ESTIMATING OF OKUN'S RELATIONSHIP IN IRAQI AGRICULTURAL SECTOR FOR THE PERIOD 1998-2019 USING BOOTSTRAP ARDL METHODOLOGY

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ABSTRACT

This study was aimed to test the relationship between the unemployment rate and agricultural growth rates in the agricultural sector of Iraq according to Okun's Law for the period 1998-2019. The differences and gap versions of Okun's Law for the relationship was conducted, Alongside with Hodrick-Prescott (HP) filter to find the potential production and the Baxter-King (BK) filter to find the trend of unemployment for the agricultural sector, and then to find production and unemployment gaps. Bootstrapping method was used to generate data because the lack of data and Augmented ARDL to identify the cointegration. The result of independent-*F* test at the level was insignificant with a value of 1.49 for the differences model, that is less than the critical value which is 9.26 of the 0.05 level of significance. While the result of independent-*F* test at the level of the gap model was 1.89, which is less than the critical value which is 12.8 at 0.05 the level of significance. Thus, confirming the absence of a co-integration relationship between the two variables. This result confirms the complete absence of Okun's relationship with the two versions in the Iraqi agricultural sector.

Keywords: augmented ARDL, Hodrick-Prescott filter, Baxter-King filter.
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مجلة العلوم الزراعية العراقية- 2024:55(2):917-930 البدوي والواسطي

تقدير علاقة اوكن في القطاع الزراعي في العراق للمدة 1998 – 2019 باستخدام منهجية المحاكاة العشوائية

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المستخلص

هدفت الدراسة اختبار العلاقة بين معدّل البطالة في القطاع الزراعي ومعدّلات النمو الزراعي وفق قانون أوكن Okun's Law في الاقتصاد العراقي على المستوى القطاعي للمدة 1998 – 2019، وبما ان السلسلة اقل من 30 مشاهدة تم استخدام أسلوب الانحدار الذاتي للابطاءات الموزعة المعدل وبتوليد البيانات باستخدام المحاكاة العشوائية لنسختي الفروق والفجوة من قانون Okun، فضلاً عن استخدام مرشح هودريك–بريسكوت لإيجاد الناتج الممكن ومرشح باكستر–كينج لإيجاد معدل البطالة المتجه العام للبطالة الخاص بالقطاع الزراعي ومن ثم إيجاد فجوتي الناتج والبطالة. جاءت نتيجة اختبار المتغير المستقل في المستوى Dependent–F غير معنوي بقيمة 1.49 تقريباً لأنموذج الفروق، وهي اقل من الحد الحرج لمستوى معنوية 0.05 والبالغ 9.26، اما انموذج الفجوة فقد جاءت نتيجة اختبار المتغير المستقل في المستوى 1.89 وهي اقل من الحد الحرج عند مستوى معنوية 0.05 والبالغ 12.8، وبهذا يتأكد غياب علاقة التكامل المشترك بين المتغيرين، وان هذه النتيجة تؤكد غياب علاقة Okun تماماً بالنسختين في القطاع الزراعي العراقي.

الكلمات المفتاحية: الانحدار الذاتي ذو الابطاءات الموزعة المعدل، مرشح هودريك–بريسكوت، مرشح باكستر–كينج.
***مستل من أطروحة الدكتوراه للباحث الأول**

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INTRODUCTION

The employment importance comes from the fact that the right to work is a basic requirement for all members of society, as we find that international regulations and legislation have committed to stipulating the necessity and importance of providing decent and appropriate work for the individual, so the Universal Declaration of Human Rights stipulated in Article 23 - first paragraph: 'Every person has the right to work and has the freedom to choose it on just and satisfactory conditions, just as he has the right to protection from unemployment, the economist Amartya Sen (Nobel Prize Winner in 2008) promised unemployment in his book - Development as freedom: "Unemployment is not merely a deficiency of income that can be made up through transfers by the state, it is also a source of far-reaching debilitating effects on individual freedom, initiative, and skills. among its manifold effects, unemployment contributes to the social exclusion of some groups and leads to losses of self-reliance, self-confidence, and psychological and physical health" (38). Unemployment is one of the most complex problems facing the economy in Iraq as a result of its inability to find and generate suitable work opportunities for those entering the labour market annually, whether university graduates or others, which led to a continuous rise in unemployment rates. Data issued by the Iraqi Ministry of Planning indicate that the unemployment rate among young people aged between 15-29 years amounted to 22.6% in 2018, and these figures differ from the figures announced by international organizations. For example, the International Monetary Fund announced in May 2018 that the rate of youth unemployment in Iraq has reached more than 40%, and this is a very alarming percentage, which means that more than a third of Iraqi youth are unemployed. Regardless of the validity of the figures, economic theories indicate that unemployment at 15% of the capable and job-seeking workforce portends the existence of a real crisis that requires governments to cooperate with the private sector, international organizations and civil society to find practical solutions to confront it. Agricultural employment is of great importance in influencing the growth of the agricultural sector in Iraq (2, 39), achieving agricultural production efficiency depends on the efficiency of using the human labour component as it is the cornerstone in developing agricultural production (5), but unemployment is a dangerous indicator that threatens economic and social stability, as the agricultural sector is the main sector to absorb the workforce in many developing countries, including Arab countries. The percentage of workers in the agricultural sector in the Arab countries is more than 20.8% of the total workforce that amounting to 131.1 million people for the year 2019 according to the Arab Organization for Agricultural Development, and thus we find that it represents a field for the employment of a large group of the labour, especially in the regions that crowded with people. The number of labour in agriculture has witnessed a sharp decrease, as it decreased from 27.1 million workers in 2010 to about 24.1 million in 2017 in all Arab countries. One of the most important causes of unemployment is the occurrence of a quantitative and qualitative imbalance between the available labour force and the job opportunities that exist in the labour market. The agricultural sector is troubled with the presence of one of the types of unemployment, which is seasonal unemployment. This unemployment arises simultaneously with the weather conditions and social habits that appear in seasonal economic activities in which production is limited during a particular quarter of the year, as in the agricultural sector. This study aimed to explain the changes in unemployment rates in the agricultural sector based on changes in the economic performance index represented by agricultural production, how it fit the Okun relationship for the Iraqi economy, and can this law be relied upon to formulate and develop appropriate economic plans and policies to alleviate unemployment.

