes through (0, 0) and (10, a) points.

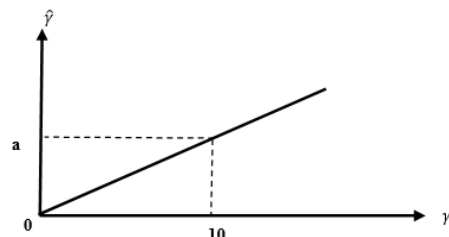


Fig. 4: Economic growth rate variable, Prepared by researcher based on Medrano-B and Teixeira (2013)

By solving the straight line's equation and compensating for the maximum value (a) of normalized variables by the value obtained in accordance with Rivano and Teixeira (2017), the new normalized economic variable will be:

$$\hat{\gamma} = \frac{1}{\sqrt{2} \times 10} \gamma \quad (3)$$

Similarly, relations between other variables can be identified and valued to obtain the result as follows:

$$\hat{\tau} = \frac{1}{\sqrt{2} \times 6} (\tau + 2) \quad (4)$$

$$\hat{\delta} = \frac{1}{\sqrt{2} \cdot 12} (12 - \delta) \tag{5}$$

$$\hat{\varphi} = \frac{1}{\sqrt{2} \cdot 10} (10 - \varphi) \tag{6}$$

This is to be achieved according to the quadrangle's areas constituted by the four variables' values. The zone A in the square is the total area of the four triangles as shown in Fig. 2. By calculating this zone's area, the result will be:

$$\hat{A} = \frac{1}{2} (\hat{\tau}\hat{\gamma} + \hat{\tau}\hat{\varphi} + \hat{\delta}\hat{\varphi} + \hat{\delta}\hat{\gamma}) \tag{7}$$

By compensating for the normalized variables in the Eqs. 3 to 6 in Eq. 7, we get the following results:

$$\begin{aligned} \hat{A} &= \frac{1}{2} \left(\left(\frac{1}{10\sqrt{2}} \gamma \right) \left(\frac{1}{6\sqrt{2}} (\tau + 2) \right) + \left(\frac{1}{6\sqrt{2}} (\tau + 2) \right) \left(\frac{1}{10\sqrt{2}} (10 - \varphi) \right) + \left(\frac{1}{12\sqrt{2}} (12 - \delta) \right) \left(\frac{1}{10\sqrt{2}} (10 - \varphi) \right) + \left(\frac{1}{12\sqrt{2}} (12 - \delta) \right) \left(\frac{1}{10\sqrt{2}} \gamma \right) \right) \\ \hat{A} &= \frac{1}{2} \left(\left(\frac{1}{120} (\tau + 2) \gamma \right) + \left(\frac{1}{120} (\tau + 2) (10 - \varphi) \right) + \left(\frac{1}{240} (12 - \delta) (10 - \varphi) \right) + \left(\frac{1}{240} (12 - \delta) \gamma \right) \right) \\ \hat{A} &= \frac{1}{2} \left(\left(\frac{1}{120} \right) \{ (\tau + 2) \gamma + (\tau + 2) (10 - \varphi) + \frac{1}{2} (12 - \delta) (10 - \varphi) + \frac{1}{2} (12 - \delta) \gamma \} \right) \\ \hat{A} &= \left(\frac{1}{240} \right) \{ (\tau + 2) \gamma + (\tau + 2) (10 - \varphi) + \frac{1}{2} (12 - \delta) (10 - \varphi) + \frac{1}{2} (12 - \delta) \gamma \} \\ 240\hat{A} &= (\tau + 2) \gamma + (\tau + 2) (10 - \varphi) + \frac{1}{2} (12 - \delta) (10 - \varphi) + \frac{1}{2} (12 - \delta) \gamma \tag{8} \end{aligned}$$

From Eq. 8, we can calculate the economic welfare indicator's value and verify that $0 \leq \hat{A} \leq 1$.

