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# The Effect of Changing Gender Composition in the Labor Market on the Economic Growth of Syria Before and After War Using Autoregressive Distributed Lag (ARDL) Model

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**ABSTRACT**

Some economists, such as Kuznets, believe that differences in the labor force in these countries can explain differences in the level of economic growth of countries. In every country, human capital and physical capital are complementary, and these two capitals together contribute to countries' economic growth and development. In recent years, women's participation in the economies of developed countries has increased dramatically. In a country like Syria, which has experienced war, there has also been an increase in women's economic participation. The important point that the present study focuses on is that this increase is not based on a regular economic policy and a change in the gender composition of the labor force but is itself a consequence of the war. Therefore, considering the importance of the concept of human capital in economic development and the above-mentioned event in the post-war Syrian economy, this study examines the effect of changes in the composition of the labor force on economic growth in Syria during the period 2000-2019 using data from the Syrian Statistics Center and the World Bank. Data analysis using the ARDL model shows that compared to men's physical capital, women's participation and the total number of employees have a positive and significant relationship with economic growth. However, the relationship between exports and imports and economic growth is insignificant.

## 1. Introduction

One of the prominent and famous indicators of the labor market is women's employment. Since gender is one of the influential factors in employment, it can be said that societies that have succeeded in creating an active and efficient labor force through proper planning and relying on scientific principles and criteria have overcome the scarcity caused by other factors of production and provide favorable economic conditions for themselves [1]. Research done by the International Monetary Fund shows that if women can enter the labor market with their full potential, the country's macroeconomic situation will improve significantly. Therefore, if women are seen as an

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active and constructive force, it will greatly impact the development and increase of human force in that society in terms of quality and quantity [2].

In general, the issue of women's employment affecting the pattern of production, distribution, and even consumption of a country's national economy has long been considered by economists [3]. Estimating the level of labor market development with emphasis on gender is one of the approaches observed in the literature of different countries. Numerous theorists have tried to explain and study the influence of women in the labor market, whose theories were presented in the form of neoclassical theories, labor market segmentation, gender theories, etc. One of the most important goals of any economic system is to achieve a high economic growth rate. High participation of women in the labor force can increase countries' economic growth by increasing the labor supply [4]. Studies conducted by the International Monetary Fund show that if women can enter the labor market with theirfull potential, the country's macroeconomic situation will significantly improve [2].

The importance of this study is due to the aftermath of World War II in many countries, including Germany and Japan. Most of the physical capitals were destroyed in these two countries during the war, but a significant portion of their human force remained. Therefore, after less than two decades, these two countries could return their economy to the desired state [5]. In Japan, after World War II - during the years of growth and reconstruction- programs were gradually designed and implemented to involve women in economic activities and, consequently, women's economic empowerment.

According to the neoclassical growth theory, wars, and human displacement harm nations' actual and potential growth. This is due to their effect on the most important assets of theeconomy, such as human and physical capital, as well as the total factor productivity of production - the capacity of an economy to produce a product for a certain level of labor and capital.

Syria has witnessed an acute armed conflict. The consequences have had a negative impact on the economic and social future of the country, and the damage has been beyond the capacity of current and future generations. One of the most obvious phenomena of any civil war, like what is happening in Syria today, is the increase in the mortality and migration rate (voluntary or forced). These two phenomena upset the balance of population composition (United Nations Development Program - UNDP). According to Syrian statistics, this will lead to a change in the gender composition of the labor force. The change in the structure of the labor force and the entry of women into various fields of work has changed the attitude of policymakers and planners toward the challenges of women's employment in this country.

During the war (after 2011), Syria met an increase in the percentage of employed women and a decrease in the percentage of employed men out of the total number of employed people in the country, so that the percentage of employed women reached 22% by the end of 2018, while in 2010 (one year before the start of the war), the ratio of employed men and women was 88% and 13% respectively[1]. These statistics show that the change in the gender composition in this country, which has resulted from migration as well as mortality among men, has improved the rate of participation of Syrian women in the labor market. During the war, a large number of men were killed, disappeared or, captured, or even emigrated. As a result, the burden of living and family livelihood falls on women, and they take on many responsibilities that they have been formerly in the hands of men. So, women are forced to enter the labor market under any circumstances. The example mentioned above can be seen in the Syrian labor market. Examining the data on women's participation rates before and after the war, we see that the increase in women's participation rates in the Syrian labor market was not due to the implementation of economic policies but because of the consequences of the war.

