Public Debt, Unemployment, and Budget Deficit: Evidence from Mena Countries

khadhraoui soukaina1 Sammi Hammami2
[1.2.] *Faculty of economics and of sfax, Tunisia*

Abstract *(Objectives: This study aims at examining the interactions between three macroeconomic variables, namely: public debt, unemployment and budget deficit. We have assumed that the increase in unemployment is caused by the worsening of the budget deficit and the increase in public debt.*

Methods: To test this hypothesis, we have used a system of simultaneous equations on macroeconomic data from 1990 to 2016 in five

Findings: All the variables were countries of the MENA countries namely (Tunisia, Algeria, Morocco, Egypt and Jordan).found to be stationary based on recent panel unit root tests. On fully applying both static (, FE, and RE) and system of simultaneous equations panel data approaches, it was found that confirm the results of the model estimation for the five countries of the MENA region we have found a unidirectional relation going from public debt to unemployment, a twin directional relation between deficit and unemployment and a unidirectional relation going from debt to deficit.
Novelty Very few studies sought to tackle the topic of this study, or at least this topic was not dealt with from all angles. This paper is an addition to existing literature as it contributes to recognize the dynamic links between three macroeconomic variables: public debt, unemployment and budget deficit. Moreover, this study is among very few studies that use regression analysis in the period between (1990) and (2016) to highlight the aforementioned relationship.

Keywords: *budget deficit, public debt, unemployment, macroeconomic variables, regression analysis*

JEL classification: E69, F32, F41, H62, H63

I. INTRODUCTION

The problem of unemployment has become gradually more important in modern economic research, making it a central argument of contemporary public policy, particularly during the last few decades when the economic context of all developing and developed countries has been marked by massive indebtedness, deterioration in the pace of economic growth, labor market rigidities and rising unemployment rates. As a result, after the 2007 crisis, the MENA region became a zone of mass unemployment. In 2011, the outbreak of the Arab Spring in 2011 reinforced the swelling of the unemployment problem, particularly in Tunisia and Egypt which had reached 16.7% and 19.5%. As for Morocco, with an unemployment rate of 9.4%, it was in a better position than its neighbors, due to the reforms it has undertaken and the new constitution signed in 2011. The wide disparities in unemployment rates observed in the region are not only explained by divergences in employment growth, but are also largely the result of activity patterns within countries in a context of integrated labor markets. Employment has followed very different trajectories in these countries, and rising unemployment has affected populations unevenly.

To highlight the main objective of this research, this article addresses the problem of rising unemployment rates. Therefore, we have assumed that the increase in unemployment is caused by the worsening of the budget deficit and the increase in public debt. To test this hypothesis, we used a system of simultaneous equations in panel data from 1990 to 2016 on a group of MENA countries (Tunisia, Algeria, Morocco, Egypt, and Jordan). The estimation of the model will include the analysis of the data to identify the essential characteristics of the variables.

The estimation of the model will include the analysis of the data to identify the essential characteristics of variables and will continue with the study of stationarity of all variables of the model the stationarity of all the variables of the model. In order to arrive at the results, a Hausman specification test will be applied to determine which of the regressions (fixed effects or random effects) is most appropriate. Afterwards, the model will be

estimated either by GLS pooled regression, random effects and fixed effects, finally, the simultaneous equation method will be used to verify the relationship between the variables of research interest.

Finally this article is organized as follows. The following section describes various theories about the effects of fiscal policy on unemployment. The theoretical works examined are from the classical theory of unemployment, the unemployment theory in the Keynesian economy, and Public choice theory. A second section gives the results of the Dynamic Links between public debt, unemployment, and budget deficit for the period 1990 to 2016 using the simultaneous equations panel data.

I Theoretical Literature

This section describes various theories about the effects of fiscal policy on unemployment. The theoretical works examined are from the classical theory of unemployment, the unemployment theory in the Keynesian economy, and the fiscal policy.

1- Theoretical basis of fiscal policy

The General Theory of Employment, Money and Interest", published in 1936 by J. M. Keynes (1883-1946). After the publication of this theory, JOHN hiks re-read Keynes' book to give birth to the famous IS-LM model. This IS-LM model was later augmented by a balance of payments (BoP) curve to account for the increasing openness of economies, and then by the Phillips curve to incorporate employment and prices, which were absent from the original neo-Keynesian analysis.

The monetarist counter-revolution in 1960 led to the abandonment of the IS-LM model for a general equilibrium model AD-AS, an extension of the first, to give pride of place to the ideas of the new classics, then to integrate the ideas of the neo-Keynesians.

This neoclassical offensive was reinforced by the acute world economic crisis of the mid-1970s, which undermined the econometric models with several simultaneous equations (Klein models), which had become ineffective for forecasting in the new economic situation characterised by high instability. This led to a radical critique of macro-econometric methods by Robert Lucas in 1976 and by Christopher Albert Sims in 1980. This monetarist critique, led by Milton Friedman and Robert Lucas, was aimed at both the macroeconomics embodied by the IS-LM model, which was doubly augmented (by the Phillips curve and the BP curve), and the Klein-style modelling that corresponded to it. It led to a reversal in econometric engineering, in favour of the empiricism long advocated by NBER researchers, as well as in academic research in favour of the ideas of the new classics.