If the value is $\hat{A} = 0$ it means that $\gamma = 0, \tau = -2, \varphi = 10, \delta = 12$, this can be described as the catastrophic economy performance, but If the value is $\hat{A} = 1$ it means that $\gamma = 10, \tau = 4, \varphi = 0, \delta = 0$, this can be described as the wonderland economy performance.

Nevertheless, Rivano and Teixeira (2017) found that the method used by Medrano-B and Teixeira (2013) is sensitive to the axes on which variables are displayed. This is why they mentioned, the previous studies did not take this problem for granted. They suggested a mathematical method dubbed Magic Hypercube with the purpose to overcome this problem. Thus, the economic welfare indicator's value can be calculated as follows:

$$\hat{A} = \gamma' \cdot \tau' \cdot \varphi' \cdot \zeta' \tag{9}$$

4. Results and discussions

4.1. Welfare indicator of Yemen's economy

To assess the performance of Yemen's macroeconomy during the period 2001–2015 and calculate the economic welfare indicator's value, Kaldor's method is used here in accordance with Medrano-B and Teixeira (2013). Table 1 shows a summary of the data used. It is obvious that the values of economic growth, unemployment, inflation, and current account balance vary between:

$$\begin{aligned} -28 \leq \gamma \leq 7.7 & \quad -10.1 \leq \tau \leq 6.8 & \quad 22 \geq \varphi \geq 3.7 & \quad 13.47 \geq \delta \geq 11.7 \end{aligned} \tag{10}$$

Table 1: Yemen's economy variables' values (2001–2015)

Year	Economic Variables			
	Growth (γ)	Unemployment (δ)	Inflation (φ)	CAB / GDP (τ)
2001	3.8	11.7	11.9	6.8
2002	3.9	11.9	12.2	4.11
2003	3.7	12.07	10.8	1.5
2004	4	12.13	12.5	1.6
2005	5.6	12.17	9.9	3.8
2006	3.2	12.09	10.8	1.2
2007	3.3	12.03	7.9	-7
2008	3.6	12.1	19	-4.6
2009	3.9	12.7	3.7	-10.1
2010	7.7	12.9	11.2	-3.4
2011	-12.7	13.08	19.5	-3
2012	2.4	13.25	9.9	-1.7
2013	4.8	13.42	11	-3.1
2014	-0.2	13.47	8.2	-0.7
2015	-28	13.4	22	-7.1

By normalizing data according to Rivano and Teixeira (2017), we get the result as stated below:

$$\hat{\gamma} = \frac{1}{35.7\sqrt{2}} (\gamma + 28) \tag{11}$$

$$\hat{\tau} = \frac{1}{16.9\sqrt{2}} (\tau + 10.1) \tag{12}$$

$$\hat{\delta} = \frac{1}{1.8\sqrt{2}} (13.47 - \delta) \tag{13}$$

$$\hat{\varphi} = \frac{1}{18.3\sqrt{2}} (22 - \varphi) \tag{14}$$

Using equations from Eqs. 11 to 14 to calculate the economic welfare indicator's value, we get the

values as shown on the left of Table 2, which represent the estimated values of variables in Table 1; and by compensating for the estimated values obtained from Eqs. 7 and 9, we get the economic welfare indicator's value as shown on the right of Table 2.

It is obvious from the values shown in Table 2 that a drastic decline exists in the level of economic welfare during the aforesaid period, and economic performance at its best was in the years 2001, 2002, and 2005. The worst performance of Yemen's

economy, however, was in the years 2011, 2013, and 2015. The previous results can be diagramed as Fig. 5 shows.