[1] The data uses in this section is taken from statics published by Syrian Statistics Center

The question here is whether this increase in the participation rate of women in the Syrian labor force, or other words, the change in the gender composition of the labor market, will lead to economic growth or not. In response to the research's main question, the hypothesis is that women's participation in the labor force affects the country's economic growth.

By considering the importance of women's participation in post-war economies, this article uses the number of women employees compared to male employees to answer the question of how the gender composition of the labor force affects Syria's economic growth. Efforts are also being made to allocate this change to the country's economic development in a way that reduces the negative effects of the crisis and helps the process of rebuilding the war-torn country. In addition, as this issue is very important for many developing countries, a new idea will be created for researchers in this field.

First, this article discusses the theoretical bases. Then, it reviews the economic growth of Syria before and after the war and the effects of the war on changing the gender composition of the labor force in this country. The next step focuses on related scientific studies. Finally, it provides a model for achieving the role of changing gender composition in the post-war labor force on Syrian economic growth to apply policy considerations to the post-war economy.

## 2. Literature

John Stuart Mill, a classical economist, analyzes his theory of growth based on factors such as labor, land, capital, and productivity, as well as factors influencing their ability, in The Principles of Political Economy book. Neoclassical economists believed that economic growth could be explained by focusing on the accumulation of the physical capital factor, the use of labor, and the existence of technology (which is exogenously included in the model) [6].

In general, neoclassical growth theory focuses more on the role of capital and technological change in growth. Still, in endogenous growth theories, it is believed that the internal mechanisms of the economy provide suitable conditions for education, research, and, in general, appropriate social infrastructure for The growth of technology, which plays an important role in economic growth. Not all business cycles can be explained in terms of physical capital accumulation, and it is important to pay attention to the types of capital, of which human capital is one of the most important.

According to previous studies, labor productivity and capital stock are the most important factors affecting the economic growth of countries. How these two variables affect the time and the effect of their changes on economic growth depends on the structure of each country. Therefore, recent economic literature shows an increasing interest in examining the role of women in the labor force for economic development. Some economists believe that the increase in the activities of women's labor force is due to the increase in education and the dynamism of economic activities. As the economy expands, women will have easier access to the labor market, increasing women's participation in productive activities. Some of the studies on women's employment are presented in Table 1.

**Table 1**
Research background appropriate to the research subject

| The most important findings | Main goals or questions | Authors |
|---|---|---|
| Women's employment in all sectors of agriculture, industry, and services has had a positive and significant effect on GDP per capita | This study aims to investigate the effect of women's employment on economic growth in selected Middle Eastern countries | [7] |

**Table 1**
Continued

| | | |
|---|---|---|
| In Nigeria, there is an inverse relationship between women's participation in the labor force and economic growth in Nigeria | The author's main purpose in this study is to examine the effect of women's labor force participation on Nigeria's economic growth | [8] |
| The most important findings of this study show a significant positive effect of women's economic participation on economic growth in the region. In particular, a percentage increase in women's employment rates and women's participation in the labor force leads to an increase of 0.028 percent and 0.021 percent in economic growth. | The main purpose of the authors is to analyze the effect of women's economic participation in sub-Saharan Africa on economic growth | [9] |
| The findings of this paper suggest that the U-shaped hypothesis between women's labor force participation and economic development is valid for all EU countries | The main purpose of this paper is to analyze the relationship between women's labor force participation and economic development in 28 EU countries | [10] |
| The results of this study showed that the growth of women's labor force has a dramatic negative impact on Nigeria's economic growth | The main objectives of this study are to analyze the relationship between women's labor force growth and economic growth in Nigeria between 1985-2016 | [11] |
| There is a U-shaped relationship between women's participation rates and India's economic development during the study period | The main purpose of this study is to investigate the non-linear relationship between economic development and women's economic participation in India | [12] |
| This study examined the cointegration and causal relationship between foreign direct investment and employment in Tunisia's manufacturing and services sector with ARDL | There is a long-term relationship between variables, and there is a causality between FDI and employment | [13] |
| This study investigated fiscal federalism's effect on Nigeria's economic development from 1981 to 2020. | Findings reveal that both revenue and expenditure decentralization positively affect Nigeria's economic development. | [14] |

