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Does the Phillips Curve Exist? Evidence from the Middle East and North African Countries

Abstract: This study aims to explore the validity of Phillips curve for eight (8) countries from the Middle East and North Africa (MENA), namely Algeria, Egypt, Jordan, Kuwait, Malta, Morocco, Saudi Arabia, and Tunisia over the period of 1991–2019. The panel autoregressive distributed lag/ pooled mean group (ARDL/PMG) estimation is employed in the study because of the nature of data. The results of ARDL/ PMG reveal that there is no trade-off between inflation and unemployment rates in the panel of eight MENA countries in the long run, while there is a negative but insignificant relationship between these two variables in the short run. In addition, the trade-off between inflation and unemployment for each of the panel's countries has also been investigated. The empirical results indicate that there is no trade-off in the short run as the estimated coefficients found are statistically insignificant. Hence, it is concluded that there is no empirical evidence of the trade-off between inflation and unemployment rates in MENA countries.

Keywords: Inflation rates, unemployment rates, Phillips curve, ARDL/PMG, MENA-8.

JEL classification: E31; E24; N15.

1. Introduction

Inflation and unemployment are the important macroeconomic indicators of an economy. High inflation and unemployment decrease wellbeing of people and need to be controlled and kept low as much as possible. Changes in monetary

conditions are often assumed to pass on to the real economy as a trade-off between inflation and real production or employment via the classical Phillips curve relationship. In fact, inflation is usually viewed as an impediment to economic growth and development when it reaches some allowable threshold level and, in this way, it remains an intriguing issue for policymakers in general. The basic objectives of every country is to achieve macroeconomic solidity in the nation and to ensure monetary growth and progress where both unemployment and inflation are the visible macroeconomic elements. In this manner, maintaining esteemed high quality and decreasing unemployment are required by rising and progressive economies. Unemployment has become one of the most challenging issues for both developing and developed countries. However, prices are escalating more in developing than in the developed countries, and monetary variables are exceedingly responsible for the upsurges in prices. Inflation is defined as the continuous increase of prices in a country over a given period of time. As a means of exchange, it lessens money's purchasing power. Also, it results in low investment and financial growth. Inflation makes an economy more vulnerable and debilitates macroeconomic soundness. Many erstwhile studies including those of Azam and Khan (2014) and Khan and Khan (2018) mention that high inflation constantly hurts the poor more than the rich.

In literature the idea of Phillips curve (hereafter PC) which depicts the trade-off, was developed by A.W. Phillips (1958) who observed a negative association between the money wage rate and the unemployment rate in the British economy during 1861–1957. The PC shows that an expansion in the cost of items and the administrative expenditures can lead to a decrease in the rate of the general population searching for a job. If the trade-off occurs between the cost of the item and the administrative expenditures, as well as the general population searching for a job, the strategic approach creators can utilise PC to make changes in accordance with the economy. These creators can increase inflation and unemployment rates to the detriment of the other variable when required (Adebowale, 2015). The fundamental principles of the PC can be understood by using the idea of labour demand and supply. On the off chance that labour demand might be greater than labour supply; the surplus in demand can put increasing pressure on the wage rate, thus causing high inflation in the country. In the circumstances, labour can easily find employment. Therefore, unemployment remains at low level. Paradoxically, if the labour supply is greater than the labour demand, the surplus in the supply of labour would bring down the wage rate, thus prompting a lower inflation rate. An over-the-top labour supply would cause trouble for specialists when finding employment and unemployment would have abnormal patterns (Furuoka, 2008).

The original PC, which delineates the backwards connection between the rate of change in monetary wages and the unemployment rate, has been modified by Samuelson and Solow into a graph, which exhibits the connection between the inflation rate and the unemployment rate. Samuelson and Solow expressed that the rate of price increase surged to 4.5% when the unemployment rate dropped to 3%. Along these lines, the higher the employment and expense generation, the higher the price increase (Samuelson & Solow, 1960). At the end of the day, the adjusted PC selects between 'higher unemployment-lower inflation' and 'lower unemployment-higher inflation'. Meanwhile, the central bank and policymakers plan to structure the economy through monetary and fiscal strategies. In this sense, the PC is considered to be a critical strategy instrument (Alper, 2017). In his study Kruškovic (2022) says: "The macroeconomic policy of central bank intervention should keep achieving full employment and low inflation (internal equilibrium) and current account sustainability (external equilibrium)."

