Factors affecting the rate of unemployment in G7 countries

Abstract. This paper aims to investigate the effect of the four key macroeconomics factors to the unemployment rate in G7 countries by using a dynamic random-effects model with a panel data and the annually aggregate data within G7 countries are collected from the OECD dataset from 1970 to 2008. Four estimators are applied to analysis the panel data and we found that the change in the GDP per capita and the long-term interest rate had a significant positive effect to the unemployment rate, but the population growth rate and the inflation rate are significantly negative. The results about GDP per capita against the Okun's law is affected by the omitted variable biased which could influence the unemployment rate and correlate with the existing regressors. Those omitted variables are not included in this model for simplicity while it leads to a biased estimation result. A better estimation result might gain if more relevant variables were included.

Keywords. The unemployment rate, Okun's law, GDP, Phillips curve, G7

1. Introduction

According to OECD (2019), the definition of the unemployment rate is the percentage of the number of unemployed people in the total number of the labour force. This indicator could directly measure the social phenomenon (Jaradat, 2012) and affect global countries as an important macroeconomic issue (Alamoudi, 2017). An increase in the unemployment rate could lead to the loss of individual income, business output and national gross domestic product (GDP) to have huge social and economic impacts (Savulea, 2008). Many countries viewed the low unemployment rate as one of the main targets within the economy (Alamoudi, 2017).

This paper aims to examine the influence of the key macroeconomics factors to the unemployment rate. The panel data was collected in the G7 countries, included Canada, France, Germany, Italy, Japan, the United States and the United Kingdom. Those industrialized countries facing different unemployment rate. According to the OECD data, at the end of the examined period, the unemployment rate in Italy had reached as high as 10%, following by 8.4% in France, 5.7% in Canada, 3.7% in the United Kingdom, 3.7% in the United States, 3.1% in Germany and 2.4% in Japan.

There are many previous studies about the effect of variables on the unemployment rate, especially which factor plays a significant role. Based on the existing debates, this section of the literature review will focus on the comparison among macroeconomics variables and the correlation between macroeconomics variables and explained variables.

Majority of explanatory variables have found a significant effect on unemployment rate with many reasons. Especially the influence of the output level on the unemployment rate, which is consistent with the results of Okun's law (1962), which provides the knowledge foundation for the empirical understanding of model and results(Daniel, Gabriela, and Aurora,2018). For example, Yashiv (2000) had employed a simulation analysis to the Israel context, they concluded that the GDP and the interest rate have a significant effect to the unemployment; while in the research of Naudé and Serumaga-Zake (2001), South Africa is under-examined by employing a standard regression, they had stated that the education factor and gender are the important determinants. Valadkhani (2003) had concluded that inflation in Iran significantly influences the unemployment rate. Frenkel and Ros (2006) proved the significant effect of the real exchange rate to unemployment in four Latin American countries by employing a panel technique.

Although those variables were indicated to have a significant effect on the unemployment rate, based on the research of factors affecting the rate of unemployment in GCC countries by Alamoudi (2017), this paper only selects the gross domestic output, the interest rate (long term), the inflation rate and the population growth rate as the explanatory variables in the regression model to satisfy the restriction of data collection and to maintain the degree of freedom in the model. The structure of this paper is as follows: Section 2 explains econometrics methodology, Section 3 discusses the main finding, Section 4 concludes.

2. Econometrics framework.

2.1 Data

This paper uses panel data which use countries as the units of observation. The annual data of four explanatory variables and the unemployment rate were collected from OECD websites and covered from 1970 to 2019 within 7 countries: Canada (CAN),

France (FRA), Germany (DEU), Italy (ITA), Japan (JPN), United States (USA) and United Kingdom (GBR). All the variables are defined in real values.