By examining various studies, in almost all studies, the effect of increasing women's participation in the labor market on economic growth depends on the structure of each country, and these studies have been examined in the stable political and security conditions of countries. In the present study, the variable of the ratio of employed women to employed men has been used due to the consequences of the war in Syria. Because in the war, the mortality and migration rate among men increased, the entry of women into the labor market increased compared to men. So, there is a change in the gender composition in the labor market.

## 3. Syrian economy

Until early 2011, Syria had made progress on many social development goals, and its success was significant in key indicators such as food security, infant mortality, and access to education (especially for girls). The Syrian economy has seen an increase in oil exports, and as a result, foreign debt has dropped significantly as official foreign exchange reserves have increased. The Syrian pound stabilized, and inflation was at a moderate level. The trade deficit, like many other Arab countries, averaged 8 percent over the same period. The gross domestic product growth (DPG) was 4.3% on average per year from 2000 to 2010, driven by the non-oil sector growth. The labor force

participation rate in Syria was 43.5 percent, and according to the National Center, unemployment was 8.6 percent.

The escalation of civil wars led to the recession and the lack of demand for labor in the economy during the period (2011-2011), so the unemployment rate reached a high level during the war. The average unemployment rate was approximately 37%, and the highest was close to 48.4% in 2015. The war reduced the number of people employed in the economy from about 5 million in 2010 to about 2.6 million in 2015. During 2011-2018, the total cost of the conflict to the economy was about $ 442.2 billion. From this, $ 117.7 billion was for physical capital and $ 324.5 billion for the gross domestic product [15].

In 2010, the country's economic growth was 5.2 percent, but when violence escalated in 2012 and 2013, real GDP lost more than 26 percent of its value yearly. In 2018, for the first time since the beginning of the conflict, GDP increased by 1.6% [15].

According to Syrian statistics, working-age women increased from 5 million in 2002 to 6.4 million in 2010. The increase in the population of women of working age was 55% of the total increase in the working-age population, which has led to an increase in the supply of women in the labor force. In 2010, the ratio of women of working age to the total active population increased from 48.48% in 2002 to 49.77%, but the total number of employed workers in 2010 reached 5.05 million; the portion of women was equal to 12.88% of the total employment and the portion of men in a total number of employments was 87.12 %. By examining the figures for the number of employed women compared to men during the war years, the portion of women increased significantly and in 2019 reached almost 23% of the total employment [16]. One of the main reasons for this change has been migration and the high mortality rate among men.

## 4. Research methods

In this study, the growth of Syria and the effect of change in the gender composition resulting from the war are examined during the period 2000-2019. In this regard, it should be noted that information on all variables has been collected from the National Statistics Center and the Central Bank of Syria. Eveiws software was used to analyze the data and estimate the model. Therefore, the Lucas model [17] can be used to examine the effect of change in the gender composition (the ratio of the total number of employed women to employed men) on economic growth. In his study, he examined three models:

i. Growth pattern with emphasis on physical capital accumulation and technical changes,
ii. Growth model with emphasis on human capital accumulation through the acquisition of knowledge,
iii. Growth pattern with emphasis on specialized human capital accumulation through on-the-job training.