Table 2: Variables' values and welfare indicator in Yemen's economy (2001–2015)

Year	Macroeconomic Data				The Magic Square Approach		The Magic Hypercube Approach	
	Growth ($\hat{\gamma}$)	Unemployment($\hat{\delta}$)	Inflation ($\hat{\phi}$)	CAB / GDP ($\hat{\tau}$)	Index	Rank	Index	Rank
2001	0.62985	0.70710	0.39026	0.70710	0.3607	1	0.1229	1
2002	0.63183	0.62720	0.37867	0.59455	0.3086	3	0.0892	3
2003	0.62787	0.55929	0.43276	0.48535	0.2770	4	0.0738	4
2004	0.63382	0.53532	0.36707	0.48953	0.2564	6	0.0610	6
2005	0.66551	0.51934	0.46754	0.58158	0.3118	2	0.0940	2
2006	0.61797	0.55130	0.43276	0.47279	0.2690	5	0.0697	5
2007	0.61995	0.57527	0.54481	0.12970	0.2053	7	0.0252	7
2008	0.62589	0.54730	0.11592	0.23012	0.1442	8	0.0091	9
2009	0.63183	0.30761	0.70710	0	0.1030	12	0	13
2010	0.70710	0.22771	0.41730	0.28033	0.1428	9	0.0188	8
2011	0.30304	0.15580	0.09660	0.29707	0.0452	14	0.0014	11
2012	0.60212	0.08789	0.46754	0.35146	0.1175	10	0.0087	10
2013	0.64966	0.01997	0.42503	0.29288	0.0841	13	0.0016	12
2014	0.55063	0	0.53322	0.39330	0.1066	11	0	13
2015	0	0.02796	0	0.12552	0	15	0	13

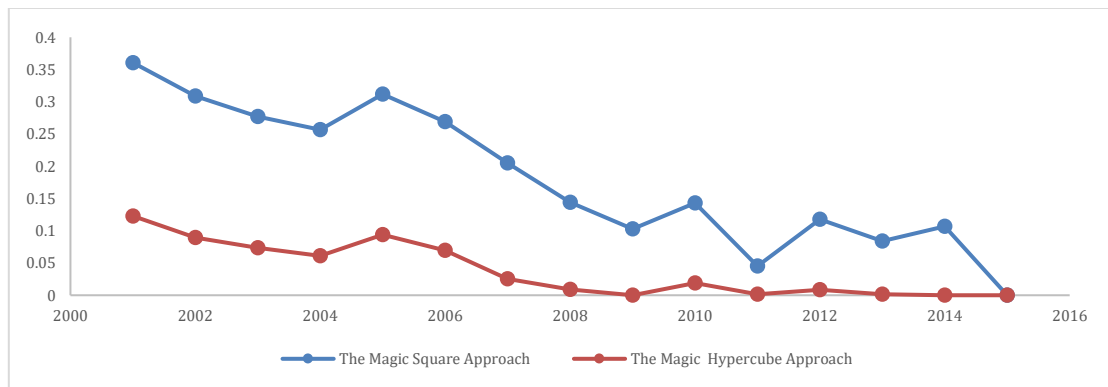


Fig. 5: Yemen's economy welfare indicator (2001–2015)

Fig. 5 displays a drastic continuous setback in the indicator of economic welfare, so that indicator's value descends, according to the magic square scale, from 0.36 to reach zero in 2015. However, according to the magic quadrangle scale, it descends from 0.12 to reach zero in 2009. It improves a bit in the next years, then, again, it goes down to zero in 2014 and 2015. Having gone through the performance of Yemen's macroeconomy during the period 2001–

2015, we come to examine it during 3-time divisions and compare economic performance at each division with the performance of the perfect and imperfect economy.

Table 3 shows the average values of magic square's variables in the periods 2001-2005, 2006-2010, and 2011–2015. Economic welfare indicator's values at each time division are also shown here.