MATERIALS AND METHODS

Okun law: It is an empirical forecasting tool developed by Arthur M. Okun in 1962 (29). Changes in the unemployment rate are linked to changes in Gross National Product (GNP), and the law is one of the foundations that have been added to the overall economy, as it reflects the economic relationship in the

overall framework between production growth and unemployment rate (commodity market and labour market). In addition, this law has content in the field of economic policy and determining the optimum growth rate, and a remedy for the problem of unemployment, especially since the adopted concept of Okun's Coefficient here is a measure of unemployment's response to the rate of production growth. The gap version states that for every 1% increase in the unemployment rate, the country's GDP will be about 3% lower than its potential GDP (24). The importance of this law lies in explaining the cost of unemployment, expressed as production. Okun's Law is an important concept in macroeconomics, both theoretical and empirical. In theory, this law is a relationship between the aggregate supply curve and the Phillips curve. Empirically, it helps in forecasting and making economic policy. The approach used in analyzing the model is to use annual data covering the period 1980-2019, with the use of time series techniques to test the relationship between the change in actual unemployment rates around its natural rate and the change in actual GDP around its potential rate. The mathematic form of Okun's law takes the following two forms (10):

The difference version:

$$\boldsymbol{U_t - U_{t-1} = \alpha_0 + \alpha_1 \dot{Y}_t + \varepsilon_t}$$

The gap version:

$$\boldsymbol{(U_t - U_t^n) = \beta\left(Y_t - Y_t^p\right) + \varepsilon_t}$$

Where: Y_t actual production, Y_t^p potential production, U_t unemployment rate, U_t^n natural rate of unemployment, β and a_1 Okun coefficient, $\dot{Y}_t$ the growth rate in GDP, e_t random error.The dynamic version of Okun's Law was also suggested based on one of Okun's notes, which is that both past and current production could affect the current level of unemployment, meaning that some relevant variables had been deleted from the right side of the equation. Based partly on this proposal, many economists use a dynamic version of the Okun Act (25). Therefore, ARDL methodology was used to find the relationship between the two variables in Iraq within this framework.

Okun law in the agriculture sector :Because of the importance of Okun law, whether it exists or not; according to the nature of the economy, it has enriched research since it formulates in 1962 and so far, at various levels, some of them addressed it in the country level, others with state level or region (as part of the country covering all sectors). In Iraq, (22) applied the Okun law in 2010. Some researchers applied the Okun law to the agricultural sector in the so-called "A Sectoral Okun's Law", such as (23) and (Apap and Gravino), on two occasions, one in 2014 (6) and the other in 2017 (7), as well as (18). This methodology will be applied in the Iraqi agricultural sector for the first time to highlight this law and its suitability and eligibility to be a base from which agricultural economic policymakers will formulate the country's appropriate agricultural policy to reduce the damage of unemployment in rural. Data were obtained for 1998-2019, i.e. the length of time is 22 years, and (6) have tested the relationship for the duration (1993-2012) which is 20 years, and less in the 2017 study of the same researchers (quarterly data for 12 years). Also (18) studied the sectoral relationship of four countries: The United States of America (1997-2016) which is 20 years, the United Kingdom (1995-20) Which is 23 years, Switzerland (2002-2016) which is 15 years, and finally Japan (2000-2016) which is 17 years. Meanwhile (14) studies dealt with the topic in the Turkish economy from 1988 to 2012 which is 25 years. Therefore, there is no problem with the assessment process as long as the length of the period studied does not compromise the quality of the model. ARDL Bound Test is a methodology developed by (Pesaran, Shin and Smith) in 2001, known as (PSS) (34), this analysis is characterized by the fact that time series do not require the same degree of integrated time series. (PSS) believed that the boundary test in this context can be applied regardless of the characteristics of the time series whether it is stationary at the level *I(0)* or in the first difference *I(1)*, but stipulated that stability should not be at the second difference *I(2)*. The ARDL model takes enough time lag periods to get the best set of data from the general framework model, the ARDL model gives the best results to coefficients in the long-run and diagnostic tests are highly reliable. Bound testing is a

