The Role of Consumer Prices, Economic Growth and Rising Population in Determining Unemployment: A Time Series Evidence from Cyprus Economy

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Abstract
Addressing an important and imperative macroeconomic issue like unemployment always remains among the top priorities of all the policy makers in almost every economy of the world. Increasing unemployment reflects the slowdown or downturn of the economy. Therefore, it is important to explore the factors which may influence unemployment in any economy. This study is aimed at investigating the role of CP- consumer prices, EG- economic growth and TP- total population on unemployment in Cyprus. After considering sample period from 1977 to 2022, the estimates of ARDL bounds test uncover the significant and positive impact of CP and TP on unemployment while EG leaves significantly inverse impact on unemployment. The study confirms presence of positive sloped Phillips curve while it also confirms presence of Okun's law in Cyprus economy. Based on these findings, this study suggests that EG should be accelerated to condense level of unemployment but CP and TP should be controlled to stop increasing unemployment.
Keywords: Unemployment, Consumer Prices, Economic Growth, ARDL

1. Introduction

Unemployment is among the main stream macroeconomic challenges that shows unavailability of demand for working class by the employers irrespective their willingness to do a job. Unemployment is a situation which enhance unrest and motivates the unemployed people to commit anything wrong to do to arrange resources for meeting their needs. The status of the action performed by the unemployed person whether it is morally acceptable by the society or not does not matter to him or her. As his or her need carries more significance.

The study is conducted to investigate the factors like CP, EG and TP which are influencing level of unemployment in Cyprus. The relationship between CP and unemployment will be helpful to see whether Phillips curve phenomenon is relevant or not. Besides this, per capita income or economic growth when it will be linked with unemployment will facilitate us to see whether Okun's law stands true for the selected country. Lastly, rising population leads to high unemployment or not will also be the objective of this study to inquire. In order to estimate empirical results, we will consider bounds testing approach for the sample period from 1977 to 2022. The literature suggests that as unemployment gap increases it reduces inflation gap this inculcates the idea of Phillips curve or in simple words unemployment and inflation have inverse relation with each other. In our case we have taken CP on the right hand side and unemployment on the left hand side to inspect this proposition whether both are inversely linked or not. If these are positively linked these will confirm the presence of stagflation or positively slopped Phillips curve. The literature further suggests that when unemployment gap increases it also reduces output gap hence it leads to inverse relationship between both. In our study the per capita income or economic growth is taken on the right hand side while unemployment has taken on the right hand side for inquiring the validity of Okun's law.

After explaining the how the equation is developed in our study for obtaining empirical results, now we will try to share some facts that how these factors are behaving in Cyprus economy. Unemployment is witnessed to be highest during 2010-2019 which is around 11.44 percent. Similarly the index value of consumer prices is 106.44 during 2020-2022. The per capita GDP is also witnessed as high during the period from 2020-2022 which is 25414.70 in constant local currency units. Lastly, total population is seen highest during the similar period as consumer prices and per capita income. It is 1244404.33. The conclusion is that consumer prices, per capita income and total population are following an increasing trend while unemployment is showing mixed trends. The same may be observed from the following Table-A:

Table-A: Trends of the Averages of Unemployment and its Factors

Years	Unemployment Rate	Consumer Price Index	Per Capita GDP	Total Population
1977-1979	2.0667	26.8813	8470.5091	664000.0000
1980-1989	2.4600	43.2819	11657.8768	726401.4000
1990-1999	2.3400	65.2375	16922.5739	855462.9000
2000-2009	3.5930	87.6470	22532.2672	1028403.2000
2010-2019	11.4410	102.5866	22603.1129	1181664.2000
2020-2022	6.8967	106.4377	25414.6979	1244404.3333

Source: Author Calculations based on World Bank (2023) Data

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The rest of the study is organized by discussing literature review in the next section-2, in the section-3; data source, model and methodology will be discussed. Results and their interpretation will be presented in section-4. The last section-5 will highlight conclusion and policy implication.