Table 3: Average of estimated values of variables, and welfare indicator of Yemen's economy during each time division

Year	Macroeconomic Data				The Magic Square Approach		The Magic Hypercube Approach	
	Growth ($\hat{\gamma}$)	Unemployment ($\hat{\delta}$)	Inflation ($\hat{\phi}$)	CAB / GDP ($\hat{\tau}$)	Index	Rank	Index	Rank
2001-2005	0.63778	0.58965	0.40726	0.57162	0.3034	1	0.0875	1
2006-2010	0.64055	0.44184	0.44358	0.22259	0.1801	2	0.0279	2
2011-2015	0.42109	0.05833	0.30448	0.29204	0.0636	3	0.0022	3

It is obvious from Table 3 that the best performance of Yemen's economy was during the period 2001–2005. However, its worst performance was during the period 2011–2015. Fig. 6 displays the results obtained as regards Yemen's macro-economy performance during the period 2001–2015.

As Fig. 6 shows, the quadrangle's area during the period from 2001 to 2005 is seen larger than that of the other quadrangles of the other two periods. This is why the period (2001-2005) is described as the

best period. However, the area of the quadrangle as regards the period 2011–2015 is seen to be the smallest. This means that Yemen's economic performance can be described as the worst during this period.

Obviously, the square of the 3 periods as a whole is seen to greatly depart away from the north-eastern part towards the opposite part. It means that the performance of Yemen's economy during 2001-2015 is generally bad.

4.2. Comparing Yemen's macroeconomy performance during 2001–2005 with that of wonderland economy

Fig. 7 displays a comparison between Yemen's economic performance during 2001–2005 and that of wonderland and catastrophic economy.

From Fig. 7 it is noticed that the square's area during 2001–2005 descends away from that of wonderland economy and approaches that of catastrophic one. The decline in the square's area indicates a malfunction in Yemen's economy. This is mainly due to the high rates of unemployment and inflation.

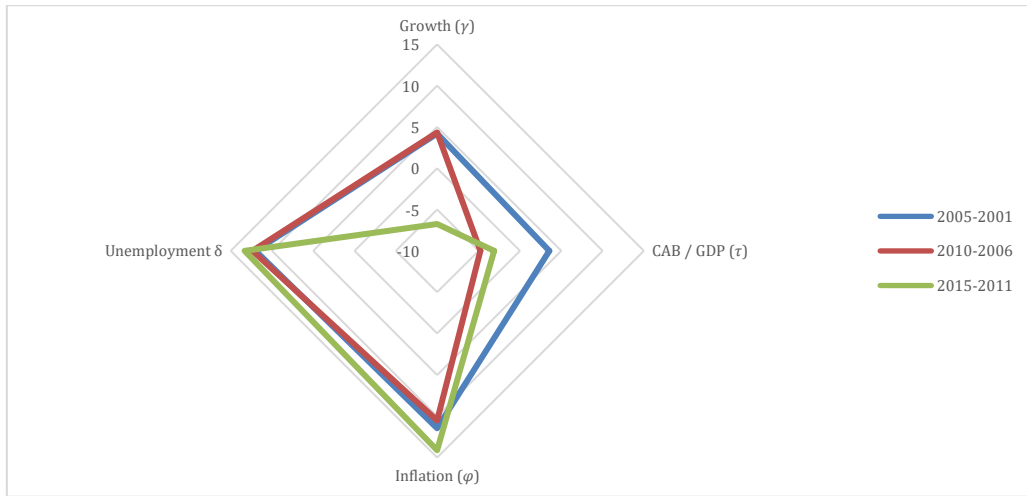


Fig. 6: Results of Yemen's macro-economy performance (2001–2015)