This panel data is a long and unbalanced panel with the reasons of T>N and missing values for some individuals superlatively. We drop the missing data in this unbalanced panel with sample selection to fix the problem of missing data by data-cleaning. For getting the best, unbiased, consistent and efficient estimator, the dataset should satisfy some properties. Firstly, the regression is the linear function. The sample data also should be independent and identically distributed. There is no multi-collinearity between regressors. Besides, the mean of error term which equals to zero is independent on the regressors. Moreover, there is no correlation among the error terms and regression is homoskedasticity. To estimate the effect of variables on the unemployment rate we also assume that the function follows a linear form the following:

$$Unemp = F(pop\_agrwth, ltint, cpi\_agrwth, lngdpcpa) \quad (1)$$

Where:

Unem=unemployment as a percentage of the total labour force
Pop_agrwth=the annual growth rate of population
Ltint=long term interest rate
Cpi_agrwth= consumer price index annual growth rate which is called inflation
Lngdpcpa=logarithm of Gross domestic product per capita

2.2 Variables description

(a) Unemployment rate

The unemployment rate is the proportion of the labour force that is not currently employed but seeking jobs. It is also an important lagging indicator, which is sensitive to economic conditions. The labour forces the number of people that have abilities to produce the good or provide the service at the age between 15 and 65, which is the sum of employed and unemployed.

(b) population growth rate

The population is the total number of people or inhabitants in a country or a region. The calculation using the difference of population between year(t) and (t-1) divides the population in (t-1) and expressed by percentage.

(c) long-term interest rate

Long-term interest rates are government bonds that are maturing in ten years, which is varying in countries. The interest rate has a high correlation with the financial market by investment. Thus, it is also a major contributor to economic growth.

(d) CPI growth rate

The Consumer Price Index is a measure that examines the weighted average of prices of a basket of consumer goods and services. CPI is also an indicator to measure the living standard. Inflation can be used to measure the purchasing power of the currency. In our research, the inflation rate is based on the CPI growth rate, which also can be calculated by other indexes.

(e) GDP per capita

GDP per capita is the gross domestic production divided by population. GDP is the total monetary or market value of all the finished goods and services produced within a country in a specific period. It is a direct and necessary signal to analyse the economic condition.

2.3 methodology

In this paper, we decided to apply the panel data technique, four types of panel estimators have applied. A pooled Ordinary Least Square (OLS) regression, the first difference estimator, the fixed effects estimator and the random effects estimator. Then, due to the consideration the countries' unobservable individual effects, we estimate the following model with first differenced, fixed effect and the random effects.

Firstly, we ignored the unobserved heterogeneity or individual effects that may exist to construct the first pooled model as the following:

$$Unemp\ t=\beta0+\beta1(pop\_agrwth\ t)+\beta2(ltint\ t)+\beta3(cpi\_agrwth\ t)+\beta4(lngdpcpa\ t)+et \quad (2)$$

Then we consider applying First difference to eliminate the individual effect or unobserved heterogeneity effect if the equation (2) is a model with fixed effect. Equation (5) is generated by equation (3) - equation (4) as the following:

$$Unemp\ it=\beta0+\beta1(pop\_agrwth\ it)+\beta2(ltint\ it)+\beta3(cpi\_agrwth\ it)+\beta4(lngdpcpa\ it)+eit \quad (3)$$

$$Unemp\ it-1=\beta0+\beta1(pop\_agrwth\ it-1)+\beta2(ltint\ it-1)+\beta3(cpi\_agrwth\ it-)+\beta4(lngdpcpa\ it-1)+eit-1 \quad (4)$$

$$\Delta Unemp\ it=\beta1\Delta(pop\_agrwth\ it)+\beta2\Delta(ltint\ it)+\beta3\Delta(cpi\_agrwth\ it)+\beta4\Delta(\ lngdpcpa\ it)+\Delta eit \quad (5)$$

Moreover, the unobserved heterogeneity effect combines with the equation (2) to express the linear model as follows:

$$Unemp\ it=\beta0+\beta1(pop\_agrwth\ it)+\beta2(ltint\ it)+\beta3(cpi\_agrwth\ it)+\beta4(lngdpcpa\ it)+uit \quad (6)$$

Where:

β0=constant term
αit=unobserved heterogeneity
uit= αit+eit

The difference between fixed effect and the random effect is determined by unobserved heterogeneity which could be tested by WU-Hausman test. To decide whether to use the random effect model or fixed effect model, we used the Wu-Hausman test to check whether there is a significant correlation exist between the existing regressors and the individual effect. If there is no significant correlation exist, eliminating all the individual effect in the fixed model would lose all the time-invariant effect. Although both estimators are consistent, the random effect estimator is more efficient than the fixed effect estimator.