2. Literature Review

This section will provide discussion about the studies made by various scholars on a similar content. We initiate the discussion from the contribution of Maqbool et al. (2013), we found that both economic growth and consumer prices were significantly controlling unemployment while population was significantly enhancing unemployment in case of Pakistan. Besides them, Arslan and Zaman (2014) reported similar results for Pakistan as Maqbool et al. (2013) reported in their study. According to Cheema and Atta (2014) unemployment responded significantly with a positive coefficient to output gap by concluding that output gap was responsible for giving boost to unemployment in Pakistan. The significantly negative effects of economic growth on unemployment were witnessed for Bahrain by Alrayes and Wadi (2018). In a new study, we find Lima and Marques (2019) who considered the case of Brazil and applied ARDL bounds testing approach to conclude the negative and significant effects of output and consumer prices on unemployment.

In another research, Ali et al. (2021) found negative and significant effects of economic growth and inflation on unemployment while they also found positive and significant effects of population on unemployment in the long run in Zanzibar. After Ali et al. (2021), the negative and significant effects of GDP on unemployment were disclosed by Ajmair and Bi (2021) for a country like Pakistan. The consumer prices left significantly positive impact on unemployment in model 3 of state 1 while the similar results were witnessed in model 2 of state 2 in case of South African economy [Buthelezi (2023)]. The significantly negative impact of economic growth on unemployment was found by Aleksandraviciene et al. (2023) for Lithuanian economy. In another study, we find Borhan et al. (2023) who disclosed positive slopped Phillips curve in the long run while they reported presence of Okun's law in the short run in case of Malaysia. Yasser et al. (2023) disclosed significantly negative impact of inflation on unemployment in case of UK while for Norway economy they reported insignificantly positive impact of inflation on unemployment.

In another research Abid et al. (2023) highlighted significantly negative impact of positive and negative changes in GDP gap on unemployment gap in the long run in case of Algerian economy. Saani et al. (2023) considered a case of Ghana and provided evidence of positive coefficient of inflation in targeting unemployment in case of females and in case of pooled or joint data for long run span. In a new study, Gomez and Irewole (2023) considered the role of inflation, economic growth and population on unemployment for the selected African economies. They found that both population and economic growth were increasing unemployment while inflation was reducing unemployment in the long run in the selected sample countries. Irushad et al. (2023) examined the role of inflation, economic growth and total population on unemployment for Maldives. They considered ARDL methodology and provided an evidence of negative and significant effects of economic growth and inflation on unemployment while total population was found to have significantly increasing effects on unemployment. After this discussion, the data source and methodology will be presented in the next part of the study.

3. Data Source and Methodology

3.1. Data Source

The data of the selected variables is collected from World Bank (2023), World Development Indicators. The annual data series is collected in constant local currency units and sample period ranges from 1977 to 2022. The variables are unemployment; consumer price index, per capita gross domestic product and total population.

3.2. Function of the Study:

$$\ln Unemp_t = f(\ln Prices_t; \ln GDPPC_t; \ln Popula_t)$$

Variables	Full Form	Construction
$\ln Unemp_t$	Natural Log of Unemployed Workers as share of Total Labor Force	$\ln[Unemplo\,yment]$
$\ln Prices_t$	Natural Log of Consumer Price Index	$\ln[CPI]$
$\ln GDPPC_t$	Natural Log of Gross Domestic Product as share of Total Population	$\ln[\dfrac{GDP}{Total\ Population}]$
$\ln Popula_t$	Natural Log of Total Population	$\ln[Total\ Population]$

3.3. Methodology

This study has collected data on a regular frequency from 1977 to 2022 therefore, we will provide basic statistics and variance inflation factor matrix in the beginning of our estimation process. In the next step, we will calculate presence or absence of unit root in the data series by considering KPSS (1990) unit root test. Afterwards, we will be considering ARDL bounds testing approach presented by Pesaran et al. (2001) to inspect long run cointegrating relation between unemployment and its

determinants. In the last step, the impact of consumer prices, gross domestic product and total population on unemployment will be inquired for the selected ARDL model for Cyprus economy.