simple method because it allows OLS to estimate the cointegration relationship once the delay order in the form is determined, unlike other multi-variable cointegration methods (1). There are some problems with application of ARDL bound test approach, as the used sample size must be more than 30 observations (whether annual, quarterly or other), as suggested by (PSS). Also, two different tests are applied: The F test and the *t* test. Where (PSS) suggested comparing the F-test with the values of the critical limits, which are two different limits to test the validity of the cointegration relationship. According to the order of integration of the variables, the critical values of the lower bounds *I(0)* and upper bounds *I(1)* are used, and if the computed test statistic lies between the upper and lower bounds, the results are inconclusive. In practice, many researchers only use the F-test and ignore the t-test in cases where the F-statistic is significant, but, when the coefficient of the dependent variable at slowing down is not statistically significant, inaccurate results can be obtained. So, (PSS) solved this problem by assuming that the dependent variable is stable in the first difference *I(1)*. However, this approach may not be an effective solution because traditional unit root tests suffer from size characteristics and the lack of heterogeneity is another problem with the traditional ARDL approach (32). To overcome these problems (McNown et al, 2018) introduced a new approach, the Bootstrap ARDL procedure. In addition to statistics based on F and t, a new test, the t-independent test, has been proposed in this approach. Through it, the significance of the independent variables is tested separately, eliminating the need for the dependent variable to be *I(1)* (9). In addition, more robust results can be obtained through the simultaneous application of F-overall and t-tests. In other words, cointegration, no-cointegration and degenerate cases can be more precisely defined using the Bootstrap ARDL approach. As an additional advantage, the method is suitable for models with more than one internal variable sample and a small sample (36). Moreover, the Bootstrap ARDL approach has no lower or upper limits. Since the critical values of Bootstrap can give more accurate results than the usual asymptotic results, (26) generated critical values using Bootstrap simulation. Thus, they eliminated the case of critical values where the traditional ARDL test statistics fall between the lower and upper bounds.

The difference version of Okun law as follows:

$$\Delta RUN_{dif_t} = \alpha + \beta_1 \sum_{i=1}^{u} \Delta RUN_{dif_{t-i}} + \beta_2 \sum_{i=0}^{k} \Delta lnVAP_{dif_{t-i}} + \gamma_1 lnRUN_{dif_{t-1}} + \gamma_2 lnVAP_{dif_{t-1}} + \varepsilon_t$$

And the gap version as:

$$\Delta RUN_{gap_t} = \alpha + \beta_1 \sum_{i=1}^{u} \Delta RUN_{gap_{t-i}} + \beta_2 \sum_{i=0}^{k} \Delta lnVAP_{gap_{t-i}} + \gamma_1 lnRUN_{gap_{t-1}} + \gamma_2 lnVAP_{gap_{t-1}} + \varepsilon_t$$

Where: α is the fixed term, β the short-run parameters, γ the long-run parameters, *and* ε the random error. Where the following null hypotheses are tested (37):

- $H_0: \gamma_1 = \gamma_2 = 0$ to test *F*-overall for all lagged variables in the level.
- $H_0 = \gamma_1 = 0$ to test *t*-dependent for lagged dependent variable at level
- $H_0 = \gamma_2 = 0$ to test t-independent for the lagged independent variable at the level.====Based on these null hypotheses, we can define two cases of no-cointegration degenerate, and the presence or absence of co-integration as follows (26):
- Degenerate case #1: If the F-overall and t-dependent statistics are significant but the t-independent statistics are not significant, which (PSS) named it Degenerate case #2.
- Degenerate case #2: If the computed F-overall and t-independent are significant, and the t-dependent statistic is not significant, which (PSS) named it Degenerate case #1.
- Absence of cointegration: If all or at least 2 test stats are not significant.
- Cointegration: If all test statistics are significant at a minimum level of 5%.

This comes within the framework of the so-called "augmented ARDL model". Figure 1 shows a summary of the results by comparing the test results with the critical values - CV's at any level of significance.