However, from the 1980s onwards, it became increasingly difficult to distinguish the theoretical macroeconomics of scientists from the empirical macroeconometrics of engineers. This merger became more pronounced with the development of the DGSE (dynamic stochastic general equilibrium) model, which since the 1990s (as an extension of the real business cycle model, RBC) and the turn of the century (with the incorporation of neo-Keynesian inputs) has been a new synthesis of the New Classics and the New Keynesians.

1-1 The principle of effective demand

This principle of effective demand explains that the level of employment is determined by the level of expected aggregate demand.

Thus, to reduce the massive unemployment of the 1930s, which was attributed to insufficient effective demand, it was necessary to increase effective demand. This aggregate demand is composed of the consumption of goods and services by households mainly and the demand for production goods (investments). According to Keynes, the consumption of goods and services depends only on aggregate income or the aggregate level of production. On a microeconomic level, Keynes explains that the marginal propensity to consume is a decreasing function of income. Therefore, according to him, we can increase household consumption for the same overall income by redistributing income to the poor, who have a high propensity to consume.

This is a secondary aspect of Keynesian therapy. The main message is about investment. These consist of private investment, which is mainly determined by the interest rate that is formed in the money market, and public investment, the level of which is set by the state at its discretion.

To increase private investment, the interest rate must be lowered. To achieve this, Keynes proposed an increase in the exogenous money supply, with the demand for money depending on the interest rate and the level of aggregate income.

Finally, Keynes advocated a coherent economic policy: a fiscal deficit policy to create additional aggregate demand ex nihilo, combined with an expansionary monetary policy to finance this fiscal deficit and to put downward pressure on the interest rate to increase private investment.

Combined with post-war reconstruction efforts in developed countries, fiscal policy was largely successful in reducing unemployment and achieving near full employment by the early 1960s.

2-Fiscal policy according to the neoclassical view

According to the neoclassical conception, if prices and wages are flexible, the market economy tends towards equilibrium; according to this theory, unemployment results from rigidities in the labor market, i.e. from regulatory obstacles that prevent the market from adjusting automatically, and not from a demand for insufficient goods.

According to the neoclassical conception, the police state is a simple guardian of the liberal economic and social order and must find the necessary resources to finance public services. In this view, budget imbalances are absurd insofar as they risk subtracting a 'deferred tax' (in the form of a subsequent increase in taxation to meet the annual debt payments) or a 'disguised tax' (in the form of inflation).

According to neoclassical theory, stimulus policy is less effective because when the government borrows to finance spending, it drives up interest rates, which tends to depress private investment by an amount similar to the stimulus.

(Barro R.1974) added that agents know that in the long run, the tax rate will rise to pay back the loan, and in anticipation of these future taxes, they reduce their consumption. The effectiveness of the stimulus is therefore hampered by agents' expectations. Under these conditions, it is necessary: encourage budget balance so as not to weigh on national savings; pay attention upstream to the generation of funds (fiscal neutrality) and downstream to the social utility of public investments.

(Barro R., 1974) has combined in his writings with the equivalence theorem attributed to Ricardo: to provoke a revival of spending, the State must go into debt; later, to repay the debt, it will need to either increase taxes or decrease public spending. The private sector will therefore find itself impoverished by the additional taxes it will have to face, or by the expenditure from which it will no longer benefit, to the extent of the enrichment from which it will have benefited immediately from the fiscal stimulus. The overall impact of the fiscal stimulus on spending is ultimately zero.

In other words, the method of financing public spending by taxation or by increasing public debt has no real impact on the economy. This result is often referred to as the "Ricardian equivalence principle" "Ricardian neutrality" or "Ricardo-Barro theorem". Equivalence exists because an increase in public debt today corresponds to an increase in taxes tomorrow, to repay the debt and the interest on it.

3. Musgrave: The Theory of Fiscal Policy

The theory of fiscal policy owes much to Musgrave (1959) who extensively took part in its development. According to this theory Policymakers are assumed to have no other goals than to promote social welfare and the public interest. The social welfare of a population is determined by a number of indications, some of which are economic in nature and others which are social in nature. The importance that policymakers focus on these indicators changes throughout time and depending on which government is in power. The weight given to policy indicators by policymakers in representative democracies is supposed to reflect voters' preferences and changes in those preferences. Economic growth, employment growth, productivity growth, inflation rate, unemployment, and income distribution are all examples of economic indicators. Life expectancy, crime rates, literacy rates, the quality of the physical environment, and the prevalence of illnesses are all social indicators. The policymakers interested in economic policy will focus on economic indicators. They have some perception of the weight that each of these economic indicators (Yi) has on the welfare function (W). Thus, we can write the equation as in equation (5);

$W = f\ (Y1, Y2, \ldots,)$ . . . . …………………………………………………….(5)

Policymakers are aware that changes in specific policy instruments (Xi) can alter indicators (Yi). Taxes, spending, and other policy tools are examples of policy instruments. These tools are available to policymakers and can be used to alter social welfare and direct it toward optimal levels. As a result, each indicator is defined as a function of the policy instruments (X). As a result, the equation can be written as equation (6);

Y_i = ( ); = 1, 2, 3, . . . ………………………………………………………………. n ; (6)

A particular instrument (X_i) is especially efficient in influencing a specific indicator (Yi). In this context efficiency means that the change in an instrument (ΔX) is necessary to change an indicator by a given amount (ΔY). The Theory of Fiscal Policy (Musgrave, 1959 argues that provided certain technical conditions are met, the implicit system of equations produced by the connections indicated above can be solved for the instrument values that maximize social welfare (W). This mathematical solution may require too large changes in the instruments However, if the instruments are efficient; the solution of the equation will require changes in their value that are technically or politically feasible.