The supporters of the PC hypothesis claim that there is a trade-off between inflation rate and unemployment rate. Islam, Hassan, Mustafa and Rahman (2003) documented: "In the 1960s and 1970s, the Phillips curve was used as an important macroeconomic policy tool in the developed as well as less developed countries. It acted as a reminder for the macroeconomic policy formulators and the governments on how far they had been able to push down the inflation rate or unemployment rate without unduly risking the other because of the trade-off relationship between these two key macroeconomic variables". It is also endorsed by Hart (2003) that "The Phillips curve still plays a prominent role in macroeconomic theory and the associated empirical work".

In his study Friedman (1968) noted that "there is always a temporary trade-off between inflation and unemployment; there is no permanent trade-off. The temporary trade-off comes not from inflation per se, but from the unanticipated inflation, which generally means, from a rising rate of inflation. The widespread belief that there is a permanent trade-off is a confusion between "high" and "rising" that we all recognize in simpler form. A rising rate of inflation may reduce unemployment, a high rate will not." In his study Mishkin (2006) summarized that "there is no long-run tradeoff between output (employment) and inflation" it is one of the 'six ideas that are now accepted by monetary authorities and governments in almost all countries of the world'.

The PC had been extensively argued in the macroeconomics literature. There are sufficient empirical studies explored in this association, and no evidence has been suggested for long run stable relationship between inflation and unemployment rate (e.g., Phelps, 1967; Leijonhufvud, 1968; Friedman, 1968; Puzan, 2009; Hye &

Siddiqi, 2010; Azam & Khan, 2014). On the other hand, many studies empirically vindicated trade-off between inflation and unemployment rate (e.g., Brechling, 1968; Fair, 1984; Fuhrer, 1995; Tang and Lean, 2007; Bhattarai, 2016, and Vermeulen 2017).

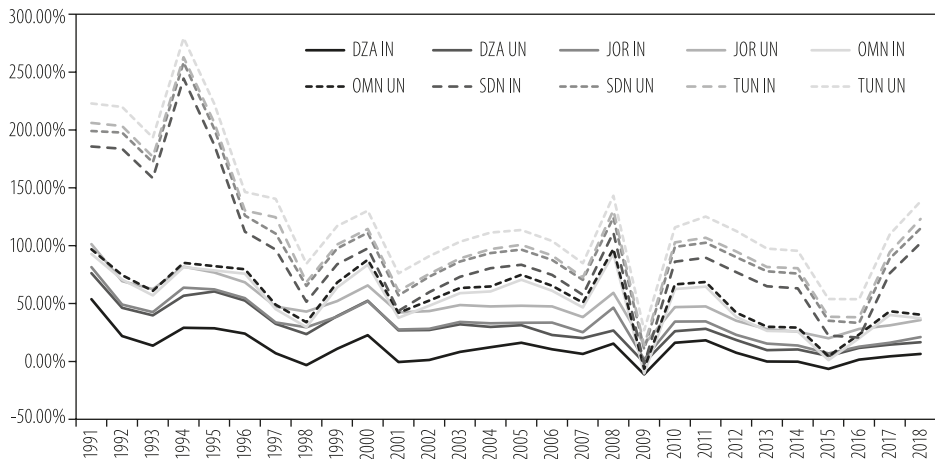
Inflation and unemployment are central to the common and financial existence of each nation. The current work refers to inflation and unemployment as concepts comprising a limitless loop, which explains the prevalent idea of poverty in creating nations. Moreover, constant enhancement in profitability has been contended as the surest method to break this endless loop. Growth in efficiency gives a huge promise to the satisfactory supply of goods and services, which consequently enhances the welfare of the general population and promotes social advancement. Unemployment has been organised as one of the unaffected obstructions to social advancement. The need to turn away from the adverse effects of unemployment has made the control of unemployment very obvious in the improvement destinations of several creating nations. It has been a significant problem among countries throughout the years. Inflation is considered as a summed-up increase in the dimension of price continued over time in an economy. In any economy, inflation and unemployment have always been on the 'front burner'. All economies dependably want to keep them both at low, single-digit rates to achieve their macroeconomic goals and growth objective; furthermore, it seeks to achieve the set of objectives and destinations of countries' financial strategies (Umaru & Zubairu, 2012).