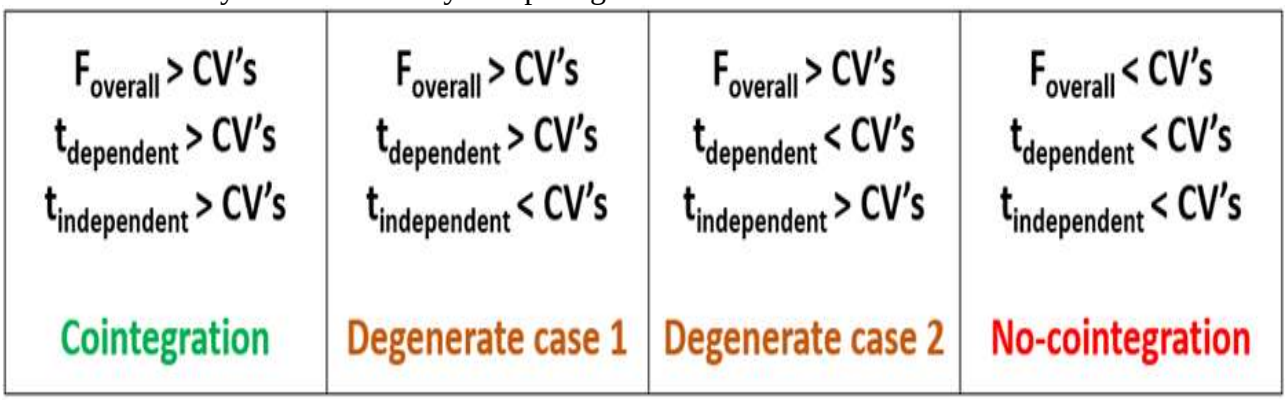

Figure 1. Summary of Bootstrap ARDL Bound test results

Source: Prepared by the authors based on the four cases.

The two cases of Degenerate cases #1 and #2 are two special cases on the subject of co-integration mentioned by (PSS), as co-integration does not exist despite its apparent existence.

Data and variables

To estimate the relationship between the growth rate and unemployment by the dynamic method according to the two versions of differences and gaps, it is necessary to find the production gap as well as the unemployment gap, and the Hodrick - Prescott (HP) Filter method (20) was used to find the potential production and then the production gap. The production function method in estimating the potential production is difficult to apply because of the difficulty of finding optimal levels of use of the inputs of the production process. It is achieved under the conditions of the Iraqi economy. Moreover, the growth in Iraq is determined by several external factors, and oil revenues play a major role in it, and then the statistical method (HP filter) becomes a better method than the economic method in this case, and the filter method (HP filter) was also used. Band-Pass for Baxter-King (8) to find the trend rate, including the unemployment gap and cyclical fluctuations.

Potential production

Estimating the Okun equation requires calculating the so-called potential production. The potential production can be defined as "the maximum rate of output that the economy can achieve without resulting in a rise in inflation rates" (30). More precisely, it is the maximum production without inflationary pressures, that is, the equilibrium point between more production and greater stability (30). At the macroeconomic level, potential GNP is defined as the long-term sustainable growth rate of the real gross national product that can be expected in light of the country's resource levels and productivity growth patterns and full employment (11). Experimentally, the Okun coefficient helps in forecasting and making economic policy (17). It is often confused with the concept of production potential limits, which expresses the level that an economy can reach when using all available inputs. The level of real production cannot reach the limits of potential production in the latter sense for many reasons, including lack of information, institutional and organizational reasons...etc. They are different in this sense. The situation that the economy is going through when the real production exceeds its potential level, means that the inputs of the production process are used excessively, and inflationary pressures will increase, and the opposite situation occurs when the real production is below its potential level, part of the inputs become idle and inflationary pressures in state of decline. The difference between the actual production and the potential production is known as the production gap, which is an economic measure of the relative difference between the actual and potential productions (15). The production gap refers to the economic reality. If the gap is positive, this means that the economy is achieving more production than its possible production, that is, the economy is in a state of expansion.

Although this expansion may appear to be a positive aspect of the economy, the economy cannot sustain a large gap for a long time, as a large production gap will accompany accelerated inflation. And if this gap increases to a very large degree, the accelerated inflation will reverse the path of expansion in the economy to decline or stagnation, and when the economy faces a state of stagnation, the production gap becomes negative (4). The main problem facing researchers is that the potential production cannot be directly determined, so the way it is estimated becomes difficult, but at the same time, it is necessary and very important. There are multiple methods used to estimate potential production and the economic and statistical methods are among the most important. The statistical method estimates the trend component that is believed to represent the potential production. A common method of estimating potential production is the Hodrick-Prescott Filter, a single-variable method (Univariate) method for estimating potential production created by researchers in 2009. There is also a multivariate method such as the production function methodology as well as multiple other methods. To calculate the production gap, the following equation can be used:

$$\boldsymbol{Output\ gap = real\ output - potential\ output}$$

A gap in production indicates that the economy is operating at inadequate levels, where it can overuse its resources, or not use them at optimal rates.

Hodrick - Prescott (HP) Filter

Hp Filter, an important method used to estimate potential production, it is designed to separate high-frequency or cyclical fluctuations from low-frequency or direction movements. HP's methodology assumes that the y_t variable time series (in our case, agricultural production) consists of trend and cyclical periodic patterns according to the following equation:

$$\boldsymbol{Y_t = \mu_t + C_t}$$

Where: Y_t agricultural production, μ_t trend, C_t cyclical

The objective function takes the following formula (19):

$$\min \mu_t \left\{ \sum_{t=1}^{T} (y_t - y_t^*)^2 + \lambda \sum_{t=2}^{T-1} [(y_{t+1}^* - y_t^*) - (y_t^* - y_{t-1}^*)]^2 \right\}$$

Where: y_t *log* Y_t, y_t^* is the value of the potential production (measured as a trend) in time t, λ a parameter used to determine the variability of the smoothing parameter component and adopted the current study (λ =100) as indicated by studies adopting annual time series.

