TODA YAMAMOTO CAUSALITY TEST BETWEEN PRIVATE SMALL AND MEDIUM ENTERPRISES, EMPLOYMENT AND ECONOMIC GROWTH IN ALGERIA 2002-2018

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ABSTRACT: Small and Medium Enterprises (SME) play an important role for employment in several countries of the world, interest to employment is very important for economic growth. The objective of this study aimed to determine if there is a relation between the private SMEs, employment, and economic growth in Algeria. Using Toda-Yamamoto causality test on Algerian data for the period 2002-2018, the results showed that there is a unidirectional relation from private SMEs to employment, a unidirectional relation from employment to real Gross Domestic Product (GDP), and a unidirectional relation from private SMEs to Real Gross Domestic Product. We recommend to encourage the creation of new SME and improve this sector.

Keywords: employment, Private SMEs, Toda Yamamoto test.

JEL Classification : C32, L26, L53, J21, E24.

1. INTRODUCTION:

Encouraging the entrepreneurship and the creation of enterprises has become one of the most important goals of governments to achieve the economic development, the Small and Medium Enterprises (MSEs) constitute the most important operator in several economies in the World. Before illustrating their role, it is necessary to respond what is SMEs? There is no clear definition of SMEs, it is defined in Europe Union as enterprises which employ between 10 and 249 employees, their annual turnover is between 2 and 50 million Euros, or, their annual balance sheet is between two and 43 million Euros (OECD publishing, 2018).

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In Algeria, the SMEs is defined by a company of goods and/or services employing one to 250 people, and whose annual turnover doesn't exceed 4 billion dinars or whose annual balance sheet doesn't exceed one billion dinars (Ministère de l'industrie et des mines, 2017).

The change in the Algerian SMEs population between the first half of 2018 and the first half of 2019 is 7,2%, all legal sector combined, for private SMEs, this change is 5%. SMEs have created 2 818 736 jobs until the first half of 2019, only 20 955 of which are public SMEs jobs with a decrease of 5,07% from the first half of 2018. In the same period the number of employers grew by 7,18% and the number of employees increased by 3,24% compared by the first half of 2018 (Ministère de l'industrie et des mines, 2019).

The sector of service has the greatest number of private enterprises in the first half of 2019 with more than the half of total private enterprises, the industry sector is in the second position with 15,47% of total private enterprises. Therefore, the petroleum, mine and energies sector has the fewer number of private enterprises with only 0,46% of the total private enterprises (Ministère de l'industrie et des mines, 2019).

SMEs occupy an important position in the Algerian economy, and the state has taken an interest in this sector by setting up support bodies for the development of SMEs in Algeria by developing national agencies responsible for implementing public policies to assist and support business start-ups., it is true that the real results of these organization may be not really satisfactory, but their balance sheets showed positive results (Si Lekhal K. and others, 2013)

The important role that plays the SMEs in the economy led us to pose the following problem; Is there a relation between the private SMEs, employment, and economic growth in Algeria?

This paper is organized as follows; in section 2 we cite the previous studies about SMEs and employment in the world, the third section assesses the methods and materials used in this study, then the study's results are presented in section 4, while the conclusion is presented in section 5.

2. LITTERATURE REVIEW:

The entrepreneurship and the creation of enterprises has an important role in employment, and economic growth. For this, many studies in the world showed the major role of the small and medium enterprises (SME), and the employment. Rotar L. J., Pamić R. K. and Bojnec Š. (2019) studied the contribution of small and medium enterprises to employment in the European Union countries using Panel Data model, the result of their empirical study is that a positive association exists between SME service sector employment and total employment, GDP per capita and total employment, they concluded that the job-

creating in SMEs service sector is important. Another study done in Jordan by Khaled A. M. A. and Mohammad S. J. (2019) to show the impact of SMEs to reduce the problem of unemployment in Jordan, their result is that the SMEs has an impact on employment looking at the percentage of the SMEs employees of the labor force, also their productivity has an essential role in the economic progress.

Barnabas G. (2017) examined the impact of Small and Medium Scale enterprises on employment generation in Plateau State in Nigeria, he founds that this impact is significant and that SMEs have an important role to improve economic growth, development, and reducing the problems of unemployment.

A study of Popescu M. (2016) discusses about the impact of SMEs from EU and Romania in economy. This study showed that Romanian economy is dominated by SMEs, furthermore, the SMEs contribute to the creation of new jobs and stimulate entrepreneurship and innovation, its contribution in Romania is greater that the EU SMEs contribution, and the added value generating by the SMEs in Romania is greater that the EU average.