Generally, the inflation rates of nations are different from each other due to various reasons. After great inflation and hyperinflation that have been observed in developed and the developing nations in mid- 1970s and 1980s, the last two and three decades have seen a disinflationary trend that has helped inflation to maintain single digits in many nations. These changes are components of basic alteration programs in which powerless establishments and monetary approaches are seriously addressed and supplanted with more grounded and steady ones (Ali, 2011). The objective, portfolio of variables, approach and time period of the present study are different if compared with the study of Ali where the author covered eight countries from MENA over 1980-2009 and used a total of ten variables in the empirical model.

This study is an attempt to verify the validity of trade-off Phillips curve for selected eight Middle East and North Africa countries (Algeria, Egypt, Jordan, Kuwait, Malta, Morocco, Saudi Arabia, and Tunisia). During the last several years, a continuous cycle of dictatorship, coercion, corruption, and economic stagnation obsessed most MENA economies. All these raised the cost of basic goods

which led to a number of “bread riots” in the entire Arab World that started in the early 1980s. In many MENA countries, unemployment, particularly among young people, remained mainly unheeded and remained the growing problem all over the 2000s. The data shows that the unemployment rate among youth in the MENA region recorded as 23.5% in 2009, the uppermost level of youth unemployment in the world at the time. Tunisia’s economic condition also lingers to worsen, with growing inflation and unemployment levels (Jamshidi, 2014). For more clarification, inflation rates (%) and unemployment rates (%) of the MENA nations are presented in Figure 1.

Figure 1: Unemployment and inflation rates of MENA nations



Source: WDI (2020)

* Where IN is inflation rates and UN is unemployment rates. DZA is Algeria, JOR stand for Jordan, OMN stand for Oman, SDN stand for Sudan and TUN stand for Tunisia.

The MENA region and oil exporting nations are especially concerned about rise in general price level. While direct inflation has appreciated gradually up to this point, these nations have, for the most part, observed that their circumstances fall apart quickly. Supported by huge increase in the worldwide costs of oil, oil-exporting nations have appreciated unprecedented dimensions of liquidity. Oil-importing nations, on the other hand, have experienced a general increase in household costs, which has fuelled residential inflationary pressures. In this regard, normal inflation for the region has seen a sharp increase to double-digit in specific nations, while for other people, huge floods have been registered. The MENA nations consistently contribute approximately US\$ 3.3 trillion to the GDP, which represents approximately 4.5% of the world income (Bolat, Tiwari

and Kyophilavong, 2017). The economies of the MENA region are exceptionally assorted. The area is best known for its oil businesses, which essentially influence the economy. Although a few nations have officially experienced improvement in a 'post-oil' economy and do not depend on oil vigorously, the MENA nations still confront a few noteworthy financial difficulties because of cultural and social reasons (Ali & Mim, 2011).

The main objective of the study is to check the validity of the PC in eight MENA countries (Algeria, Egypt, Jordan, Kuwait, Malta, Morocco, Saudi Arabia, and Tunisia) over the period ranging from 1991–2019, by assuming that all these eight countries from MENA have similar characteristics. Both inflation and unemployment rates have increased in these countries over the past three decades, notwithstanding some expansions in GDPs. Inflation rates and unemployment rates are current problems that are affecting the economies. Indeed, the trade-off PC has been studied widely, but there is no coherence proof on the existence of trade-off between inflation and unemployment rates. Furthermore, as to our knowledge, there is no accessible experimental study on the PC on MENA countries. An examination of the association between the inflation rates and unemployment rates in MENA countries will remarkably support financial leaders in these countries by securing the leaders with the knowledge likely needed to confront the unemployment rates and inflation rates in MENA countries.

The rest of the paper is organised as follows. Section 2 deals with the literature review. Section 3 discusses the data and empirical methodology. Section 4 presents the result and analysis, and Section 5 concludes the study.

2. Literature Review

Existing literature on the association between inflation rate and unemployment shows contradictory results, for example, Tang and Lean (2007) confirmed the trade-off between inflation and unemployment in Malaysia both in short- and long-run from 1971–2004. Herman (2010) examined the association between unemployment rates and inflation rates in Romania from 1990–2009. He found a positive but insignificant relationship between the variables. Haider and Dutta (2012) in their study found the trade-off between inflation and unemployment in the Bangladesh economy during 1987–2009. Shahbaz, Islam and Shabbir (2012) examined the relationship between unemployment rates and inflation rates in North Cyprus from 1978–2007 and found a significant and adverse relationship between the variables. Empirical findings of Bhattarai (2016) suggested that PC phenomena are still empirically substantial for 28 out of 35 of OECD countries

from 1990:1 to 2014:4. Furthermore, Vermeulen (2017) observed no evidence of a trade-off between inflation rate and the unemployment rate in the short-run for South Africa during 2000–2015, and the long-run results showed a negative association between inflation and unemployment. Chuku, Atan and Obioesio (2017) examined the relationship between unemployment rates and inflation rates in Nigeria from 1960–2009 and concluded that there was an opposite link between both variables.