The model based on the theoretical bases of the present study is introduced as follows:

$$Y= f (K, EM, GCWM) \quad (1)$$

Where *Y* represents economic growth, which is measured by GDP; *k* represents the physical capital index, which is measured by gross fixed capital formation; *EM* is the total number of employees, and GCWM is the change in gender composition and is obtained by dividing the number of female employees by male employees. In addition to the factors mentioned in the Lucas model, in each country's economic growth process, other factors based on specific conditions of that country affect it. Most studies of economic growth have not followed a specific pattern. This means that researchers first consider the growth accounting equation and then add variables appropriate to the

research conditions to the model in order to examine a country's economic growth better [18]. This is due to the inability of growth models to explain economic growth. Based on endogenous growth patterns, in explaining economic growth, along with labor and capital factors, other macro variables are also effective in explaining economic growth [19]. For example, exports and imports in Syria are important variables that have affected the economic growth process in Syria. Therefore, the model used to study the growth of the Syrian economy in this study will be as follows:

$$Y = \mathrm{A_t f(K_t . EM_t . GCWM_t . Z_t)} \quad (2)$$

Where *y* is the total real output in the economy; *A* is the total production technology; *EM* is the total number of employees; *K* is the physical capital, and Z is the other factor that will affect economic growth at time t. The criterion proposed by Mankiw *et al.,* [20] is used to investigate the effect of change in the gender composition in the labor force on Syria's economic growth. Therefore, the model used is as follows:

$$\mathrm{GDP = f(K . EM . GCWM . X . M)} \quad (3)$$

Where *X* indicates exports, and *M* indicates imports,

The data used in this study are employed women compared to employed men, which can indicate a change in the labor force. Also, the Syrian Statistics Center provides data on the total labor force, physical capital, and GDP growth rate for 2000-2019. Using the ARDL model can show how and to what extent the ratio of employed women to employed men affects the economic growth of Syria.

After specifying the Syrian function of economic growth, the ARDL method of Eviwes software is used to examine the effective factors. Then, after examining the reliability of the variables, the autoregression distributed lag model (ARDL) is specified and estimated separately. The important advantage of the ARDL method among the cointegration methods is that this method can be used without considering that the model variables are I (1) or I (0) [21]. On the other hand, with this method, economic analysis can be done in the short and long run.

One of the important requirements in estimating economic equations with time-series data and estimating the model by the ordinary least squares method is to perform a reliability test. First, the Generalized Dickey-Fuller test investigated the reliability of variables for the proposed model to determine whether the regression was false. If the model variables are unreliable, false regression is possible. Therefore, examining the existence of a single root in model variables is also very important. The results of the Generalized Dickey-Fuller (ADF) test are given in Table 2.

**Table 2**
The results of the Generalized Dickey-Fuller (ADF) test

| imports | exports | Labor Force Gender Composition Index | Number of employees | Physical capital | Economic Growth Rate | Variable name |
|---|---|---|---|---|---|---|
| M | X | GCWM | EM | K | Y | Terminological name |
| I(0) | I(0) | I(1) | I(0) | I(0) | I(1) | Condition |
| -3.224 | -3.021 | -2.948 | -3,083 | -5.807 | -3,728 | Statistics |
| 0.0343 | 0.0508 | 0.0056 | 0,004 | 0,0002 | 0,0130 | Possibility |

Source: Research Findings

The results of Table 2 show that the time series are either accumulated from zero degrees and at a static level or are static with a degree of differentiation. Hence, the results are acceptable, and the ARDL model can be used.

5. Estimation of a research model

In the following, detailed results obtained from estimating short-run coefficients of the model are investigated. Then, the classical assumption test, coefficient stability test, and long-run relationship are presented. Finally, the results of estimating the long-run coefficients of the model are presented. Diagnostic and structural stability test results show that the classical assumption is established for estimating, and the coefficients are stable. Since the sample size is relatively small[1] and because the high number of legs reduces the degree of freedom of the model, just one lag has been used for the test, which AIC criteria have done. Due to the occurrence of war, a virtual variable has been used to estimate the short-run of the model. Then, the long-run relationship in the model is investigated using the bond cointegration test. Table 3 shows the results of the model's cointegration test and the critical values provided by Bannerji, Dolado, and Master for K=5.