The trend of unemployment

To estimate the trend of unemployment rate in Iraqi agricultural sector we used one of the important filters in this aspect which is (Baxter-King filter), following (Slacalek 2014) who calculate the trend rate in the USA economy, by separating the cyclical periodic fluctuations that reflects the trend rate gap from non-cyclical periodic fluctuations (39).

RESULTS AND DISCUSSION

Potential agricultural production

The potential agricultural production in Iraq was estimated using the HP filter, for comparison it was placed in a single table with agricultural production data as in Table 1, where evidenced by possible agricultural data (HP_GDP) which reflects the volume of production that can be accessed using all idle energies in the economy. Table 1 also includes the cycle column, which is the difference between the actual and potential productions, Figure 2 shows the three curves through time.

Table 1. Real and potential agricultural production in Iraq for 1998-2019 (million) (2015=100)

Years	Value of agric. production (VAP) (1)	Potential production (HP-TREND) (2)	Production gap (VAR_VAP_GAP) 3=1-2
1998	4431.59	4391.49	40.10
1999	4181.85	4399.90	-218.05
2000	4085.81	4408.72	-322.90
2001	4698.65	4416.15	282.50
2002	5262.90	4417.20	845.70
2003	4176.57	4409.67	-233.10
2004	4050.69	4399.85	-349.15
2005	4372.18	4391.67	-19.50
2006	4385.57	4385.59	-0.02
2007	4243.74	4381.86	-138.12
2008	3826.13	4380.74	-554.61
2009	3868.94	4381.10	-512.17
2010	4468.92	4376.27	92.64
2011	4801.96	4354.46	447.50
2012	4881.40	4304.80	576.60
2013	5418.91	4220.89	1,198.01
2014	5087.75	4102.12	985.63
2015	3023.28	3959.84	-936.55
2016	3034.01	3815.25	-781.24
2017	2934.28	3680.20	-745.92
2018	2886.61	3558.73	-672.11
2019	4462.18	3447.40	1,014.78

Source: Value of agric. Production from FAO Data on faostat, the rest by authors using Eviews 12

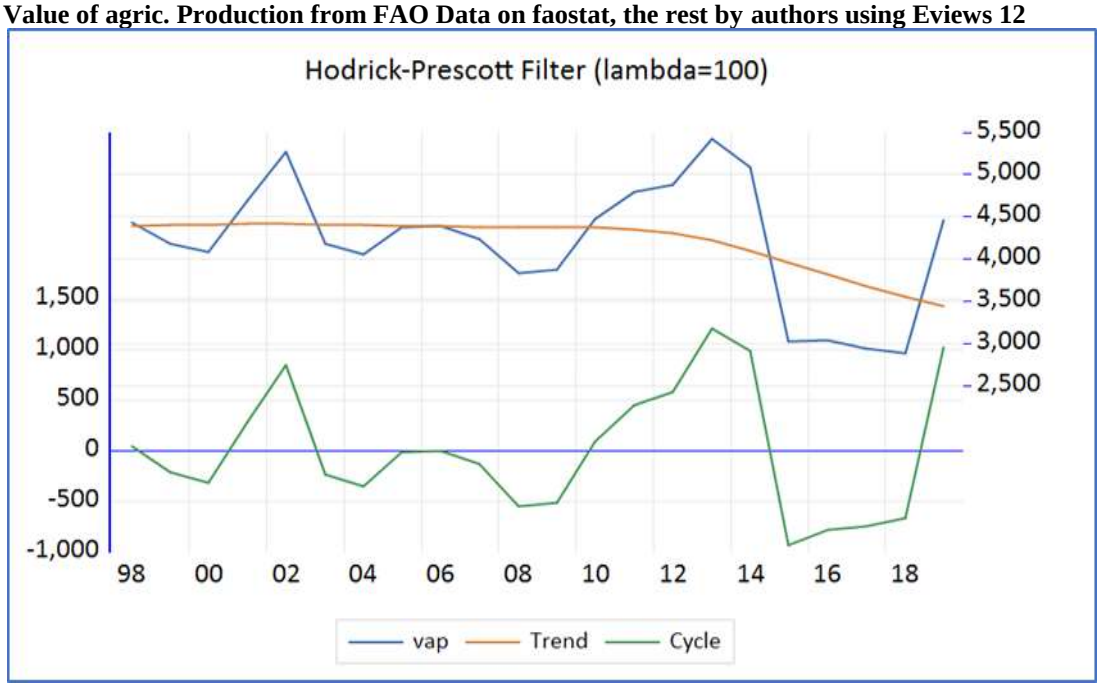

Figure 2. Actual, potential and cyclical fluctuations of agricultural production in Iraq

Source: Prepared by the authors based on table 1

Unemployment in Iraqi agricultural sector

To measure the trend of unemployment, the researchers used the Baxter-King filter, which is one of the important filters in calculating seasonal fluctuations in time series data and is one of the Band-Pass filters (21). The results showed that the trend rate approached and matched the actual unemployment rate for several years in the middle of the series (Figure 3). Cycle unemployment fluctuations (representing the difference between the actual rate and the trend) were relatively stable in the middle of the period studied from 2005 to 2010, during which the trend rate approached the actual rate of unemployment in the agricultural sector, while other periods experienced various fluctuations, including positive and others negative.