The study of Buba and Aljadi (2017) investigated association between inflation and unemployment rate in Nigeria from 1977–2011, which concluded the opposite connection between the two variables. According to Esu and Atan (2017), the unemployment and inflation rates in sub-Saharan African countries from 1991–2015 showed a positive but an insignificant relationship. Karahan and Uslu (2018) examined the association between inflation and unemployment in Turkey from 1996–2016 and they observed an opposite connection between the variables. Similarly, Jula and Jula (2017) examined the relationship between unemployment and inflation rates in Romania from 1992–1997 and also found an opposite connection between both variables. Also, Shaari, Abdullah, Razali and Saleh (2018) studied the association between unemployment and inflation rates for high-income countries from 1990–2014 and found an opposite association between unemployment and inflation rates. Zayed, Islam and Hasan (2018) also found the same results in the study conducted for Philippines for the period 1950–2017. Similarly, Victor, Farkas and Jeelson (2018) studied the association between unemployment and inflation rates in Hungary from 1999–2017 and found an inverse relation between the variables. Grammy (2019) found a trade-off between inflation and unemployment rates in the Islamic Republic of Iran during 1980–2015. Similarly, Ho and Iyke (2019) investigated the relationship between inflation rates and unemployment rates for the euro area nations from 1999–2017 and found an inverse relationship between the variables. Leightner (2020) employed the Bi-Directional Reiterative Truncated Least Squares method that solves the neglected variables problem to investigate the tradeoff between inflation and unemployment for 34 countries over 2002–2017. The author claimed that “I find that this tradeoff varies noticeably from country to country in a given year, but that many of these tradeoffs move in the same direction over time.”. Table 1 shows some further studies on the direction of the relationship between inflation and unemployment.

Table 1: Selected studies on the relationship between inflation and unemployment rates

Author(s)	Data (countries)	Estimator (s)	Response variable	Explanatory variables	Findings
Puzan (2009)	1980–2005 ASEAN-4	OLS	Inflation rates	unemployment interest rate, and exchange rate	No trade-off PC
Hye & Siddiqi (2010)	1971–2009 Pakistan	VECM, rolling window regression method	Inflation rates	Unemployment rates	No trade-off PC
Dirtsaki & Dritsaki (2012)	1980–2010 Greece	VECM	Inflation rates	Unemployment rates	Positive and insignificant connection
Shahbaz et al. (2012)	1978–2007 North Cyprus	ARDL & DOLS	Unemployment rates	Inflation rate	Negative and significant connection
Ojapinwa & Esan (2013)	1970–2010 Nigeria	VECM	Inflation rates	Unemployment rate	Positive and insignificant relation
Adebowale (2015)	1977–2013 Nigeria	OLS & VECM	Unemployment Rates	Inflation Rates	Negative and significant relation
Alper (2017)	1987–2016 Romania	ARDL	Inflation rates	Unemployment rates	Positive and insignificant relation
Shaari et al. (2018)	1990–2014 High income countries	VECM	Inflation rates	Unemployment rates	Negative and significant relation
Karahan & Uslu (2018)	1996–2016 Turkey	ARDL	Inflation rates	Unemployment rates	Negative and significant relation
Sasongko & Huruta (2018)	1984–2017 Indonesia	GCT	Inflation rates	Unemployment rates	Positive and Insignificant relation
Abu (2019)	1980–2016 Nigeria	ARDL	Inflation rate	Unemployment rates	Negative and significant relation

Source: Authors' compilation

3. Data and empirical methodology

3.1. Data and empirical model

To check the existence of trade-off between inflation rate and unemployment rate, we used balanced cross-sectional annual data from 1990-2019 for eight Middle East and North Africa countries: Algeria, Egypt, Jordan, Kuwait, Malta, Morocco, Saudi Arabia and Tunisia. The GDP deflator annual percentage represent inflation rate and for some missing years, GDP deflator is replaced with the consumer prices index annual percentage. Similarly, the unemployment rate as a

percentage of total labour force (modelled ILO estimates) is used.¹ The restriction is for the eight countries of the Middle East and North Africa due to the availability of data for the years 1991–2019 either on inflation rate or unemployment rate, where the countries with high inflation rate (> than 30%) are excluded from the analysis.