II. Empirical Literature Review

1. The effect of public debt on growth

The issue of the relationship between public debt and economic growth has shown in the literature that the level of public debt plays a very important role in its impact on economic growth. Most of the work on this topic indicates that high levels of public debt have a negative effect on long-term growth. One of the most influential analyses of this issue is the work of Reinhart and Rogoff **(2010**) they suggest the possibility of a non-linear correlation between real GDP growth and the debt-to-GDP ratio. They show that real GDP growth tends to decline if the debt-to-GDP ratio is very high. However, they add that there is no significant relationship between the accumulation of public debt and economic growth if the debt-to GDP ratio is low. Herndon et al **(2014)** have criticized the work of Reinhart and Rogoff (2010). The authors re-did the work and found that errors in coding, selective exclusion of available data and unconventional weighting of summary statistics lead to serious errors that inaccurately reflect the relationship between public debt and GDP growth. In 20 advanced post-war economies, they estimated that when correctly calculated, the average real GDP growth rate for countries with a public debt ratio of more than 90 per cent has a factual effect of 2.2 per cent, rather than -0.1 per cent as published by Reinhart and Rogoff. For them, the relationship between public debt and GDP growth varies considerably depending on the period and the country. However, many empirical papers published following the work of Reinhart and Rogoff (2010) found similar conclusions to the original paper. They find that the relationship between debt and growth is non-linear and characterized by the presence of a threshold at which economic growth starts to slow down. For example, Kumar and Woo (2010) analysed the impact of public debt on long-term economic growth. This analysis is based on a panel of 38 advanced and emerging countries over the period 1970-2007. They have validated that the debt threshold is 90%. ChecheritaWestphal and Rother (2012) studied the impact of public debt on the growth of GDP per capita in 12 countries of the euro area over the period 1970-2010. They conclude that there is a non-linear relationship between debt and growth when the debt/GDP ratio is 90-100%. They also analysed the channels through which public debt is likely to affect economic growth. The channels through which public debt is found to have a non-linear impact on the rate of economic growth are private savings, public investment and total factor productivity. Baum et al **(2013)** on a panel of 12 euro area countries for the period 1990-2010 also validated that the threshold debt is 90%. Swamy**(2015)**has shown that the effect of debt on growth differs across countries and depends mainly on debt regimes and other important macroeconomic variables such as inflation, trade openness, government spending on consumption and foreign direct investment. Chudik et al **(2013)** have shown that the effects of public debt on growth vary across countries, depending on factors and institutions within each country. Eberhardt and Presbitero**(2013)**suggested that the debt-growth relationship differs across countries. In addition to this work, which focuses on the level of public debt, there is work that has studied the impact of the public debt trajectory on economic growth. Using data on a sample of 40 countries over the period 1965- 2010, Chudik et al **(2013)**concluded that there are negative long-term effects of public debt and inflation on economic growth. If debt relative to GDP is high and the increase is permanent, there will be negative effects on economic growth. But if the increase is temporary, then there will be no effect on long-term growth because the debt-to-GDP ratio is reduced to its normal level. They also conclude that the debt path may have more important consequences for economic growth than the level of debt itself. Pescatori et al **(2014)** focus on the long-term relationship between the stock of current debt relative to GDP and GDP growth in the coming years. They find that there is no net threshold that seriously hampers growth in the medium term and that the debt trajectory has more important

consequences for economic growth than the level of debt itself. They also find evidence that higher debt appears to be associated with more volatile growth that may nevertheless be detrimental to economic welfare. Panizza and Presbitero**(2013)**reviewed the theoretical and empirical literature that studies the relationship between public debt and economic growth in advanced economies. They found that there is no paper that can make a strong case for a causal relationship ranging from debt to economic growth and that the case for a causal effect ranging from high debt to low growth has yet to be made. They also found that the presence of thresholds for a nonmonotonic debt-growth relationship is not robust to small changes in data coverage and empirical techniques. Thomas Herndon, Michael Ash and Robert Pollin**(2013)** revealed methodological errors in the study by Reinhart and Rogoff**(2010).**Markus has published a working paper for the International Monetary Fund in which he finds that while there is a debt threshold above which public debt is harmful to growth, it is not common to all countries and is not constant over time, leading them to reject the idea that the same economic policy is not necessarily applicable to all countries, let alone at the same time. In a new IMF publication, Andrea Pescatori, DamianoSandri and John Simon **(2014**) used a new econometric method to take into account reverse causality, i.e. the impact of economic growth on public debt. The authors find no empirical evidence for the existence of a threshold of public debt at which medium-term growth prospects are affected. On the contrary, the medium-term association between public debt and growth weakens for high levels of debt. A study by IgberichristianaOgonna, Odo Stephen Idenyi,Anoke Charity lfeyinwa and Nwachukwugabriel**(2014)** therefore concluded that public borrowing in Nigeria has not created the desired impact in the economy. Consequently, the increase in public debt has not reduced unemployment. Furthermore, the rapid increase in debt service obligations is an obstacle to the implementation of new development-oriented projects, thus worsening the unemployment situation, as part of the revenue for this purpose is earmarked for servicing previous debts. It is pertinent to note that this obvious problem is attributed to the level of corruption prevailing in the economy, the distribution of public expenditure and the diversion of borrowed funds to unproductive or non-investment oriented projects which should in turn create employment. Numerous studies have then examined the link between public debt and economic activity. For example, Carmen Reinhart and Kenneth Rogoff**(2010)**have suggested that high public debt is associated with lower activity, but the direction of causality is unclear. However, as UgoPanizza and Andrea Presbitero**(2014)**point out, it may simply be low activity that tends to push public debt to high levels. Alan Auerbach and YuriyGorodnichenko**(2017)**have studied a sample of about 20 developed countries and confirm that stimulus through public spending increases stimulates activity and that the size of the public spending multiplier depends on the position in the cycle : a stimulus will stimulate economic activity more when the economy is depressed than when it is expanding. Moreover, they find that public expenditure shocks do not lead to sustained increases in public debt-to-GDP ratios or financing costs for fiscal authorities, especially in periods of economic weakness. Indeed, stimulus packages in depressed economies not only stimulate output, but also improve fiscal sustainability according to the various indicators that Auerbach and Gorodnichenko study. In short, it is unlikely that a government will see its interest rates or debt ratio rise sharply when it increases spending to cope with a recession; even if it's public debt is initially high. Yi Huang, UgoPanizza and Richard Varghese **(2018)**analyzed data for a sample of nearly 550,000 companies in 69 countries, both developed and emerging countries, over the period 1998 to 2014. They found a negative correlation between public debt and business investment: high levels of public debt are associated with lower private investment and with a higher sensitivity of investment to internally generated funds. This correlation could reflect a Keynesian causality ranging from low investment to public debt (or rather, the action of a third variable, namely low activity): when companies invest little, which is likely to be the case during a recession, the government will tend to stimulate activity, thus incurring debt. Huang and his co-authors believe, however, that the causality is in the opposite direction.