Table 2. unemployment, trend and the gap in the agricultural sector of Iraq (%)

Years	Agric. Unemp. (RUN)	Agric. trend of Unemp. (AG_trend)	Unemp. gap (RUN_GAP)
1998	26.47	-	-
1999	26.33	26.35	-0.02
2000	26.24	26.15	0.09
2001	25.88	26.08	-0.20
2002	26.15	26.43	-0.28
2003	27.28	26.31	0.97
2004	25.44	25.87	-0.43
2005	24.91	24.80	0.11
2006	24.05	24.21	-0.16
2007	23.67	23.57	0.10
2008	22.97	23.03	-0.06
2009	22.45	22.44	0.01
2010	21.89	21.92	-0.03
2011	21.42	21.13	0.29
2012	20.05	20.46	-0.41
2013	19.94	19.61	0.33
2014	18.80	19.35	-0.55
2015	19.36	18.91	0.45
2016	18.53	18.82	-0.29
2017	18.58	18.50	0.08
2018	18.38	18.35	0.03
2019	18.1	-	-

Source: Agric. Unemp. form ILO data, www.theglobaleconomy.com and (3), the rest by the authors.

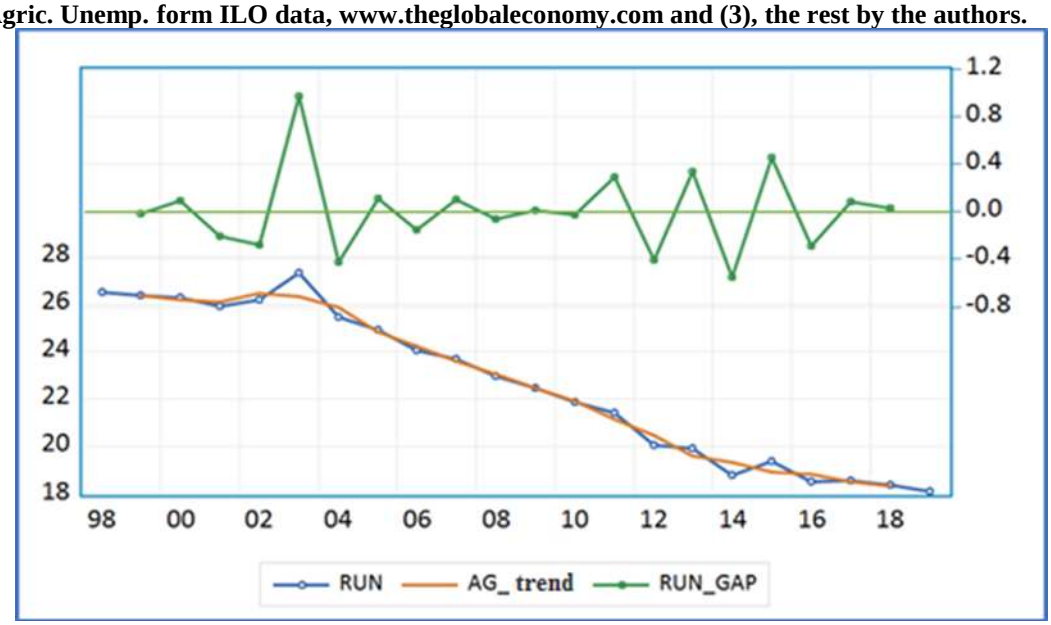

Figure 3. Agricultural unemployment (RUN), trend and cyclical fluctuations (RUN_GAP) in Iraq from 1998 – 2019.

Source: By authors using Eviews 12

To eliminate the data dispersion, we chose to estimate the logarithmic version of the agricultural production variable after extracting the agricultural production gap and the agricultural unemployment gap, so it became possible to estimate Okun's relationship in the gap version $(U_t - U_t^n) = \beta(Y_t - Y_t^p) + \varepsilon_t$ after renaming the variables, as follows:

$$\boldsymbol{RUN_{gap} = RUN_t - RUN_{tr}}$$

$$\boldsymbol{lnVAP_{gap} = lnVAP_t - lnVAP_{po}}$$

Where: *tr* the trend, *po* the potential production.