Based on the studies of Furuoka and Munir (2009), Azam and Khan (2014), and Esu and Atan (2017), following equation is used to test the relationship between inflation and unemployment rates for the eight MENA countries:

$$INF_{i,t} = \beta_{0i} + \sigma_i INF_{i,t-1} + \delta_i UNE_{i,t} + \mu_{i,t} \quad (1)$$

where INF represents inflation rate, UNE is unemployment rate, $i=1, \dots, N$ denotes a country, $t=1, \dots, T$ denotes a year and $t-1$ denotes one year lagged of the variable. The term β_{0i} is the unobserved individual effects, and $\mu_{i,t}$ shows the error (idiosyncratic) term.

3.2. Estimation strategy

In this section, the general framework for analysing dynamic panel regression is reviewed. Initially, cross-sectional dependency and panel unit root analysis is discussed. Then, we rationalize to estimate the short run and long run relationship between inflation and unemployment.

3.3. Cross-sectional dependency (CD) and panel unit root tests

The standard panel data model generally assumes cross-sectional dependence (CD), while Pesaran (2004) suggested that when the time dimension is greater than the cross-sectional dimension, CD should be used in the panel data model (cited in Guzel and Okumus, 2020). Moreover, before applying certain panel unit root tests, CD test is recommended. Shariff and Hamzah (2015) argued that the problem arises when testing the stationarity of the panel variable in the presence of CD, with the Breusch-Pagan (1980) LM test and Pesaran (2004) CD test, we first examined the problem of CD in panel variables and panel data model. We will prefer the outcome of CD-LM test for cross-sectional dependency because time dimension is greater than cross-sectional dimension in our panel data

¹ Data availability statement: The data used in this study are openly available and can be provided upon request. The data have been taken from this source: World Development Indicators (2020), the World Bank publication. <http://data.worldbank.org/country>

model in regression (1). Both the test-statistics assume the null and alternative hypothesis as follows:

$$H_0 = \rho_{ij} = \rho_{ji} = 0 \text{ for } i \neq j \quad (\text{No cross-sectional dependence})$$

$$H_0 = \rho_{ij} = \rho_{ji} \text{ for some } i \neq j \quad (\text{Cross-sectional dependence})$$

After the cross-sectional dependence test, the cross-sectional augmented dickey fuller (CADF) test is used to analyse the stationarity of the variables. This method is from the family of second-generation panel unit root test and was proposed by Pesaran (2007). CADF allows cross-sectional dependence in the panel data variable and is applicable in both cases if $N > T$ and $T > N$. Pesaran extended the conventional augmented dickey fuller regression model as follows:

$$\Delta Y_{it} = \alpha_i + \beta_i Y_{it-1} + \delta_i \bar{Y}_{t-1} + \theta_i \Delta \bar{Y}_t + \varepsilon_{it}$$

In Equation (2), the standard ADF regression is extended by adding the one period lagged of the averages of all cross-sectional and its first difference. Therefore, the impact of cross-sectional dependence can be eliminated by using CADF regression in Equation (2). Instead, the Maddala and Wu (1999) (MW) test was also used for robustness of the unit root results. The MW test comes from the first generation of panel unit root test and performs poorly with cross-sectional dependence.

3.4. Cointegration test and pooled mean group (PMG) estimation

After identification of the order of integration or level of stationarity, we employed the cointegration approach proposed by Westerlund (2007). This test assumes the null hypothesis that variables are not cointegrated and suggests four different statistics to test panel cointegration. Furthermore, if the calculated test statistic value exceeds the critical value, the null hypothesis of “no cointegration” will be rejected and the alternative hypothesis of “cointegration” will be accepted.

In literature, the Generalized Method of Moments (GMM) is the most commonly used method for estimating dynamic panel regression (Arellano & Bover, 1995). However, we cannot apply the method of GMM, as the panel's time dimension is greater than the dimension of the cross-section. Reportedly, in the case of dynamic panel regression, GMM work well when the data has a large number of cross-sections (N) relative to the time period (T) stated by Roodman (2006). For larger T , like this study, the traditional procedure for estimation like fixed effects and GMM fails to produce consistent and correct estimates (Pesaran *et al.* 2001). Thus, the panel ARDL/PMG may be chosen since it can simultane-

ously estimate the short run and long run dynamics and can be used in mixed order of integration of variables i.e., $I(0)$ and $I(1)$. The PMG estimator holds the long run coefficient homogeneous across the panel while allowing the intercepts, short run coefficient and error correction term to vary.