**Table 3**
The results of the cointegration test

| Critical limit values (with y-intercept and with no trend) | |
|---|---|
| 10% | 5% |
| 2/93 | 3/34 |
| Statistic t | Variable number |
| t= 7.3 | K=5 |

Source: Research Findings

Since the calculated quantity is at a 95% confidence level which is higher than the critical quantity provided by Bannerjee, Master, and Dolado, the H0 hypothesis is rejected, and there is a long-run equilibrium relationship between the studied variables. Therefore, the obtained results confirm the hypothesis of a cointegrating relationship between variables in the model. Results are shown in Table 4.

**Table 4**
Results of estimating short-run coefficients of the model by ARDL method (1, 0, 0, 0, 0, 0)

| Possibility | Static t | Standard Deviation | Coefficient | Variable | Variable name |
|---|---|---|---|---|---|
| 0.6385 | 0.482 | 0.154 | 0.0745 | Y(-1) | Economic Growth |
| 0.0562 | 2.113 | 1.4431 | 3.049 | EM | Number of employees |
| 0.0452 | 2.235 | 8.099 | 1.810 | GCWM | Labor Force Gender Composition Index |
| 0.0420 | 2.275 | 4.635 | 1.054 | K | Physical capital |
| 0.9400 | -0.076 | 4.057 | -0.311 | M | import |
| 0.4410 | 0.796 | 7.423 | 5.916 | X | export |
| 0.0014 | -4.116 | 3.184 | -13.109 | DUMMY | virtual variable |
| | | | $R^2$= 0.845 | | |

Source: Research Findings

The results of estimating the dynamics of economic growth show that the coefficient of determination is equal to 0.845, which means that 84.5% of the changes in the independent variable (economic growth rate of the country) are explained by the independent variables in the model.

Detection statistics can be used to establish classical assumptions (lack of autocorrelation, normal distribution of residuals, and variance heterogeneity). The results of these tests are presented in Table 5.

[1] Lack of access to the required economic data is one of the most important constraints that the researcher has faced

**Table 5**
Results of Detection Statistics

| | |
|---|---|
| 0.231 = χ2<br>0.890 | Variance Heterogeneity Test |
| 0.0675 = $x^2$<br>0.240 | Autocorrelation Test |
| 0.077 = $x^2$<br>0.085 | Normality Test |

Source: Research Findings

As shown in Table 5, considering that all computational statistics exceed 0.05, we can be sure of the classic assumption in the model.

The stability of the model's estimated coefficients was also investigated by using a cumulative sum of recursive residuals (CUSUM) test and the cumulative sum of squares of recursive residuals (CUSUM) test. The results of these tests are shown in Figures 1 and 2.