2. The effect of Budget Deficit on Economic Growth

The explanations of the impact of budget deficits on the economy vary across different schools of thought. The neoclassical theory illustrates an inverse relationship between economic growth and budget deficit, because persistent deficits crowd out private investment. Cebula**(1995)** investigates the impact of U.S. budget deficits on real GDP growth over the period 1955-1992. However, the Keynesian school views that a budget deficit will achieve a national income improvement and need not crowd out private investment, if the resources in the economy are initially under-employed. In contrast, the Ricardian school views a budget deficit as merely postponing tax, and having no real effect. The Ricardian argument is built on the understanding that a lower tax rate and a budget deficit require higher taxes in future. The study of Cebula indicates that federal budget deficits reduce the rate of economic growth. Siddiqui and Malik **(2001)** state that the impact of budget deficit on GDP ratio is expected to negatively crowd out public saving.

3. The effect of debt on unemployment

Kurecic and Kokotovic**(2016),**a linear regression conducted for five of the EU15 countries concerning the effect of public debt on unemployment revealed a statistically significant correlation between the variables. At the same time, the study pointed out that there is a strong causality between public debt and unemployment; for example, unemployment would increase by about 2.7% if public debt increases similar to those of 2012 and 2013 in Portugal, Greece, Ireland and Italy. This research on the relationship between public debt and unemployment has defined the budget deficit as a negative determinant of unemployment. It is also worth mentioning the study by Korol and Cerkas**(2015)**on Greece, whose conclusion argues that a 1% increase in public debt increases the unemployment rate by 0.46%; Oganna et al **(2016),**analyzed the Nigerian economy between 1980 and 2015 and argued that a 1% increase in public debt would lead to a 1.6% increase in unemployment due to the long-term relationship between the two variables. Last but not least, Jimenez and Mishra **(2010)** confirmed the distorting effect of the increase in public debt on unemployment through their academic work on the influence of the increase in public debt on the demand for labor in the United States for the period 1980-2008. The list of studies on the relationship between public debt and unemployment can be extended; it should be noted, however, that there is a large body of valuable work studying the relationship between external debt and unemployment (see Chinedu, **2015**; Battaglini and Coate, **2016;**Isaev and Masih, **2017**and Holden and Sparrman, **2011**; Ayyoub et al., 2012; Maqbool et al., 2013; Amaral and Lopes, **2015**; Bianchi et al., **2015**; Richard). The study by Kokotovic**(2016)**can be considered pioneering in this respect. The study's sample consists of Spain, Greece, and Croatia, which has the highest levels of youth unemployment, followed by Germany, Denmark, and the Czech Republic, which have the lowest youth unemployment rate in the EU. The results of the estimation of the autoregressive distributed lag (ARDL) show that youth unemployment is more affected by public debt than total unemployment in Croatia and Spain. The author stressed that new economic measures should be implemented to combat youth unemployment in those EU countries that are still suffering the destructive effects of the 2008 global financial crisis.