Davidescu Adriana (2014) analyzed the relationship between unemployment rates and shadow economy in Romania with Toda-Yamamoto causality test, and she found that a unidirectional causality between unemployment rate and shadow economy exists when the lag order selected is sufficiently high.

Ngui T. (2014) illustrated in his study the role of SMEs in employment creation and economic growth using studies and statistics of different economics including EU, Malaysia, Kenya, Kongolo, Australia, India, Japan, Korea, Taiwan, and Thailand. He concluded that the creation of SME contributes to reducing the poverty, increasing income, GDP and employment opportunities.

Herman E. (2012) examined the relationship between the SMEs sector and employment in Romania from 2000 to 2010 by comparing between the SMEs and large enterprises. The results show that the jobs created by the SMEs are bigger than the jobs created by large enterprises, and their productivity are greater than the large enterprise productivity.

A study of the world Bank in the MENA region (Sahar N., Douglas P.,2012) indicates that SMEs are a major contributor to GDP, and they are responsible for significant proportion of employment. In terms of finance, their finance is dominated by banks, also, the level of SMEs corporate financing is low. In addition, a study in Iraq analyzed the relation between the development economic and the unemployment in Iraq using law of Okun and Toda-Yamamoto test (2010 ،عيسى .ع رجاء ،جودة .ه ندوة) concluded that a unidimensional relation from unemployment to GDP exists and that Okun coefficient is insignificant, so, the law of Okun isn't applicable on the Iraqi economy.

Baptisa R. and Thurik A. R. (2007) analyzed the relationship between the entrepreneurship and unemployment in Portugal for the 1972-2002 period, they concluded

that Portugal is an outlier by comparing between observed unemployment level in Portugal and the predicted one by the model base on OECD, as well, "micro-businesses" has only a small impact on growth and employment despite its large proportion.

3. METHODS AND MATERIALS:

In this study we use Toda Yamamoto test to teste the causality between private SME, employment and GDP in Algeria for the period 2002-2018. This period is chosen due to the availability of private SMEs' data.

We have annual observations of the Gross Domestic Product GDP (noted gdp) expressed by $ US constants of 2010, employment rate (noted emp), and the number of private SME (noted sme). The annual observations are transformed into quarterly observations using the "sum-match quadratic" method (DENTON F.T., 1971). This method allows to adjust the seasonality of the data by reducing the point-to-point data variations when they are converted from low frequency to high frequency ((DENTON F.T., 1971), (SBIA R. & others, 2013), (BORJIGIN S., 2018), (SHAHBAZ M. & others, 2017, 2018)).

Noting that, real GDP's data are available in the World Bank, employment rate's data (measured by the proportion of the total population aged 15 to 60) are collected from publications of the National Statistics Office (NSO) in Algeria, and the data of the private SMEs are obtained from the statistical bulletins of SME published by the ministry of industry and mine.

we give interest to the Granger causality test in the sense of Toda-Yamamoto because the traditional Granger causality test applies only to stationary series, and these series should be in the same order before differentiation (Granger, 1981:p126,127), also the transformation of data by differencing implies a loss of long run information, in addition, unit root tests are less efficient on small samples (Jonas Kibala Kuma, 2018:p10).

Toda and Yamamoto proposed in their test to estimate an augmented VAR, to serve as a basis for the causality test, when the variables of the model may be integrated or cointegrated of different order, under the hypothesis of the maximal order of integration (d_{max}) is less or equal the optimal lag (Toda, Yamamoto, 1995).

Toda-Yamamoto causality test (TY) based on MWALD statistic (Wald statistic computed from an estimated augmented VAR) (Zapata, Rambaldi, 1997) that follows an asymptotic Chi-square distribution. TY is represented like as follows in the case of a bivariate relationship (*X*, *Y*) (Jarita, 2007):

$$Y_t = \alpha_1 + \sum_{i=1}^{k+d_{max}} \beta_i Y_{t-i} + \sum_{i=1}^{k+d_{max}} \delta_i X_{t-i} + \mu_t$$

$$X_t = \alpha_2 + \sum_{i=1}^{k+d_{max}} \phi_i Y_{t-i} + \sum_{i=1}^{k+d_{max}} \theta_i X_{t-i} + v_t$$

When μ_t and v_t are error correction terms that are assumed to be white noise.

Noted that the MWALD statistic formula is (حسن توكل، 2018):

$$W = T\left[\frac{\hat{\beta}_i}{s.e(\hat{\beta}_i)}\right]^2$$

When $\hat{\beta}$ is the estimated parameter, $s.e(\hat{\beta}_i)$ is the parameter standard deviation, and T is the sample size.