First, the stationary of the time series must be tested, if the time series is not stationary at *I(0)*, the use of the ordinary least square-OLS method is not appropriate, as it is possible to obtain high values for both *t*, *F* and R^2 and at the same time spurious regression method (28). Therefore, we used the augmented

Dickey-Fuller ADF unit root test and it takes the following formula:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum \alpha_i \Delta Y_{t-i} + \varepsilon_t$$

The time series stationary test is based on the significance of parameter (δ) by comparing the calculated (t) with tau-statistic τ, if the t value is greater than the τ (in absolute terms), this means that the time series is stationary at the level, and the vice versa in which case the first difference is required. The second test for time series stationary is the Phillips-Perron test, it is different from the ADF test in the processing of the higher-rank serial correlation, as it uses statistical methods that are non-parameter methods into account the serial correlation within the error terms without adding the terms of lagged differences (35).

Unit root test result

The results showed that all variables are stationary at the level *I(0)*, according to the PP and ADF tests as shown in Table 3, so that the variables do not contain a time trend problem.

Table 3. Time series stability test by PP and ADF

		Phillips-Perron (PP) Unit Root Test At Level			
		RUN_DIF	**RUN_GAP**	**LNVAP_DIF**	**LNVAP_GAP**
With Constant	**t-Statistic**	**-5.7056**	**-24.8752**	**-3.0920**	**-2.6676**
	Prob.	**0.0002**	**0.0000**	**0.0435**	**0.0962**
		***	***	**	*
With Constant & Trend	**t-Statistic**	**-5.5720**	**-31.9451**	**-2.9066**	**-2.5316**
	Prob.	**0.0012**	**0.0001**	**0.1810**	**0.3112**
		***	***	**No**	**No**
Without Constant & Trend	**t-Statistic**	**-4.0802**	**-25.3356**	**-3.2447**	**-2.7577**
	Prob.	**0.0003**	**0.0001**	**0.0026**	**0.0083**
		***	***	***	***
		Augmented Dickey-Fuller (ADF) Unit Root Test At Level			
		RUN_DIF	**RUN_GAP**	**LNVAP_DIF**	**LNVAP_GAP**
With Constant	**t-Statistic**	**-5.7253**	**-9.8185**	**-3.5682**	**-4.7194**
	Prob.	**0.0002**	**0.0000**	**0.0187**	**0.0017**
		***	***	**	***
With Constant & Trend	**t-Statistic**	**-5.5923**	**-9.5809**	**-3.0455**	**-4.6442**
	Prob.	**0.0012**	**0.0000**	**0.1494**	**0.0087**
		***	***	**No**	***
Without Constant & Trend	**t-Statistic**	**-1.7150**	**-10.1016**	**-3.5587**	**-4.8039**
	Prob.	**0.0814**	**0.0001**	**0.0014**	**0.0001**
		*	***	***	***

Notes: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%. and (No) Not Significant

Source: Eviews 12 results

Bootstrap ARDL

First, the traditional ARDL model must be estimated and then we can estimate the B-ARDL model, go back to the Okun relationship models they will be as follows:

Difference model

The results shown in table 4 appeared to show that the best model among 20 models is (1,0), i.e. one lag of the dependent variable and zero lag for the independent variable. The results showed the insignificance of both the effect of lagged dependent variable and the independent variable in their relationship with the dependent variable, as well as the insignificance of the model as a whole by F test result.

Table 4. ARDL model estimated for the difference model

Dependent Variable: RUN_DIF				
Method: ARDL				
Sample (adjusted): 2000 2019				
Included observations: 20 after adjustments				
Maximum dependent lags: 4 (Automatic selection)				
Model selection method: Schwarz criterion (SIC)				
Dynamic regressors (4 lags, automatic): LNVAP_DIF				
Fixed regressors: C				
Number of models evaluated: 20				
Selected Model: ARDL(1, 0)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
RUN_DIF(-1)	-0.278723	0.222042	-1.255271	0.2264
LNVAP_DIF	-0.083399	0.068343	-1.220301	0.2390
C	-0.519168	0.169058	-3.070935	0.0069
R-squared	0.157156	Mean dependent var		-0.411500
Adjusted R-squared	0.057998	S.D. dependent var		0.659276
S.E. of regression	0.639872	Akaike info criterion		2.082385
Sum squared resid	6.960422	Schwarz criterion		2.231745
Log likelihood	-17.82385	Hannan-Quinn criter.		2.111542
F-statistic	1.584900	Durbin-Watson stat		1.722352
Prob(F-statistic)	0.233804			

Source: Eviews 12 results.

Bound test of Bootstrap ARDL

From the results shown in Table 5, overall-F testing 11.72 represents the critical values of data generated using Bootstrapping to test bound-test boundaries, which are significant at the level 0.01, and the *Exogenous-F* test for Augmented ARDL appeared to be insignificant, at approximately 5.63, and for the t_{dep} test for the RUN_DIF variable, it was significant at 0.01 and was about -5.76, while the new and most important test is the F-independent variable test at level (LNVAP_DIF-F) has come insignificant at a value of about 1.49. This confirms the absence of a relationship of cointegration between the two studied variables, and we cannot estimate the long and short-term relationships.