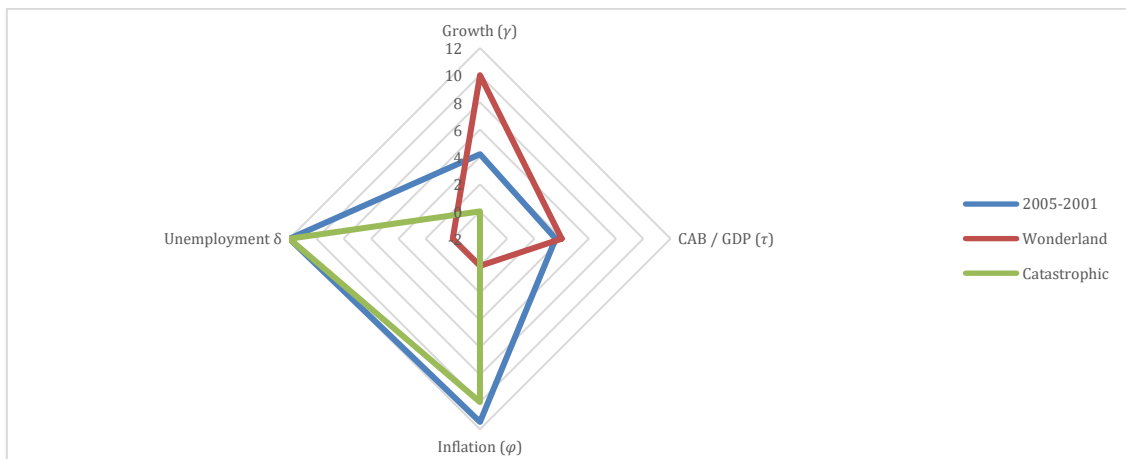


Fig. 7: A comparison between Yemen's economic performance during 2001–2005 and that of wonderland and catastrophic economy

4.3. Comparing Yemen's macroeconomy performance during 2006–2010 with that of wonderland economy

Fig. 8 shows Yemen's Economy Performance during 2006–2010 compared with that of wonderland and catastrophic Economy.

As Fig. 8 shows, the area of the square as regards the period 2006–2010 is in alignment with that of the imperfect economy. The decline in this square's area means that the performance of Yemen's macro-economy is getting more and more malfunctioned. The reason behind this decline refers to the high rates of unemployment and inflation, with a greater deficit in the current account balance. Notably, the 2008 crisis had a clear negative effect on Yemen's economic performance in general, and on the current account balance in particular.

4.4. Comparing Yemen's macroeconomy performance during 2011–2015 with that of wonderland economy

Fig. 9 shows Yemen's macro-economy performance during 2011–2015 as compared with that of wonderland and imperfect Economy.

As Fig. 9 shows, the area of the square as regards the period 2011–2015 is larger than that of an imperfect economy. Consequently, the performance of Yemen's macro-economy here is extremely worse than that of even the worst economy can be supposed. The decline in this square's area means that the performance of Yemen's macro-economy is suffering a great decline. This is chiefly referring to a setback not only in economic growth rates which have negative values in some years, but also in the high rates of unemployment and inflation, and the increasing deficit in current account balance. In

addition, we understand from Fig. 9 that the political unrest in the country during this period had a great

negative effect on the performance of the economy.

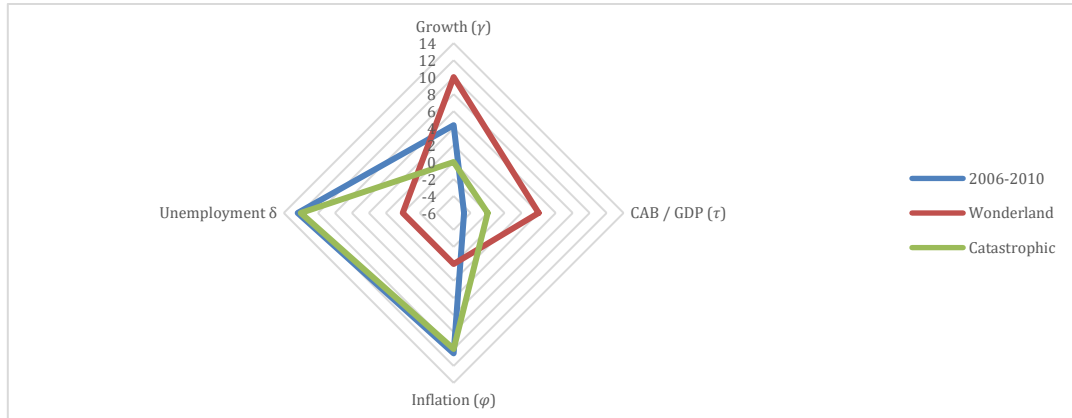


Fig. 8: A comparison between Yemen's economic performance during 2006–2010 and that of wonderland and catastrophic economy