4. The effect of Budget deficit on unemployment

Pressman (1995) examined that fiscal policy was incapable of solving the unemployment problem premised on the argument that government deficits crowded out consumer spending, business investment and net exports. He called attention to existing theoretical and empirical supports of the positive effect of fiscal policy on employment rate which many nations have failed to take advantage of to curb the rising rate of unemployment. Bargawi and McKinley (2011) critically analyzed the severity of Tory-inspired public belt tightening on US economy with a view of predicting the effect of deficit reduction on economic recovery in UK and Southern Europe. The study used the „State of the World Economy" global macroeconomic model to compare two basic scenarios and observed that the outcome of reduction in budget deficits would largely be counter-productive as it would negatively affect the growth of GDP, private investment and employment. Battaglini and Coate (2011), who studied the relationship between fiscal policy and unemployment, suggest that any increase in unemployment can be reduced by tax cuts and increased government spending. Madueme and Nwosu (2011) found that the deficit had a favorable impact on Nigeria's unemployment rate. However, the effect was statistically negligible. Tagkalakis (2013) looked at the effects of fiscal policy changes on unemployment in Greece from 2000 to 2012 using the Blanchard and Perotti (2002) SVAR methodology and found evidence that unemployment reduced when there was an increase in government purchases, government consumption, the government wage bill and government investment and increased when there is a cut in government purchases and its subcomponents. The study also discovered that tax hikes increased unemployment. The analysis in summary posited that spending containment increased unemployment hence alluding that government expansionary fiscal policies reduced unemployment.

Egbulonu and Amadi (2016) examined the fiscal policy and unemployment rate association in Nigeria (1970 – 2013). In the long run, the analysis found a negative association between unemployment and fiscal policy. The vector error correction model was employed in Okoye, Evbuomwan, Modebe, and Ezeji's (2016) research model (VECM) and granger causality test and found a significant negative and causal relationship.

5. The effect of Unemployment on Investment

Arestis also investigated the link between macroeconomic variables and the rate of unemployment and Mariscal (1998) tested whether a fall in investment causes long-term unemployment. Their results point out that both capital shortages could significantly influence long-term unemployment and a shortage in demand may have a persistent effect on employment. Arestis et al. (2007) study the importance of capital stock in the determination of wages and unemployment rates for nine EMU countries and make a comparison of the findings across these countries. Their results found a negative relationship between investment and unemployment for all countries covered in the study. Miaouli (2001) used annual data from five European countries. His conclusions

state that investments within the private sector positively affect unemployment rates in all countries. In a similar vein, Nickell et al. (2005) examined the empirical analysis of unemployment patterns in the OECD countries which span from 1961 to 1995. Their result checks that unemployment is always determined by aggregate demand. Despite these studies, Karanassou and Snower (2004) achieve that imposing strong invariance restrictions on labor market activity implies that policies that increase the capital stock do not have any long-run effect on the unemployment rate. The nexus between investments and14 unemployment rates are also studied by Stockhammer (2004), who seeks to compare and test the validity of the NAIRU and Keynesian theories on unemployment in a time series method. He tests this suggestion and suggests that the NAIRU formation performed poorly with only the tax wedge having a positive effect on unemployment as predicted. Alexiou and Pitelis (2003) tackle the relationship between capital stock and unemployment using a post-Keynesian approach, where a panel data study is used from 1961 to 1998 for several European countries. Their result exposes that the negative and statistically significant coefficient of capital stock justifies their hypothesis that capital stocks play a very significant role in explaining unemployment rates. Abiad et al. (2015) examined the macroeconomic effect of increased public investments for 17 OECD countries from 1985 to 2013. Their conclusions reveal that an increase in public investment reduces the unemployment rate by about 0.11% in the short term and by about 0.35% over the medium term.

6. The effect of inflation on Unemployment

Ansari, Mohamad and Alias at el. (2014).The Multivariate Time Series Analysis on the link between the Inflation Rate and the Employment Rate with the Gross Domestic Product was discovered. They are utilising Malaysian time series data from 1982 to 2006. They estimate using econometric techniques such as Unit Root Tests, Co-Integration Tests, and the Granger Causality Test. The results reveal that all variables are stationary on first difference in the unit root test; Johansen Co-integration shows that GDP and the explanatory variables move closely to achieve the long run equilibrium. Overall, the findings indicate that inflation and employment have a one-way relationship with GDP in the short run. Muhammad, Shahid, M. (2014) investigated the impact of unemployment and inflation on wages in Nigeria. The Ordinary Least Squares Method was originally based on t-statistics, which show that unemployment has a major impact on wage rates, and Durbin-Watson statistics, which show that the model is not misleading. According to the Unit Root Test results, all variables are stationary on 1%, 5%, and 10%. According to the Granger Causality Results, unemployment and inflation do not granger cause wage rate. This conclusion implies a one-way causal relationship between unemployment and wage rate, rather than inflation and wage rate. Unemployment has a beneficial effect on wage rates, whereas inflation has no effect on wage rates. Jaradat M. A. (2013) discovered the influence of unemployment and inflation on Jordanian GDP (GDP). He used time series data spanning the years 2000 to 2010. He obtained the information from a global bank database. He estimated the relationship between dependent and independent variables using the liner regression method in SPSS. His findings show that if we increase inflation by 0.906 percent, GDP will increase by 1%; conversely, if unemployment falls by 0.697 percent, GDP will grow by 1%. Overall, the findings suggest that GDP and unemployment have a negative significant association, whereas GDP and inflation have a strong positive significant relationship.

In Pakistan, researchers looked into the relationship between economic growth and unemployment. They used data from 1972 to 2006 as a time series. They utilised the Augmented Dicky Fuller test for Unit Root, and all of the variables are stationary on the first level difference, thus they used Johansen Co-integration to determine the long run relationship between variables. Hussain, T, Siddiqi, M. W, & Iqbal, A (2006). The findings of the Co-integration test indicate that GDP Growth, Unemployment, Labor, Capital, and Trade Openness have a long-term relationship. Overall, the findings imply that GDP growth has a negative connection with unemployment.