4. RESULT AND DISCUSSIONS:
4.1. STATISTICAL ANALYSIS:
The following table shows the statistical information of the series used in this study.

Table N° 01: Descriptive statistics of all variables.

	EMP	GDP	SME
Mean	8.989706	4.08E+10	97148.01
Median	9.228516	4.03E+10	92323.16
Maximum	9.798438	5.13E+10	164113.6
Minimum	7.361719	2.91E+10	45605.09
Std. Dev.	0.605516	6.22E+09	35567.36
Skewness	-1.576079	0.042122	0.316367
Kurtosis	4.647746	1.931602	1.877028
Jarque-Bera	35.84498	3.254287	4.707350
Probability	0.000000	0.196490	0.095019
Sum	611.3000	2.77E+12	6606065.
Sum Sq. Dev.	24.56554	2.59E+21	8.48E+10
Observations	68	68	68

Source: Author's own elaboration using Eviews 10.

The descriptive statistics shows that the size of our sample is 68, also, the variables under study are Gaussian at 5% except the employment rate (according to Jacque-Berra probability's). In addition, GDP and SME are characterized by high variability unlike the employment rate (in view of standard deviation).

Figure N°01: Graphic representation of variables.
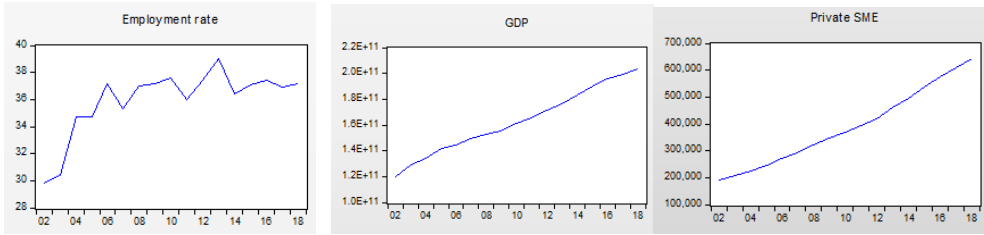
Source: result of Eviews 10.

The graphical representation leads us to assume that the three series under study are not stationary. This result will be confirmed by stationarity tests.

4.2. TODA-YAAMOTO TEST:

The procedure of the Toda-Yamamoto causality test based on standard VAR as follows:

4.2.1.   Determination of the maximum order of cointegration.

The first step is to determine the maximum order of cointegration (d_{max}) of the variables in the system.

➢ Dicky-Filler Augmented (DFA) test

DFA test allows testing the null hypothesis of non-stationarity of the series, it is based on Ordinary Least Squares (OLS) estimation of the following models (Bourbonnais, 2009:p250):

- Model without trend and intercept: $\Delta x_t = \rho x_{t-1} - \sum_{j=2}^{p} \Delta x_{t-j+1} + \varepsilon_t$
- Model with intercept: $\Delta x_t = \rho x_{t-1} - \sum_{j=2}^{p} \Delta x_{t-j+1} + c + \varepsilon_t$
- Model with trend and intercept: $\Delta x_t = \rho x_{t-1} - \sum_{j=2}^{p} \Delta x_{t-j+1} + c + bt + \varepsilon_t$

We reject the null hypothesis when $t_c < T_t$.

Table N° 02: DFA unit root test result.

Variable		Level : Trend & intercept	First difference : Trend & intercept	Second difference : Trend & intercept	Integration order
gdp	t_c	-3.248937	-2.044188	-7.838363	I(2)

	T_t (5%)	-3.489228	-3.489228	-3.483970	
emp	t_c	-3.747239	-4.089369	-	I(1)
	T_t (5%)	-3.483970	-3.483970	-	
sme	t_c	-1.731285	-2.805572	-5.444434	I(2)
	T_t (5%)	-3.483970	-3.479367	-3.483970	

Source: Author's own elaboration using Eviews 10.

> KPSS test

Kwiatkowski, Philips, Shmidt, and Shin (1992) proposed in their test to verify the null hypothesis of stationarity with LM statistic (Bourbonnais, 2009:p251,252).

$$LM = \frac{1}{s_t^2} \frac{\sum_{i=1}^{n} s_t^2}{n^2} \quad ; \quad s_t^2 = \sum_{i=1}^{t} e_i$$

The null hypothesis has to be rejected when the LM statistic is greater than the critical value.

Table N° 03: KPSS unit root test result.
Source: Author's own elaboration using Eviews 10.