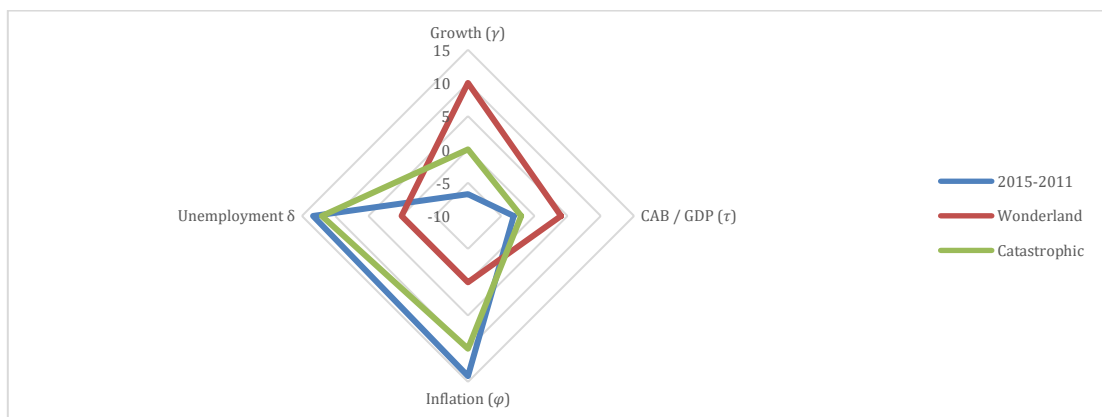


Fig. 9: A comparison between Yemen's economic performance during 2011–2015 and that of wonderland and catastrophic economy

5. Conclusion

A country's macro-economy performance assessment encounters many challenges that hinder the achievement of economic policy objectives. There is, moreover, no consensus among the economists as regards the identification of variables that can be considered while assessing the performance of a country's macro-economy. Though economic growth rate is used for assessing the performance of a macro-economy, an indicator consisting of an average weighted for all variables instead of a single variable is commonly used. This, of course, requires developing indicators that contain a number of variables for obtaining an accurate and objective assessment. It is also required to use a convenient method for assessment containing full-scale data that enables us to measure and assess a country's macro-economy performance. This study aimed at assessing Yemen's macro-economy performance during the period 2001-2015 using the four economic variables (economic growth rate, unemployment, inflation, and current account balance) that constitute Kaldor's Magic Square chart of 1971. Moreover, to avoid challenges connected with variables' measurement, the economic welfare indicator created by Medrano-B and Teixeira (2013) has been used. The study arrived at the following:

- There is noticed a significant decline in the level of economic welfare during the period included in this study.
- The best performance of Yemen's economy was in 2001, 2002, and 2005. However, the worst performance was during the years 2011, 2013, and 2015.
- There is noticed a significant and constant setback in economic welfare indicator's value from 0.36 in 2001 to zero in 2015 according to the magic square scale.
- The best performance of Yemen's economy was during the period 2001–2005, whereas the period 2011–2015 characterized the worst performance of Yemen's economy.
- Yemen's macro-economy performance descends away greatly from that of a perfect economy. Thus, it can be described as an ill-performance economy.
- Yemen's macro-economy performance during the period 2001–2005 was found to have malfunctioned. This is chiefly due to the high rates of unemployment and inflation.
- Yemen's macro-economy performance during the period 2006–2010 was found to be more malfunctioned than before, mainly due to the high rates of unemployment and inflation, besides increasing deficit in current account balance. Also, it was noticed that the 2008 crisis had a significant

negative effect on Yemen's macro-economy performance, the current account balance in particular.