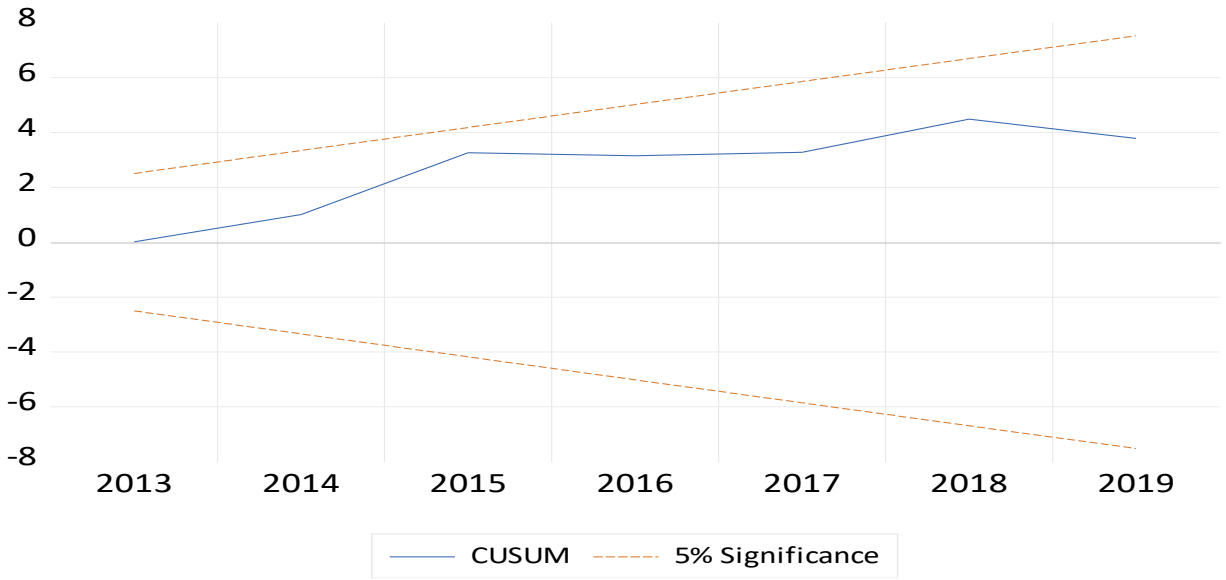


**Fig. 1.** Residuals Test

As shown in Figure 1, the cumulative residual diagram has not crossed the boundaries at the significant level of 5%, and the null hypothesis (i.e., specification of the regression equation) has not been rejected. Therefore, the estimated coefficients in the studied period have structural stability. The CUSUMQ test uses the residual sum of squares (RSS). A significant level of 5% is usually considered in this test, and the result is shown in the diagram. This test is performed for the model studied, and its result is shown in Figure 2. As can be seen, due to the placement of the CUSUMQ diagram at the significant level of 5%, the stability of estimated coefficients during the study period is confirmed. The CUSUMQ test investigates sudden and instantaneous deviation in regression coefficients.

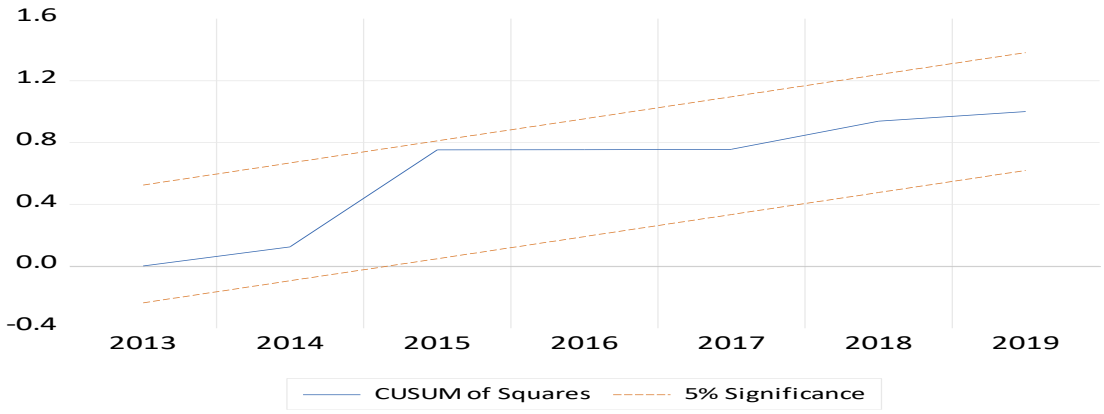


**Fig. 2.** Cumulative Sum of Residuals

After ensuring the classical assumption and short-run relationship and performing the coefficient stability test, the boundary test by Pesaran and Shin [21] was used to test the long-run relationship between the model variables, and the computational statistics value F was 7.3. Regarding the higher computational statistics F compared to the critical value, the null hypothesis – there is no long-term relationship- is rejected, and it can be concluded that there is a long-run relationship between the model variables. The results of estimating the long run using the ARDL method are presented in Table 6.