Later, it will be examined whether stability graphs like CUSUM and CUSUM square remain inside their respective critical values or not? The stability of mean and variance of the error term will be confirmed if both above suggested graphs remain inside their respective critical values. This will further confirm that the estimated coefficients are not structurally instable over the sample selected in the study. Besides CUSUM and CUSUM square graphs, we also test the other diagnostic as well.

4. Results and Discussion

In this section, the empirical results will be estimated and their discussion will be presented. The section starts from the results of variance inflation factor which may help us to conclude about the presence or absence of multicollinearity issue. The results are reported in the below Table 1:

Table 1: Matrix of Variance Inflation Factor

Variables	$lnPrices_t$	$lnGDPPC_t$	$lnPopula_t$
$lnPrices_t$	-	1.1202	1.0095
$lnGDPPC_t$		-	1.0040
$lnPopula_t$			-

The above Table 1 shows the magnitude of variance inflation factors among the independent variables that we have obtained by using the formula $[1/1 - r^2]$ for our study. The small "r" represents coefficient of correlation which is used to find out strength of correlation between two variables. The results reveal that the values of VIF for all the explanatory variables are found to be less than 10. This confirms that the explanatory variables are insignificantly correlated hence these do not provide any evidence of multicollinearity. After this, we are going to report the results for unit root test in following Table:

Table 2: Unit Root

at Zero Difference			at First Difference		
Variables	LM-Stats	Decision	Variables	LM-Stats	Decision
$lnUnemp_t$	1.7268	Non-Stationary	$\Delta lnUnemp_t$	0.1068	Stationary
$lnPrices_t$	0.6102	Stationary	$\Delta lnPrices_t$	0.5046	Stationary
$lnGDPPC_t$	0.8078	Non-Stationary	$\Delta lnGDPPC_t$	0.4201	Stationary
$lnPopula_t$	0.7613	Non-Stationary	$\Delta lnPopula_t$	0.3142	Stationary
Note: The KPSS (1992) asymptotic critical values are 0.739 at 1%, 0.463 at 5% and 0.347 at 10% percent levels of significance.					

The study applies KPSS unit root test for inspecting the stationarity of the data and results have been reported in the above provided Table 2. The calculated values of LM-stats for unemployment (1.7268 > 0.739); per capita GDP (0.8078 > 0.739) and population (0.7613 > 0.739) are found to be greater than their corresponding critical values at 1 percent significance level at zero difference. Therefore, it is concluded that all these stated variables are nonstationary at zero difference. However, the LM-stat for domestic prices (0.6102 < 0.739) is witnessed less than its critical value. This confirms that domestic prices is stationary variable at zero difference. All these variables when tested at first difference confirm that these are stationary at first difference because their calculated values using KPSS unit root test are less than the one percent critical value. Based on these results, we conclude that our study reports mixed order of integration. After coming to know about the order of integration of our study; now we utilize ARDL bounds test for obtaining long run cointegrating relation between unemployment and its determinants. The results are provided in the Table 3 which is presented as below:

From the above provided Table 3, we may see that the F-test = 13.9132 which is greater than the 5 percent upper critical bound = 4.7534 and the W-stat = 55.6528 which is also greater than the 5 percent upper critical bound = 19.0134. This confirms presence of long run cointegrating relation between unemployment and its factors considered in this study. As far as the post diagnostic tests are concerned; the probability values of all the post diagnostic tests like serial correlation, functional form, normality and heteroskedasticity tests allow us to accept their null hypotheses respectively. These conclude that there is absence of serial correlation, functional form is well or correctly specified, error term follows normal distribution and variance of error term is not heteroskedastic. Based on these findings, now we compute and report long and short run coefficients for the selected ARDL model in the Table 4 and Table 5 respectively. These results are presented stepwise as below:

Table 3: ARDL Cointegration Approach

Estimated Model	$\ln\text{Unemp}_t = f(\ln\text{Prices}_t; \ln\text{GDPPC}_t; \ln\text{Popula}_t)$			
Optimal lags	(1 , 0 , 0 , 0)			
F – statistics	13.9132**			
W – statistics	55.6528**			
Significance Level	*Critical Bounds For F – Statistics*		*Critical Bounds For W – Statistics*	
5 percent	3.4964	4.7534	13.9857	19.0134
10 percent	2.8843	3.9880	11.5372	15.9518
DIAGNOSTIC TESTS				
Serial Correlation	0.4107 [0.522]		*Normality*	2.5953 [0.273]
Functional Form	0.6773 [0.411]		*Heteroscedasticity*	1.3352 [0.248]

Note: "**" represents significance level at 5 percent while "*" shows significance level at 10 percent. The values presented in the square brackets are the Probability Values.

Table 4: Long run Coefficients

Dependent Variable: $\ln\text{Unemp}_t$				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
$\ln\text{Prices}_t$	0.3970	0.0704	5.6405	0.0000
$\ln\text{GDPPC}_t$	-0.5685	0.0577	-9.8513	0.0000
$\ln\text{Popula}_t$	0.3890	0.0750	5.1898	0.0000
C	-1.3422	1.0408	-1.2896	0.2044

The long run coefficients disclose that consumer prices and total population have positive and significant impact on unemployment. One percent increase in consumer prices will escalate unemployment by 0.3970 percent while one percent increase in total population will accelerate unemployment by 0.3890 percent. The results further reveal that increase in domestic production is helpful in enhancing employment opportunities and hence lead to reduce unemployment. One percent increase in per capita GDP will significantly reduce unemployment by 0.5685 percent. The inverse relationship between GDP and unemployment confirms validity of Okun's law in Cyprus economy. While positive sloped Phillips curve or stagflation also stands valid as can be witnessed from the positive coefficient of domestic or consumer prices factor. The positive coefficient of consumer prices is supported by Borhan et al. (2023) and Saani et al. (2023) while the negative impact of economic growth was endorsed by Aleksandraviciene et al. (2023); Ali et al. (2021), Ajmair and Bi (2021) and Lima and Marques (2019). Lastly, the positive coefficient of population was validated by Gomez and Irewole (2023) and Irushad et al. (2023). After discussing the long-run coefficients, now we would like to highlight short run coefficients based on error correction representation and results are provided in the following Table 5:

**Table 5: Error Correction Representation for the selected ARDL Model**

Dependent Variable: $\Delta\ln\text{Unemp}_t$				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
$\Delta\ln\text{Prices}_t$	0.2468	0.0327	7.5498	0.0000
$\Delta\ln\text{GDPPC}_t$	-0.3534	0.0413	-8.5603	0.0000
$\Delta\ln\text{Popula}_t$	0.2418	0.0682	3.5473	0.0010
ecm_{t-1}	-0.6217	0.0760	-8.1821	0.0000
Diagnostics				
Adjusted R – Square			0.7419	
F – Test (Probability Value)			33.3451 (0.000)	
DW – Test			1.7784	

The above Table 5 sheds light upon the impact of prices, per capita GDP and total population on unemployment in the short run. The results disclose similar results as the study has reported for long run span. Both domestic prices and total population

significantly uplift unemployment while per capita GDP is significantly controlling unemployment. One percent increase in domestic prices enhance unemployment by 0.2468 percent, while due to one percent increase in total population, unemployment increases by 0.2418 percent and the one percent increase in per capita GDP diminishes unemployment by 0.3534 percent respectively. The conclusion based on short run coefficients are similar to the conclusion which are made on the basis of long run coefficients.

After that, it is also found that the coefficient of the ECT-error correction term is negative and significant, which validates the presence of convergence hypothesis. The coefficient of the ECT is −0.6217; this indicates that the imbalance resulting from any macroeconomic shock will be removed by 62.17 percent in each year. So, we will be able to achieve a stable, long-term equilibrium after approximately 1.61 years. The estimated coefficients of this study whether carry any structural instability or not will be witnessed through the CUSUM and CUSUM square graphs. The Figure 1 presented as below is uncovering the discussion about stability of the estimated coefficients.