- There is noticed a significant decline in Yemen's macro-economy performance during 2006–2010, basically due to a setback in the rates of economic growth which, in turn, had negative values in some years. This is in addition to the high rates of unemployment and inflation, and the deficit in the current account balance. Undoubtedly, the political unrest in Yemen affected greatly negatively the country's macro-economy performance.

The results obtained show that the economic policy-makers of Yemen lack a clear strategy and vision for developing their country's economy. The absence of such a convenient strategy leads to neglect of resource mobilization and allocation. All those have reflected negatively on a minimum level of economic welfare. It is clear that the government's policies and programs aimed to achieve high growth rates (according to the 3rd Plan for Economic and Social Development, a growth rate of 7.1% was targeted as an average for the period 2006-2010). It is pointed out that there is difficulty in saying that the economy improves through a variable as economic growth. For example, if we just look at the growth rate, we will have variable results for the results mentioned above, where we will find that the best performance will be in 2010 and it approaches from a wonderland economic performance. This result disagrees with the economic condition in Yemen. Therefore, the other macroeconomy variables must be regarded in the process of economic evaluation. We can say that although achieving somewhat high growth rates in some years, it coincided with rising unemployment rates, and according to the economic literature, this concurrency can't be explained, except by considering the achieved growth as an unreal growth depends on sectors that don't reflect real rising in production and in the absorption of employment. Here, we refer to oil and government services sectors, where a rate of its sharing in local product about 39% according to the Central Statistical Organization data for 2001. This applies to the current account, where fulfilled overflowing in this account for some years is because of improvements in the oil sector. Finally, we can say that government policies and programs in Yemen have failed in achieving idealism in any of the four magic square aims except the current account variable through the first period of the study.

Compliance with ethical standards

Declaration

This study was derived from the ongoing Ph.D. dissertation entitled "The Effectiveness of Monetary Policy Channels in Achieving the Objectives of Magic Square: An Econometric Analysis on Yemen

Economy" of Maeen Alhuwesh under the advisory of Assoc. Prof. Dr. M. Hilmi Özkaya.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References

- Aiginger K, Horvath T, and Mahringer H (2011). Why labor market performance differed across countries: The impact of institutions and labor market policy. WIFO Working Papers 396/2011, Austrian Institute of Economic Research, Wien, Austria.
- Al İ and Yıldız EB (2019). Macroeconomic performance of Turkey in the 2006-2017 period: The magic squares approach. *İktisadi ve İdari Bilimler Dergisi*, 33(1): 303-320.
- Al-Afandi M A (2010). Scenarios for the economic path in Yemen under the hypothesis of oil depletion 2020. Yemen 2020 Scenarios for the Future: 63-86. Friedrich-Ebert-Stiftung and Political Development Forum, Sana'a, Yemen. [In Arabic]
- Al-Hawri MA (2019). Measuring the relative importance of fiscal and monetary policy in stimulating economic growth in Yemen: An econometrics study using co-integration approach. *Journal of Social Studies*, 25(4): 1-28.
- Al-Mamoory M (2015). Evaluating the performance of the Iraqi economy using the kaldor square 2003-2012. *Journal of Administration and Economics*, 102: 28-48. [In Arabic]
- Barro RJ (1999). Reagan vs. Clinton: Who's the economic champ? *Business Week*, New York, USA.
- Calmfors L and Driffill J (1988). Bargaining structure, corporatism and macroeconomic performance. *Economic Policy*, 3(6): 13-61. <https://doi.org/10.2307/1344503>
- Chattopadhyay S and Bose S (2015). Global macroeconomic performance: A comparative study based on composite scores. *Journal of Reviews on Global Economics*, 4: 51-68. <https://doi.org/10.6000/1929-7092.2015.04.05>
- Çiçen YB (2017). The relationship between institutions and economic performance: Theoretical framework. *The Journal of International Scientific Researches*, 2(7): 109-118. <https://doi.org/10.23834/isrjournal.363157>
- Daşbaşı B, Barak D, and Çelik T (2019). Analyzing the macroeconomic performance index for Turkey (1990-2017): Artificial neural network approach. *Bingol University Journal of Economics and Administrative Sciences*, 3(1): 93-112. [In Turkish]
- Dow AHA and Deeneyr T (1998). Meaning and measurement of national economic success: UK relative economic performance in the 1980s. *Economic Issues*, 3(Part 2): 73-86.
- Fahmi M (2014). The role of economic policy in attracting foreign direct investment: A case study of Yemen. Ph.D. Dissertation, University Mohamed Khider Biskra, Biskra, Algeria.
- Firme VA and Teixeira JR (2014). Index of macroeconomic performance for a subset of countries: A Kaldorian analysis from the magic square approach focusing on Brazilian economy in the period 1997-2012. *Panoeconomicus*, 61(5): 527-542. <https://doi.org/10.2298/PAN1405527F>
- Gress M (2014). Is Ukraine ready for the OECD membership? [Aktual'ni Problemy Ekonomiky] *Actual Problems in Economics*, 158: 40-49.
- Güran MC and Tosun MU (2005). The macroeconomic performance of Turkey's economy: A nonparametric measurement for 1951-2003 period. *Ankara University SBF Journal*, 60(4): 89-115. [In Turkish]