Umair, M., & Ullah, R. (2013) Discovered the effect of GDP and inflation on Pakistan's unemployment rate they are using time series data from 2000 to 2010 and running regression using SPSS. They discovered that inflation has a negative impact on GDP and a negative relationship with unemployment.

7. The effect of GDP on unemployment

Mali and molana (2001) they were conducting research on the Relationship between the amount of output and the rate of unemployment. According to the study, only Germany out of the pooled data reveals a negative link between the level of output and the rate of unemployment using an estimation method that allows for trends, cyclical variations, and breaks. Nor Noor and Ghani (2007). From 1970 to 2004, Malaysia was involved in a project to investigate the Okun-type relationship between output and unemployment. Their research used basic econometric analysis to test stationarity using the ADF and Phillip-Perron tests. They also discovered a negative link between unemployment and output growth. Furthermore, they demonstrated the existence of a two way

correlation between unemployment and GDP in the Malaysian economy. Zabihi, R., & Pordel, M. (2011) Investigate the dynamic influence of Iran's unemployment rate on per capita real GDP. The study attempts to provide a comprehensive statistical examination of the simultaneous dynamics of output and unemployment rate. Their investigation spanned the years 1971 to 2006, and they employed the Auto-regressive Distribution lag (ARDL). The long run coefficients of the ARDL show that the unemployment rate is statistically important in predicting per capita real GDP in the long run. According to the short and long run statistics, the unemployment rate is positively connected to per capita real GDP.

Revoredo-Giha, C., Leat, P. M., & Renwick, A. W.(2012). In Scotland, researchers investigated the relationship between output and unemployment. Their research was driven by a drop in Scottish labour market circumstances; the situation did not improve even though the Scottish economy emerged from recession in the fourth quarter of 2009. Their findings reveal that differences in the makeup of the rural and urban economies led to a substantial link between growth and employment in urban areas. Furthermore, Lo, S., Stephan, G., & Wilke, R. A.(2012) used a bivariate unobserved component model to describe Okun's law for France and the United Kingdom. The analyses used OECD data from 1969:1 to 2011:2 for France and quarterly data from 1971:1 to 2011:2 for the United Kingdom. The study's findings demonstrate a negative correlation between the trajectories of both series, lending support to the actual business cycle theory.

8. The effect of Openness on unemployment

Loganathan,N., Sukemi, M. N., & Kogid, M. (2011). The relationship between trade openness and unemployment has been studied, with inconsistant results. In their research on Malaysia, they discovered that an increase in the trade balance had a negative Granger non-causality effect on the rigidity of unemployment dynamics. This suggests that trade liberalisation has the potential to boost aggregate productivity in a variety of sectors. As a result, economic performance and efficiency increase the rate of labour use. The main finding of Alawin's (2013) study of Jordan's trade balance and UNR using quarterly data from 2000 to 2012 is the absence of a long-term relationship between the two elements. His findings show that a trade balance deficit causes unemployment in the near run and vice versa.

Kim and sun (2009). In most industries involved by the North American Free Trade Agreement (NAFTA), such as the automobile, chemicals, and clothing sectors, indices of trade openness have a substantial role in labour market churning. This finding supports the concept that trade openness encourages export and forces certain firms to restructure, typically leading in a decrease in labour utilisation in some sectors and an increase in others.

Jamal, M., Hasan, M., Mathewson, A., & Razeeb, K. M. (2012) show no indication of a decline in unemployment as a result of trade reforms; on the other hand, urban unemployment falls with trade liberalisation in states with flexible labour markets and boosts employment share in net exporter industries. Even after eliminating control variables, their findings are similar to the cross-country estimation of Dutt et al. (2009) for 90 developing countries. However, Dutt et al. (2009) discovered only a limited support for the Heckscher–Ohlin postulate, which states that the link between trade openness and unemployment shifts from negative to positive in labor-abundant and capital-abundant countries, respectively

III. Methodology

1. Data

Our investigation is based on annual data provided by several international institutions. We use data for the six euro zone countries (Spain-France-PortugalCyprus-Ireland-Greece) and five the MENA region countries (Tunisia, Algeria, Morocco, Egypt, Jordan). We have used annual data from international institutions in our empirical framework (IMF and World Bank, OECD, INSEE, Eurostat) which were mobilized to build a database covering the period 1990-2016, i.e. 26 observations.

2. Model specification

Modelling operates in three phases: design, i.e. writing or specifying the model; model estimating equations, and the use of appropriate techniques. To ensure the interrelationships between the three variables in our study (public debt, budget deficit, unemployment,) we have used a system of equations that recognizes the endogeneity of the explanatory variables under study. Our model consists of the three following equations:

$$UNEMP_{it} = \alpha + \beta 1BD_{it} + \beta 2D_{it} + \varepsilon_{it} \quad \text{(Eq1)}$$

$$BD_{it} = \alpha 2UNEMP_{it} + \theta 1CTS_{it} + \theta 2GDP_{it} + \theta 3MMR_{it} + \theta 4INF_{it} + \varepsilon_{it} \quad \text{(Eq2)}$$

$$D_{it} = \alpha 3 + \gamma UNEMP + \gamma 2BD_{it} + \gamma 3CTS_{it} + \gamma 4GFCF_{it} + \gamma 5OP_{it} + \varepsilon_{it} \quad \text{(Eq3)}$$

With: $UEMP_{it}$, represents respectively, unemployment rate, public debt and budget deficit. CTS: the sustainable primary balance threshold calculated from the accounting approach of a country i at a time t. α1, α2 and α3 are the parameters to be estimated UNEMP (it-1) DP(it-1) and BD(it-1) represent the delayed dependent variables.