Based on Pesaran, Shin and Smith (1999), we consider ARDL (1, 0) observed inflation in an Equation (1); and for the purpose specified pooled mean group (PMG), the model forms the following structure:

$$INF_{it} = \mu_i + \sigma_{it}INF_{it-1} + \delta_{it}UNE_{it} + \varepsilon_{it} \quad (3)$$

The corresponding re-parameterized of equation (3) is:

$$\Delta INF_{it} = \theta_i(INF_{it-1} - \varphi_{0i} - \varphi_{1i}UNE_{it}) + \sigma_i \Delta INF_{it} + \delta_i \Delta UNE_{it} + \varepsilon_{it} \quad (4)$$

In equation (4), $\theta_i = \frac{-1}{(1-\sigma_i)} \varphi_{0i} = \frac{\mu_i}{(1-\sigma_i)}$, $\varphi_{1i} = \frac{\delta_i}{(1-\sigma_i)}$

Further, finally equation (4) can be written in vector error correction version as follows:

$$\Delta INF_{it} = \theta_i \eta_{it-1} + \sigma_{it} \Delta INF_{it-1} + \delta_{it} \Delta UNE_{it} + \mu_i + \varepsilon_{it} \quad (5)$$

where INF is the inflation rate, UNE stands for unemployment rate, σ represent coefficient of the lagged dependent variable, δ is the coefficient of lagged independent variable and φ_{0i} allows for non-zero mean of the co-integration relationship between the variables. On the right-hand side of the equation η_{it-1} represents the error correction term and θ shows the error correction term coefficient which measures the speed of the adjustment towards the equilibrium in the long run. The subscript i and t represent country and time, respectively, whereas Δ stands for difference. The parameter μ and ε represent the fixed effects and error term, respectively. As per literature θ_i is expected to be negative and economic theory of inflation and unemployment also shows a trade-off between the two variables resulting its coefficient to be negative in the short run.

4. Results and discussion

4.1. Results of CD and panel unit root test

The empirical investigation initiated from a CD test as a pre-test prior to use the panel unit root test. This study applied Bruesch-Pagen (1980) LM and Pesaran's (2004) CD test and results are reported in Table 2. The results of the CD test in-

dicates that inflation and unemployment are dependent across the eight MENA countries. It can be seen that the CD test rejects the null hypothesis of cross-sectional independence by a value of 9.54 ($p=0.00$) and 9.78 ($p=0.00$) for inflation and lagged of inflation, respectively. Moreover, CD test does not reject the null hypothesis of no cross-sectional dependence in the case of unemployment rate. Furthermore, the Breusch-Pagan LM test rejects the null of no CD in all cases. These findings highlight the importance of CD test in panel unit root testing. Therefore, in addition to the first-generation panel unit root test, we used the second-generation panel unit test to effectively identify the level of integration in each panel variable.

Table 2: Results of CD test

Test	INF_{it}	INF_{it-1}	UNE_{it}
Pesaran CD	9.54* (0.000)	9.78* (0.000)	0.626 (0.531)
Breusch-Pagan LM	132.6* (0.000)	136.42* (0.000)	168.71* (0.000)

Note: CD test assumes under the null hypothesis of cross-sectional independence i.e., $N(0, 1)$. The bracket values are p-values and * indicates 1% significance level

Following the CD test, MW test and CADF panel unit root tests were applied. The former is from the family of the first-generation panel unit root tests developed by Maddala and Wu (1999) and the latter is from the family of the second-generation panel unit root tests developed by Pesaran (2007). Under the null hypothesis, both tests assume unit root, but the first does not account for the presence of CD in panel variables. The results of the tests are presented in Table 3.

Table 3: Panel unit root test analysis

Variable	Lag	Without trend specification		With trend specification	
		MW Test	CADF Test	MW Test	CADF Test
INF_{it}	0	164.91* (0.00)	-6.31* (0.00)*	137.49* (0.00)	-5.58* (0.00)
	1	84.19* (0.00)	-3.39* (0.00)*	69.02* (0.00)	-2.25** (0.01)
INF_{it-1}	0	157.22* (0.00)	-6.28* (0.00)	129.22* (0.00)	-5.23* (0.00)
	1	77.43* (0.00)	-3.03* (0.00)	59.57* (0.00)	-1.81** (0.03)
UNE_{it}	0	14.07 (0.74)	0.58 (0.71)	8.87 (0.96)	0.83 (0.79)
	1	23.78 (0.16)	-0.21 (0.42)	17.15 (0.51)	0.33 (0.63)
ΔINF_{it}	0	557.85* (0.00)	-13.41* (0.00)	447.61* (0.00)	-12.73* (0.00)
ΔINF_{it-1}	0	518.88* (0.00)	-13.35* (0.00)	444.73* (0.00)	-12.70* (0.00)
ΔUNE_{it}	0	142.51* (0.00)	-7.41* (0.00)	120.18* (0.00)	6.49* (0.00)