Figure 1: CUSUM and CUSUM Square Graphs
CUSUM Graph
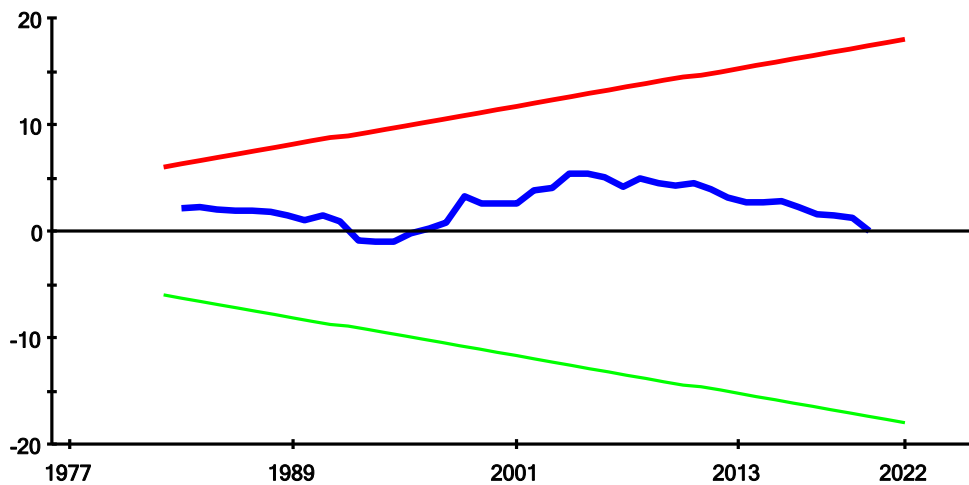
CUSUM Square Graph
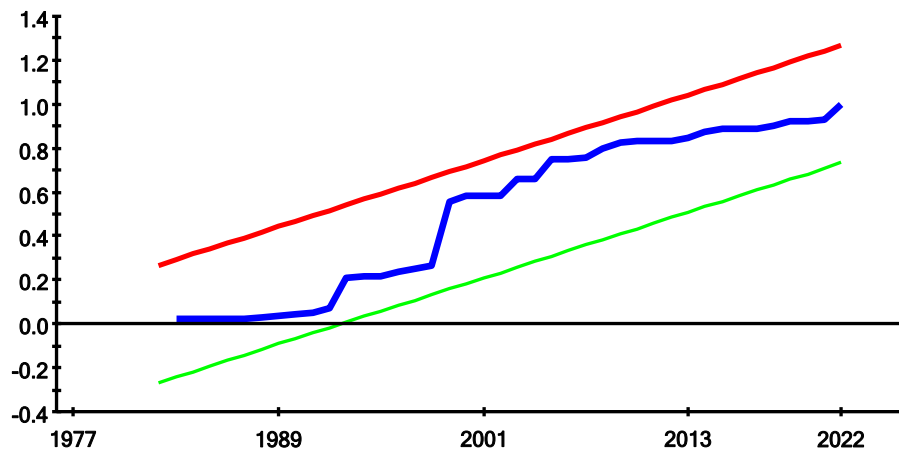
These graphs will suggest the stability or instability of mean and variance of error term of the proposed model of this study. If the calculated mean and variance of error term remains within their critical bounds then we will conclude that both mean and variance of error term are stable therefore, the estimated coefficients are structurally stable and there is no evidence of structural break in the study. The above presented graphs confirm the stability of mean and variance of error term of the proposed model of

the study. Hence we conclude that the estimated coefficients are structurally stable. There is absence of structural instability in this study.

5. Conclusion

In this research we have tested the impact of consumer prices, economic growth and total population on unemployment for Cyprus economy. This study takes into account ARDL bounds testing approach for a time series data from 1977 to 2022 and provides an evidence of positively slopped Phillips curve. The findings further confirm the presence of Okun's Law in Cyprus. Finally it is also found that the increasing size of population is elevating level of unemployment. According to the currently found results, this study suggests level of production must be enhanced while level of prices and size of increasing population must be controlled in order to condense level of unemployment in Cyprus.

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