2.4 Summary statistics

The following table 1 shows the descriptive statistics of each variable about the overall, between, and within variation.

Table 1 Summary Statistics

```
. xtsum unemp pop_agrwth ltint cpi_agrwth lngdpcap
```

Variable		Mean	Std. Dev.	Min	Max	Observations
unemp	overall	6.63269	2.500097	.4315552	12.6798	N = 233
	between		2.060753	3.753889	9.604802	n = 7
	within		1.841219	1.305918	12.04204	T-bar = 33.2857
pop_ag~h	overall	.5976575	.503537	-1.836	1.8103	N = 233
	between		.4034445	.09932	1.123257	n = 7
	within		.2755998	-1.366561	1.475653	T-bar = 33.2857
ltint	overall	5.103896	3.13781	-.06625	14.98917	N = 233
	between		1.871546	2.124161	6.954432	n = 7
	within		2.616695	-.5987781	13.13863	T-bar = 33.2857
cpi_ag~h	overall	2.750603	2.563503	-1.352837	13.5492	N = 233
	between		1.31994	.533849	4.042555	n = 7
	within		2.231608	-1.647498	12.25725	T-bar = 33.2857
lngdpcap	overall	10.12204	.6199983	8.303459	11.04855	N = 233
	between		.2650226	9.867475	10.5041	n = 7
	within		.5747882	8.558024	11.15973	T-bar = 33.2857

The first variable is the unemployment rate which average value is nearly 6.63%. the minimum value overall is around 0.43%, and the maximum value is 12.68%. Besides,

the standard deviation is 2.5. The second variable is the population growth rate. the average value is nearly 0.5977%. Besides, the lowest rate is -1.836% and the highest is 1.81%. the standard deviation is around 0.50.

Additionally, the average on the long-term interest rate is about 5.1%. The minimum rate is -0.066% and the maximum rate is around 14.99%. The standard deviation is more than 3.1. The average inflation rate based on the consumer price index is approximately 2.75%. The highest rate is nearly 13.5% and the lowest is around -1.35%. The standard deviation is more than 2.5.

Furthermore, for the fifth variable, the average value on the log GDP per capita is around 10.122. The minimum level is 8.303 and the maximum value is approximate 11.05. The standard deviation is about 0.62. Besides, between variation performance, the variables across the groups and within variation describe the variables overtime in the given group. As there is no variable equal to zero in between and within variation, all variables are time and group varying regressors.

2.5 statistical test

To provide a valid estimation result, a stationarity test should be performed on the model to verify whether there is a unit root exist. The reason why we should test unit root first is that the existence of unit root in the time series will lead to spurious regression which is that there is no cointegration relationship between a set of non-stationary time series, but the regression model also can be constructed. Spurious regression cannot explain the relationship between the unemployment rate and determinants. Moreover, because of the unbalanced panel data, we used the Fisher-type test (Choi 2011) with the first difference to investigate the stationary level of variables. The null hypothesis is that all the panels contain a unit root. The alternative one assumes that at least one panel is stationary. The results are presented in Table 2.

Table 2 Unit Root Test

	Unemp	Pop_agrwth	ltint	Cpi_agrwth	Lngdpcap
test statistics	1.9758	2.1843	1.2816	2.8556	5.9529
p-value	0.0241	0.0145	0.1	0.0021	0

Note: the given values are statistics in the test, and values in the second line are the P-values. Additionally, we use 10% significant level.

There is no statistically significant unit root exist in the panel data, the null hypothesis is rejected as the P-values are smaller than the critical value at a 10% significance level.