Note: Null for MW and CIPS tests assume that series is $I(1)$. MW tests assume cross-sectional independence while CADF test assumes cross-section dependence is in form of single unobserved common factor. The bracket values are p-values. The */** represent 1%, and 5% level of significance.

As displayed in Table 3, irrespective of the trend specification inflation rate, the lagged value of inflated rate is stationary at level. Both the test values are highly statistically significant and inflation rate and lagged value of inflation rate are integrated of zero order i.e., $I(0)$. However, the tests value for unemployment rate at level is neither significant at zero lag nor at first lag. This confirms that unemployment rate is non-stationary at level. After taking the first difference, the null hypothesis of a unit root is rejected, and the results suggest that unemployment rate is of integrated first order i.e., $I(1)$.

4.2. Results of Westerlund Panel co-integration test

After we established that variables are stationary at mix order i.e., $I(0)$ and $I(1)$, cointegration approach proposed by Westerlund (2007) was applied. This method is called error correction based cointegration method, which identifies four different test results reported in Table 4.

Table 4: Results of Westerlund panel co-integration test

Statistic	Value	Z-value	p-value
Gt	-3.080	-4.344*	0.000
Ga	-13.695	-3.595*	0.000
Pt	-10.085	-5.589*	0.000
Pa	-13.533	-6.000*	0.000

Note: All test statistics assume the null (H_0) hypothesis of no cointegration and alternative (H_1) hypothesis of co-integration. The first two tests are group mean statistics and the last two are the panel statistics. * Indicates one per level of significance.

It is evident from Table 4 that all the results are highly statistically significant. All the test statistic values are rejecting the null hypothesis of no cointegration and accept the existence of a long run relationship between inflation and unemployment rates for the selected MENA countries.

4.3. Pooled mean group estimation

The results from panel unit root tests show that variables are stationary at mix order of integration i.e., $I(0)$ and $I(1)$, and none of the variable is stationary at second order of integration. Therefore, for long run parameter estimation and short run dynamics, the PMG estimator was used. Table 5 shows short run and long run PMG results of inflation and unemployment rates for the group of panels, while Table 6 shows country-specific short run results for each country of the panel.

In the output of PMG estimator, the estimated coefficient of unemployment is statistically significant in the long run. As p-value of the coefficient is 0.04, this indicates the significance level at 5%. The outcome of long run analysis confirms a positive relationship between the two concerned variables of the model, which implies that inflation fails to reduce unemployment rate in the long run. However, in the short run, the relationship between inflation and unemployment is negative, but statistically insignificant at 5% significance level. This indicates that our results do not support a trade-off between inflation and unemployment in the selected panel of MENA countries. Comparing with previous research, our results contradict with the findings of Alper (2017) and Shaari et al. (2018) and Ribba (2020), while supporting the results of Puzan (2009) and Hye and Siddiqi (2010). Furthermore, it is also endorsed by Fabris (2018) that “There are no trade-offs between inflation and unemployment. There is no longer theoretical or empirical evidence nowadays to confirm the existence of a long-term trade-off between inflation and economic growth. Any potential use of trade-offs could only bring more uncertainty regarding inflation in the future.” Furthermore, in our regression results, the corresponding error correction term coefficient is of value -0.568, which is negative and significant. The negative and significant value of error correction term indicates that around 60% of disequilibrium is corrected within the period of one year.

Table 5: The PMG estimation of inflation and unemployment trade-off

Variables	Coefficient	Std. Error	z-value	p-value
Long run parameter estimates				
$UNE_{it}(\delta)$	0.260**	0.129	2.00	0.045
Short run parameter estimates				
ECT	-0.568*	0.074	-7.72	0.000
$\Delta UNE_{it}(\delta)$	-0.396	0.232	-1.70	0.088
Constant	0.620	0.507	1.22	0.222

Note: Δ represents first difference. The */ ** represents 1%, and 5% and level of significance.