D_{it} : The public debt ratio as a % of GDP

BD_{it} : The budget deficit rate as a % of GDP

$UNEMP_{it}$: The unemployment rate

GDP_{it} : The current GDP growth rate

INF_{it} : The inflation rate

OP: Opening Rate

MMR_{it} : Money Market Rate

$GFCF_{it}$: Gross fixed capital formation

CTS_{it}Indicates the critical threshold of sustainability and it is calculated by the accounting approach. d_t= -[(rt-nt)/ (1+nt)]bt dt appears to be the level of the primary fiscal balance required in each year in order to keep the government debt ratio constant at its current level

3. Descriptive statistics

The following is a summed up description of the data from the research. Thus, the table below summarizes the descriptive statistics of the study variables. The purpose of this descriptive analysis is to identify the descriptive characteristics of the explanatory and control variables in our study model. These characteristics concern the average, standard gap, minimum, and maximum. The descriptive statistics of the different variables for the panel MENA countries are presented in Table 1.On average, the highest levels of unemployment (13.8),public dept (86.18); budget deficit (3.04), as well as is the case for MENA countries

TABLE I

. DESCRIPTIVE STATISTICS FOR MENA COUNTRIES

Descriptive statistics

panel	Descriptive statistics	UNEMP	CTS	D	BD	OP	GDP	INF	GFCF	MMR
	Mean	13.78	4.37	68.7	-3.04	75.84	6.43	5.9	22.13	3.34
	SD	4.78	15.95	31.72	5.84	28.25	12.24	5.97	4.01	1.72
	Min	8.1	-6.924	2.85	-3.46	32.98	2.04	-1.69	11.44	0.27
	max	29.5	9.62	219.8	-8.96	149	12.41	8.67	31.05	8.029

SD, standard deviation , UNEMP , unemployment rate ,BD budget deficit ,D public dept ,GDP The current GDP growth rate ,INF The inflation rate ,OP Opening Rate ,FBCF Gross fixed capital formation ,MMR Money Market Rate , min minimum , max maximum

4 Panels Unit Root test

The decision rule is that the H0 assumption (all series are non-stationary) is rejected if p-values are inferior to 5%. The results of the hadri stationarity test show that almost all the variables are stationary in level (I(0)), i.e. (UNEMP,BD,D,GDP,INF,OP,FBCF,MMR) while only the variable CTS is not stationary. The table 2 above shows the result of unit root test of HADRI applied on the five MENA countries data (Tunisia, Algeria, Morocco, Egypt, Jordan)

TABLE II

Results of panel unit root tests

variable	T-statistics	P value
UNEMP	25.2759	0***
CTS	5.168	0***
D	24.129	0***
BD	5.1157	0***
OP	17.306	0***
GDP	1.7611	0.03**
INF	14.382	0***
GFCF	14	0***
MMR	23.638	0***

5 Results of static panel estimations

The results of the statistic Panel regression are presented in Table 3. In this case first of all, I run the FE and RE models step by step, then at the same time, to become sure which one is appropriate, the Hausman test was employed. Altogether, the Hausman test absolutely prefers FE for MENA countries. In relation to the Hausman test shows that the p value is less than (0.000), therefore the fixed effect model is appropriate the empirical for analyzing of data.

TABLE III

RESULTS OF FIRST MODEL ESTIMATION (EMPLOYMENT AS INDEPENDENT VARIABLE)

	Pooled OLS Regression		**GLS Random Regression**		**Fixed-effects**	
variable	Coef.	P>z	Coef.	P>z	Coef.	P>t
CTS	-0.08	0.034	-0.08	0.032	-0.012	0.693
D	0.007	0.588	0.007	0.587	0.071	0
BD	0.361	0	0.361	0	0.17	0.001
OP	0.014	0.319	0.014	0.317	-0.064	0.009
GDP	0.068	0.136	0.068	0.134	0.03	0.88
INF	0.153	0.02	0.153	0.018	0.053	0.9
GFCF	-0.063	0.501	-0.063	0.5	-0.025	-0.34
MMR	0.652	0.004	0.652	0.003	0.264	1.39
_cons	11.578	0	11.578	0	13.5	5.16
R-squared	**0.5995**					
Wald test chi2	83.825(0.000)					
Homogeneity test	F(8,122) 12.98					
	Prob>F(0.000)					
F Test	F (4, 122) = 25.70					
	Prob>F=0.000					
Hausman test chi2(4)	183 0.00					
Number of obs	135					
Number of countries	5					

In FE model for MENA countries, the p value of R-square is 0.595, which explains that the relationship between the dependent variable (Unemployment) of the MENA countries and all the independent variables (, BD, CTS, D, GDP, INF, OP, FBCF, MMR) is high. The value means that about 59 % of variation that occur in unemployment can be explained by BD, CTS, D, GDP, INF, OP, FBCF, and MMR. As expected, we find that BD, INF and D have positive and significant impacts on unemployment. Therefore, we find OP, has negative and significant impacts on unemployment in the MENA countries.