- Kaldor N (1971). Conflicts in national economic objectives. The Economic Journal, 81(321): 1-16.
<https://doi.org/10.2307/2229754>
- Lovell CK, Pastor JT, and Turner JA (1995). Measuring macroeconomic performance in the OECD: A comparison of European and non-European countries. European Journal of Operational Research, 87(3): 507-518.
[https://doi.org/10.1016/0377-2217\(95\)00226-X](https://doi.org/10.1016/0377-2217(95)00226-X)
- Masoud Y (2018). Economic reform as an indicator of institutional reform: An applied study on the Libyan economy using the Kaldor square functions for the period 1996-2018. Journal of Economic and Political Sciences, Faculty of Economics and Trade, Al-Asmaria Islamic University, (12): 4-34. [In Arabic]
- Medrano-BR and Teixeira JR (2013). A kaldorin macroeconomic index of welfare. Revista de História Econômica and Economia Regional Aplicada, 8(14): 1-8.
- Melyn W and Moesen W (1991). Towards a synthetic indicator of macroeconomic performance: Unequal weighting when limited information is available. Public Economics Research Papers, 1-24.
- Messaoudi Z (2017). Evaluating the results of deepening the economic reforms programs in Algeria through Kaldor magic square: Study for the period 2001-2016. Algerian Review of Economic Development, 6: 215-228.
- Moesen W and Cherchye L (1998). The macroeconomic performance of nations measurement and perception. CES-Discussion Paper Series DPS 98.22, Centre for Economic Studies, Leuven, Belgium.
- Nehme GN (2014). Ensuring effectiveness of economic and monetary policies through considering economic schools of thought: Lebanon 1990-2010. Open Journal of Social Sciences, 2: 197-205. <https://doi.org/10.4236/jss.2014.24020>
- Okun AM (1970). The political economy of prosperity. Brookings Institution, Washington, USA.
- Picek O (2017). The magic square of economic policy measured by a macroeconomic performance index. Working Paper 02(2017), The New School for Social Research, New York, USA.
- Rivano SN and Teixeira JR (2017). Magic hypercube and index of welfare and sustainability. *Economia*, 18(1): 88-97.
<https://doi.org/10.1016/j.econ.2016.11.001>
- Savoiu G, Gogu E, and Țaicu M (2017). Hierarchies of associative dynamics, starting from Romania's macro-economic imbalances in the EU-28: What Does Romania's Economic Evolution in the EU-28 Look Like? *Romanian Statistical Review*, 3: 35-46.