Table 6 shows country-specific results for the short run dynamics and for the error correction term. Results show that the coefficient of the error correction term in each country case is negative and significant even at 1% level of significance. For each country, the negative and significant value of ECT indicates the long run relationship between the inflation and the unemployment. Furthermore, the value of ECT is relatively low for Algeria and high for Jordan, which gives indication of relatively low and high speed of adjustment towards the equilibrium, respectively. Furthermore, in country-specific panel regression, the coefficient of

unemployment is found to be positive and significant in Algeria while negative but insignificant in all other countries in the short run.

To summarize, results show no evidence of the trade-off between inflation and unemployment in selected MENA countries in the long run. Unemployment has a negative but insignificant impact on inflation rate in the short run, which indicates no trade-off between inflation and unemployment rates in the short run. Moreover, our results do not reflect significant trade-off between inflation and unemployment in the short run country specific analysis.

Table 6: Country-wise PMG estimation

Country	Variables	Coefficient	Std. Error	z-value	p-value
Short run coefficients					
Algeria	ECT	-0.271*	0.094	-2.88	0.004
	ΔUNE_t	0.880**	0.351	2.51	0.012
Egypt	ECT	-0.536*	0.153	-3.49	0.000
	ΔUNE_t	-0.901	0.897	-1.00	0.316
Jordan	ECT	-0.967*	0.177	-5.44	0.000
	ΔUNE_t	-0.992	0.562	-1.76	0.078
Kuwait	ECT	-0.688*	0.154	-4.47	0.000
	ΔUNE_t	-0.109	1.509	-0.07	0.942
Malta	ECT	-0.675*	0.208	-3.24	0.001
	ΔUNE_t	-0.318	0.507	-0.63	0.531
Morocco	ECT	-0.486*	0.143	-3.40	0.001
	ΔUNE_t	-0.479	0.534	-0.90	0.369
Saudi Arabia	ECT	-0.461*	0.161	-2.86	0.004
	ΔUNE_t	-1.168	1.232	-0.95	0.343
Tunisia	ECT	-0.460	0.136	-3.37	0.001
	ΔUNE_t	-0.083	0.1677	-0.50	0.620

Note: Δ represents first difference. The */**/ represents 1 % and 5% significance level.

5. Summary and conclusion

This study is an attempt to investigate empirically the validity of Phillips curve (trade-off) between inflation and unemployment rate in eight MENA countries (Algeria, Egypt, Jordan, Kuwait, Malta, Morocco, Saudi Arabia, and Tunisia) from 1991–2019. In the study cross-sectional dependency test, CADF second generation panel unit root test and Westerlund cointegration test were employed.

The results of Bruesch-Pagan LM test and Pesaran CD test indicated the cross-sectional dependence in the series. The study used MW and Pesaran's CADF panel unit root tests to determine the level of integration of the variables after confirming cross-sectional dependence in the variables of the model. Results indicated that inflation is integrated at zero order and unemployment is integrated at first order, irrespective of the constant and trend specifications in the regression model and the panel unit root test showed mix order of integration. Furthermore, ARDL and PMG estimators were employed to verify the trade-off between inflation and unemployment both in short run and long run.

The PMG estimates confirmed a significant positive relationship between inflation and unemployment in the long run, while negative but insignificant association in the short run for the selected MENA countries. This implies that inflation does not increase with decrease in unemployment rate in the long run as well as in the short run, rather these variables move in the same direction over time. In addition, results for short run dynamics and error correction terms are provided in a country-specific analysis and the error correction coefficient is significant in all the cases, but no significant trade-off between inflation and unemployment was found in the analysis. Results of the study are in line with the findings of Fabris (2018) and Leightner (2020) that there is no trade-off between inflation and unemployment rates.

The study recommends that the governments of MENA countries concentrate on primary issues such as leadership styles, business segment, export of marketable goods and bilateral agreements among domestic organisations of public or private interest. Such policies are similar to those among global gatherings and organisations alongside legislative key plans that have embraced their role in supporting the prosperity of local businesses and family income. Likewise, this study recommends the implementation of strategies that improve satisfactory economic situation by ensuring price stability and generate employment opportunities in order to boost social welfare in the region. It is also endorsed by Ali (2011) that inflation expectations have a prodigious effect on inflation; therefore, the monetary authorities should focus on affixing inflation expectation, which necessitate precise measurements of inflation expectations using the prudent approach. Moreover, it is necessary to control the increasing budget deficit to confirm the offensiveness of the monetary policy needed for price stabilization.

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