3. Empirical results

Table 3 present the empirical results estimated by equation (2), equation (5) and equation (6) about Pooled OLS, panel data model with fixed effect or random effect and the first difference method.

Table 3 pooled and panel data model estimated results

	Pooled Model	First Difference	Fixed Effect Model	Random Effect Model
constant(β0)	-16.9541	0.251	-8.562	-8.769
	(4.007)	(0.099)	(3.254)	(3.326)
Pop_agrwth	0.3745		-0.891	-0.819
	(0.344)		(0.416)	(0.409)
Pop_agrwth.D1		-0.089		
		(0.198)		
ltint	0.4506		0.351	0.356
	(0.0854)		(0.068)	(0.068)
ltint.D1		-0.022		
		(0.071)		
Cpi_agrwth	-0.1329		-0.178	-0.175
	(0.0945)		(0.073)	(0.073)
Cpi_agrwth.D1		-0.157		
		-0.023		
Lngdpcap	2.117)		1.425	1.456
	(0.3719)		(0.297)	(0.296)
Lngdpcap.D1		-5.887		
		(2.397)		
R2	0.1843	0.1570	0.0823	0.0922
Heterogeneity test (FE)			P-value =0	
BP test (RE)				P-value =0
Hausman test			P-value =0.3975	

pooled OLS

In the pooled OLS regression, the panel structure in the dataset was ignored and treated as a cross-sectional one. The limitation of using this model is the unobservable individual effects are out of control, which means the countries' heterogeneity is ignored. However, those countries' specific characteristics might have a significant influence on the estimated parameters, consequently leading to biased estimation. The regression result can be expressed as:

Unemp = -16.9541 +0.3745(pop_agrwth)+0.4506(ltint)-0.1329(cpi_agrwth)+2.117(lngdpcap) (7)

（4） (0.344) (0.0854). (0.0945) (0.3719)

We can see that GDP per capita has the largest effect on Unemployment among these independent variables. If the GDP per capita increase by 1%, the unemployment rate will increase by about 2.12%. Other positive determinants are long term interest rate and population growth rate. An increase in the long term by 1% will lead to an increase in the unemployment rate by around 0.45%. The coefficient of the population growth rate is 0.3745, which means that the unemployment rate will decline by approximately 0.37% when the population growth rate rises by 1%.

However, the inflation rate has a negative correlation with unemployment. When the inflation rate increase by 1%, the unemployment rate will go down by 0.133%. The P values under long term interest rate and log of GDP per capita are smaller than critical value 0.05 at 95% significance level, indicating these two independent variables have the significant impact on the unemployment rate. However, the population growth rate and inflation rate does not have a significant influence on unemployment as the P-value is too large.

First difference estimator

Moreover, the first difference estimator which transforms the origin model by taking the first difference to eliminate the effect of heterogeneity. The results are a little bit different from the previous model. The change in values has a negative impact on the changes in the unemployment rate. The changes in GDP per capita growth is still having the largest impact on unemployment, but it is not positive anymore. When the changes in GDP per capita growth increase by 1%. The unemployment rate changes will decrease by 5.89%. As the P-values are smaller than 0.05 significant level, the effect of changes in inflation rate and GDP per capita growth rate on unemployment rate changing is indeed significant.

To compare with GDP per capita, the coefficient of the lag of inflation is smaller. When the lag of inflation rate increase by 1%, the changes in unemployment will decrease by around 0.16%. The changes in population growth rate and long-term interest rate have little influence on unemployment rate changes. Besides, the p-values are larger than the critical value 0.05, which implies the impact of changes in these two variables does not affect the changes in the unemployment rate significantly. Moreover, the first

differencing induced serial correlation in the Δeit, the FD model is inefficient. Therefore, we decided not to use FD estimator in examining this topic.

Fixed effect estimator

In the Fixed Effect model**,** the population growth rate and inflation rate still have a negative relation with the unemployment rate, which is the same as the Pooled OLS model, but the value is different. when the population growth rate increase by 1%, the unemployment rate will fall by around 0.89%. besides, an increase in inflation by 1% will lead to a decreasing in unemployment by 0.178%.