**Table 6**
Results of estimating long-term coefficients

| Possibility | Statics t | Standard deviation | Coefficient | Variable |
|---|---|---|---|---|
| 0.0680 | 2.005 | 1.643 | 3.295 | EM |
| 0.0217 | 2.637 | 7.415 | 1.956 | GCWM |
| 0.0677 | 2.008 | 5.675 | 1.1398 | K |
| 0.9400 | -0.076 | 4.381 | -0.336 | M |
| 0.4495 | 0.781 | 8.176 | 6.392 | X |

Source: Research Findings

The results of estimating long-run show that the relationship between physical capital, number of employees, exports, and economic growth is positive. At the same time, there is a negative relationship between economic growth and imports, which is consistent with theory. Also, the relationship between the number of employees, changes in the gender composition of the labor force index, and physical capital with economic growth was significant. In contrast, the relationship between economic growth and exports and imports was insignificant. The interpretation of the results of the change in gender composition index represents that the increase in women's participation rate compared to men's in the labor force positively impacts growth. The number of employed people has the greatest impact on Syria's economic growth, which means that with the increase in the number of employed women compared to men, the GDP increases by 1.95. This indicates the high efficiency and productivity of women's employment in this country.

## 6. Results of estimating the error correction model

Error correction models are increasingly popular in experimental work. The most important reason for the popularity of error correction models is that they relate short-run fluctuations of variables to their long-run equilibrium values. In other words, the ECM coefficient shows that a few percent of the short-run imbalance in the growth rate are adjusted to reach the long-run equilibrium

in each period. Estimating the error correction model consists of two steps. The first step is to estimate a long-run equilibrium relationship and ensure that it is not false, or in other words, the same steps are taken in the ARDL method and reached a long-run equilibrium relationship. This means that the residual of that long-run relationship is sustainable. In the next step, the residual leg of the long-run relationship is used as the error correction factor, and the following relation is estimated:

$$\Delta y_t = a + \beta \Delta V_t + C U_{t-1} + e_t \quad (4)$$

Error correction coefficient means estimating the C coefficient. If it appears with a negative sign (which is expected to be so), it will indicate the error correction speed and the trend for long-run equilibrium [22].

**Table 7**
Results of estimating the error correction model with AICA criterion (AIC)

| Possibility | Statistic t | Standard deviation | Coefficient | Variable |
|---|---|---|---|---|
| 0.0000 | -7.881 | 0.117 | -0.925 | ECM(-1) |

Source: Research Findings

As seen in Table 7, the coefficient indicates the high explanatory power of the model. The error correction coefficient is significant, has a negative sign, and shows that by moving from one period to the next, the deviation of research variables is reduced by 0.92 to achieve long-run equilibrium.

## 7. Conclusions and suggestions

The study of factors affecting production and economic growth is very important. Understanding these factors and examining how they affect can help a country's macroeconomic policy in the short and long run. In general, previous studies show that increasing women's participation in the labor force through outcome equality and economic diversity increases the potential for countries' economic growth. Therefore, if a society wants prosperity, it must invest properly in the social, cultural, and economic growth and development of its women. In this study, by using time series data and aself-explanation model with wide legs of short-run and long-run relationships, the Syrian economic growth was estimated due to the change -because of the war in the gender composition of the labor force. Findings from estimating the long-run and short-run model indicated that the coefficient of change in the gender composition (number of female employees/number of male employees) in the short and long run was positive and significant. The total number of employees and physical capital had a positive and significant effect on the economic growth of Syria during the study period. This confirms the solo model. According to the solo, the accumulation of physical capital cannot alone justify the large growth of per capita production over time and the huge differences in per capita production of different. However, physical capital is the main complement to human capital. The research results also indicate that the effect of exports and imports is insignificant to economic growth.

Regarding the positive role of increasing the number of employed women in Syria's GDP (Syrian economic growth), the government should try to improve the quality of the women's labor force. After the war subsides, the government will face a new challenge in managing the path to return to normalcy. Therefore, policy priorities, after the establishment of peace, change to the reconstruction of institutions and infrastructure and the creation of conditions for recovery and sustainable economic growth. Since women's economic empowerment is one of the most important factors in

achieving economic growth and sustainable development goals, a set of recommendations is presented: Increasing women's skills through free training courses, Using modern technologies by the government to create jobs in accordance with the women's talent and ability; Directing women's participation to the jobs that are most in demand in the labor market; and Developing women's entrepreneurship through small business plans.

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**Conflicts of Interest**
The author declares no conflicts of interest.

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