The findings indicate that the coefficient of Public debt has a positive and significant impact at a 1% threshold on the unemployment rate. This implies that a 1 % increase in public debt increases unemployment by 0.071% in the MENA countries. This result is reinforced by Kurecic and Kokotovic (2016), Korol and Cerkas (2015).

The budget deficit shows a positive and significant impact on unemployment rate. This implies that a 1 % increase in budget deficit increases unemployment by 0.17% in the MENA countries. This result is reinforced by Pressman (1995).

The opening rate coefficient shows a negative and significant impact on unemployment rate. This implies that a 1% increases in openness decreases unemployment by 0.064% in the MENA countries. This result is supported Dutt et al. (2009)

1.6 Result of Simultaneous-Equation Panel Data Models

In this section we will check the link between the budget deficit, unemployment and public debt for the MENA countries and euro zone countries , so the question that now assumes that it is the impact of the sustainability of public debt on unemployment? Is there really a relationship between these three variables? How can we conclude this relationship?

The table 5 above corresponds to the results of our model estimation by the simultaneous equation mechanism. We have to recall that all estimates were made using STATA software. We can recall that the purpose of this study is to test the relationship between the budget deficit, the public debt and the unemployment rate. We then have to analyses the effects of an indicator on the other two variables and the same work will be done with the other variables to be explained. Indeed, with regard to the first equation Presented in table 7 show that:

$$\mathrm{UNEMP}_{it} = \alpha + \beta 1 \mathrm{BD}_{it} + \beta 2 \mathrm{D}_{it} + \varepsilon_{it} \quad \text{(Eq1)}$$

The public debt ratio (D) acts positively with the unemployment rate at a 1% threshold, implying that a very high public debt ratio can hamper economic growth and consequently affect investment negatively and labor creation, especially in a non-stable economic context characterized by a drop in demand. This result is on line with [Broner et al, 2014] and Yi Huang, Ugo Panizza and Richard Varghese (2018). Similarly, the negative effect of the budget deficit is statistically significant; here it implies the effectiveness of fiscal policy in terms of boosting demand and reducing unemployment rates. At the level of the second equation presented in table 4

$$BD_{it} = \alpha 2 UNEMP_{it} + \theta 1 CTS_{it} + \theta 2 GDP_{it} + \theta 3 MMR_{it} + \theta 4 INF_{it} + \varepsilon_{it} \quad \text{(Eq2)}$$

The results of Equation 2 indicate that the coefficient of unemployment has a positive and significant impact at a 1% threshold on the budget deficit. This implies that a 1 % increase in unemployment increases budget deficit by0.44017 % in the MENA countries

Not least, we have find that the public debt ratio has negative and statistically significant at a 1% threshold on budget deficit, which shows that today a high debt can provide resources to finance productive public spending (such as infrastructure investments) that can raise the path of growth .The coefficient of GDP is significant at the 5% level and the sign is positive indicating that 1% increase in GDP decrease budget deficit by 0.09638.

Also we find the coefficient of inflation has negative sign at 1% level. This implies that a 1 % decrease in inflation will decrease budget deficit by 0.1936.

The results of the third equation (Eq3) presented in table 7

$D_{it} = \alpha 3 + \gamma UNEMP + \gamma 2BD_{it} + \gamma 3CTS_{it} + \gamma 4GFCF_{it} + \gamma 5OP_{it} + \varepsilon_{it}$ Show that the unemployment rate in the MENA region has no effects on the public debt

TABLE IIII.
RESULTS ESTIMATION BY SIMULTANEOUS EQUATIONS

MENA countries		
Variable	Coefficient (p value)	
UEMP(-1)	1.09109	0***
D	0.01369	0.001***
BD	-0.2007	0.001***
b100	-2.2195	0.011***
BD(-1)	0.3712	0.001***
UEMP	0.44017	0.001***
D	-0.6148	0***
GDP	0.09638	0.008***
INF	-0.1936	0.002***
MMR	0.16724	0.282*
b200	-7.8768	0***
Dp(-1)	0.86528	0***
UEMP	0.13884	0.722*
CTS	-0.1864	0***
BD	-0.7493	0.115*
OP	0.01563	0.52*
GFCF	-0.0029	0.989*
b300	3.29691	0.741*
Hansen's J chi2(12) = 9.3011 (p = 0.6770)		

Conclusion

In this research based, we have tried to contribute to the resolution of a fundamental question: is there a link between unemployment, public debt and budget deficit for the five privileged countries of the MENA region? Therefore, we should note that no empirical study has been done so far to determine the interactions between these three variables and in order to analyze the interdependence between these systems of equations, we have found that only the simultaneous equation model is able to allow us to analyze the dynamics between its different variables. The variables used in our econometric model are: the critical threshold of the sustainable primary balance, the budget deficit, the public debt, unemployment, inflation, the current GDP growth rate, the money market rate, the fixed capital formation, the openness rate. The study lasted from 1990 to 2016. Indeed, the results of the model estimation for the five countries of the MENA region we have found a unidirectional relation going from public debt to unemployment, a twin directional relation between deficit and unemployment and a unidirectional relation going from debt to deficit. According to the results obtained we can assert that Keynesian and neo-classical macroeconomic policies have shown limited in the fight against unemployment for MENA countries: these policies have not made it possible to eradicate unemployment. Therefore, it is important to develop a macroeconomic policy that promotes growth, combined with appropriate structural policies aiming at changing the rules of the game in factor markets, as well as to placing greater emphasis on active labor market policies and make them effective.

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