Table 5. Cointegration test by Bootstrap ARDL methodology

Method: Bootstrap ARDL					
Rndseed: Improved Knuth generator					
Simulation Strategy: Parametric					
Number of Simulations: 1000					
Model: ARDL (1, 0)					
Credit: olayeniolaolu.blogspot.com					
Dep Var: RUN_DIF	Statistics	Value	1%	5%	10%
	Overall-F	11.720	10.962	5.792	4.633
	Exogenous-F	5.628	14.645	7.839	6.106
	RUN_DIF-t	-5.759	-4.668	-3.393	-2.932
	LNVAP_DIF-F	1.489	14.961	9.262	6.393

Source: Eviews 12 results.

Gap model: The results showed that a model (1, 0) of the ARDL models was selected and as in table 6, i.e. slowing down the dependent variable by one degree and not slowing down the independent variable.

Table 6. ARDL model estimated for the gap model

Dependent Variable: RUN_GAP				
Sample (adjusted): 2000 2018				
Included observations: 19 after adjustments				
Maximum dependent lags: 4 (Automatic selection)				
Model selection method: Schwarz criterion (SIC)				
Dynamic regressors (4 lags, automatic): LNVAP_GAP				
Number of models evaluated: 20				
Selected Model: ARDL (1, 0)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
RUN_GAP (-1)	-0.700333	0.168793	-4.149060	0.0008
LNVAP_GAP	-0.541327	0.393506	-1.375653	0.1879
C	-0.002985	0.058376	-0.051136	0.9599
R-squared	0.544189	Mean dependent var		0.003250
Adjusted R-squared	0.487212	S.D. dependent var		0.354000
S.E. of regression	0.253497	Akaike info criterion		0.237008
Sum squared resid	1.028170	Schwarz criterion		0.386130
Log likelihood	0.748428	Hannan-Quinn criter.		0.262245
F-statistic	9.551129	Durbin-Watson stat		2.272134
Prob(F-statistic)	0.001863			

Source: Eviews 12 results.

From the results shown in Table 7, the Overall-F test 34.45, which is significant at the level of 0.01 and the Exogenous-F test for augmented ARDL appeared to be insignificant with a value of 0.95 Approximately, for the t_{dep} test for the RUN_GAP variable, it was significant at level 0.01 which is about -10, while the independent variable test at level (LNVAP_GAP-F) was insignificant with of value 1.89. This confirms the absence of the relationship of cointegration between the two variables as well, we cannot estimate the long and short-run relationships.

Table 7. Bootstrap ARDL cointegration test results

Method: Bootstrap ARDL					
Rndseed: Improved Knuth generator					
Simulation Strategy: Bootstrap					
Coefficient Uncertainty: None					
Number of Simulations: 1000					
Model: ARDL (1, 0)					
Credit: olayeniolaolu.blogspot.com					
Dep Var: RUN_GAP	Statistics	Value	1%	5%	10%
	Overall-F	34.452	11.405	7.144	5.784
	Exogenous-F	0.949	14.328	9.568	7.645
	RUN_GAP-t	-10.073	-4.834	-3.907	-3.491
	LNVAP_GAP-F	1.892	22.129	12.886	9.228

Source: Eviews 12 results

Reflected in the applied aspect of Okun's relationship in the agricultural sector of Iraq, the relationship between production growth and unemployment is almost non-existent in Iraq, contrary to what is prevalent in developed countries, but is consistent with many studies on the subject in developing countries such as (12) in Algeria, (31) in Turkey, and (33) had been found Ineffectiveness of Okun law in Turkey, South Africa and Brazil. In Egypt, (27) results for the period 1975-2005 and (16) for the period 1970-2010 were similar, both researchers found a negative significant relationship, but the first one found that the coefficient was 0.001, and the second one found its value to be -0.022. They are both very weak. As for Iraq, the reason for this can be attributed to the fact that the nature of Iraq's economic structure is different from that of developed countries, so Okun law works more accurately in those countries in applying than in Iraq. Unemployment in Iraq, whether total or agricultural, is not cyclical unemployment —

as in developed countries, but structural or frictional unemployment, structural unemployment is the result of changes in the structure of the economy and is inconsistent with the prevailing education and training courses it was stipulated in microeconomic theory. Unemployed people are not the reason for the stagnation of the economy, but because they do not have the skills to perform the jobs and available work. On the other hand, unemployment may be the result of a lack of knowledge about the available jobs that are compatible with their skills despite the skills of individuals seeking employment. Consequently, production growth cannot reduce these types of unemployment. The Iraqi economy is a rentier economy (oil is the main sector, and the overall growth process is a function of this sector's outcome) as this sector is characterized by capital density, so growth in this sector will not reduce unemployment rates, so Okun is high in developed countries whose economies are diversified, unlike Iraq's singular-sided economy. In particular, the nature of Iraq's labour market, both macro and agricultural, is controlled by the government as the main source of demand for labour, making the labour market rigidity, unlike in developed countries, where it is flexible . Regardless of the reason for Okun's inequity, it can be said that weak growth in Iraq does not explain the problem of unemployment and that Iraq's economic growth rate does not contribute to job creation (employment) and operates by the so-called jobless growth hypothesis, i.e. achieving certain growth rates (which may seem acceptable) but without job creation.

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