Variables		Level Trend & intercept	First difference : Trend & intercept	Second difference : Trend & intercept	Integration order
gdp	t_c	0.128102	0.148299	0.052421	I(2)
	T_t (5%)	0.146000	0.146000	0.146000	
emp	t_c	0.210927	0.036927	-	I(1)
	T_t (5%)	0.146000	0.146000	-	
sme	t_c	0.268140	0.083168	-	I(1)
	T_t (5%)	0.146000	0.146000	-	

We conclude that our variables are not stationary, GDP series is integrated in the second order, emp series in the first order, and the last one is integrated in the first order according to KPSS test and in the second order according to DFA test. Then d_{max} equals to two (2).

4.2.2. Determination of optimal lag.

In this step, we have to determine the optimal lag length using Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), and Hannan-Quinn Information Criterion (HQ). Their functions are (Bourbonnais, 2009: p185):

$$AIC(h) = \ln\left[\frac{\text{SSR}_h}{n}\right] + \frac{2h}{n}$$

$$Sc(h) = ln\left[\frac{SSR_h}{n}\right] + \frac{h.ln(n)}{n}$$

$$HQ(h) = ln\left[\frac{SSR_h}{n}\right] + 2\frac{h.ln[ln(n)]}{n} \qquad \text{(Ayalew,Babu and Row, 2012:p11)}$$

Such as: SSR: the residual sum of squares, n: number of disponible observations, h: number of delays.

The result of Akaike, Schwarz and Hannan-Quinn criteria are summarized in the following table:

Table N° 04: Determination of optimal lag in the VAR model.

	h=0	h=1	h=2	h=3	h=4
AIC	67.20758	53.12125	51.78963*	51.91313	52.13134
Sc	67.30878	53.52604	52.49802*	52.92511	52.06870*
HQ	67.24745	53.28072	52.06870*	53.44690	52.64960

Source: Author's own elaboration using Eviews 10.

According to minimization lag length criteria, the lag retained is $h =2$. As maximum order of integration does not exceed the optimal lag ($d_{max} \leq h$), therefore we can apply augmented VAR test in the order $p = d_{max} + h$.

4.2.3. Causality test.

After determining the order of integration p, we estimate the VAR (4) and apply Granger causality test based on TY causality test method, the result is showed in table 05.

**Table N° 05: Granger causality test based on TY causality test method.**

Dependent Variables	Independent variables	Wald test $(\chi)^2$	Probability
gdp	Sme	11.38037	0.0226
	Emp	6.188801	0.1855
sme	Gdp	6.625004	0.1571
	Emp	1.013884	0.9077
emp	Gdp	16.56005	0.0024
	Sme	16.09347	0.0029

Source: Author's own elaboration using Eviews 10.

The result in table 05 indicate that the null hypothesis that the number of private SME doesn't cause the real GDP can be rejected at 5% level, also, we can reject the both of null hypothesis "the real GDP doesn't cause the employment rate and the number of private SME doesn't cause the employment rate" at 1% level. So, we can say that there is unidirectional causality between the number of private SME and the employment rate, unidirectional causality between the employment rate and the real GDP, and between the GDP and the number of private SME.

All of this result will be simplified in the figure 02.

Figure N°02: Causal links between variables.
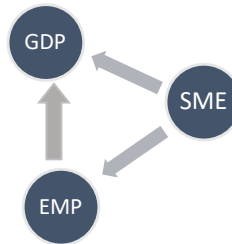
Source: Author's own elaboration

Therefore, we conclude that the private small and medium enterprises have a double impact on both the employment and the economic growth in Algeria; furthermore, the employment has an impact on the economic growth.

5. CONCLUSION:

SMEs play an essential role in improving the employment; they are an important factor to generate new employment opportunities. In addition, the SMEs stimulate the economic growth. In this paper, an empirical study is done using Toda-Yamamoto causality test based on MWALD statistic, this test was chosen taking into account the data's nature and the role of the study, in the first step the number of lags was determined, after we generate the test. We can conclude that a relation exists between private SMEs, employment, and economic growth in Algeria. a unidirectional relation from private SMEs to employment, a unidirectional relation from employment to economic growth, and a unidirectional relation from private SMEs to economic growth. These relations are justified by the important increasing in the number of the private SMEs in the last century and its contribution to create new jobs and stimulate the productivity. Finally, it is recommended that greater encouragement has to be given to the creation of SMEs by helping young people to set up their own businesses and spread the culture of entrepreneurship, especially in the academic world, by developing programs to finance businesses and checking the law framework that organize the creation of SMEs.

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