Besides, the coefficient of GDP per capita change to 1.4248. when GDP per capita increase by 1%, the unemployment rate will go up by approximately 1.42%. moreover, long term interest rate has the smallest impact on unemployment. An increase in long term interest rate by 1% will cause the unemployment rate to rise by 0.35%. As P-values are all smaller than critical value 0.05 at 95% significance level. The effects of determinants on unemployment are statistically significant.

Random effect estimator

The result of the random effect model in table 3 show that the regression can be expressed below and values in parentheses are standard error of coefficient:

$$Unemp = -8.7692 - 0.8196 pop\_agrwth + 0.3557 ltint - 0.175 cpi\_agrwth + 1.4562 lngdp\ cap \quad (8)$$

$$(3.326)\quad (0.4095)\quad (0.0678)\quad (0.07272)\quad (0.2963)$$

GDP per capita is still the largest contributor to unemployment compared to the other explanatory variables. An increase in GDP per capita by 1 percentage will cause a decreasing in the unemployment rate by around 1.456%. The coefficient of the long-term interest rate is 0.356, which means that when the long-term interest rate increase by 1%, the unemployment rate will rise by approximately 0.36%. The coefficient of population growth rate is -0.8196, which implies an increase in population growth rate by 1 percentage will lead to the lower unemployment rate by around 0.82%. And the other variable that moves in the opposite direction to the unemployment rate is the inflation rate. When the inflation rate increase by 1%, the unemployment rate will fall by 0.17%. Besides, as all the P-values are smaller than the 5% significant level, these factors have a significant impact on the unemployment rate.

4. model selection

4.1 Heterogeneity test

If there is no heterogeneity observed, the POLS estimator would be the most efficient. To compare the efficiency between estimators, we test the existence of unobservable heterogeneity by Brenuch and Pagan test in RE model and by F test in the fixed model to choose estimation between pooled OLS model and individual effect model. The result is revealed in table 3.

In the fixed effect model, an F test was applied to the individual effects. The null hypothesis is all the individual intercepts are identical. The P-value showed in the bottom line is equal to zero, which leads us to reject the null hypothesis. It Indicated that the individual effects across individual the individual intercepts are statistically different from each other, there is significant heterogeneity observed so then the Pooled OLS estimator is inefficient.

In the random effect model, a Breusch-pagan Lagrangian multiplier test was applied to examine whether there is variance exist in the individual effect. The null hypothesis of the test is accepted as the variance of the random effect is zero. If we fail to reject the null hypothesis, the pooled OLS estimator is more appropriate. From table 3, the p-value is equal to 0 that smaller than the 0.01 at 99% significant level. Thus, the null hypothesis is rejected. The variance of random effect is statistically significantly different from 0.

Overall, according to the heterogeneity test, there is significant individual effect exists and vary across individuals and it has a significant nonzero variance. The random individual effect existed in the model and the random effect estimator is more efficient than the Pooled OLS and First Difference estimators. The Pooled OLS estimator is still consistent but inefficient and cannot be used to explain the relationship between unemployment and factors. The individual effect in the error term exists. In other words, the individual-specific effects model is extremely better than the pooled OLS model.

4.2 Fixed effect or Random effect estimator

Table 4 Hausman test

```
. hausman fe random, sigmamore

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       fe        random       Difference          S.E.
-------------+------------------------------------------------------------
  pop_agrwth |   -.8913114    -.8196146       -.0716969        .0786459
       ltint |    .3519476     .3556548       -.0037071        .0041329
  cpi_agrwth |   -.1783652    -.1750388       -.0033264        .0033163
    lngdpcap |    1.424793     1.456198       -.0314055        .0210255
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =          4.06
                Prob>chi2 =        0.3975
```

The null hypothesis is that there is no correlation between the unobservable individual effects and the unemployment dependent variable in Table 4. The random effect and fixed effect estimators are both consistent, but the random effect estimator is more efficient than the other. The alternative hypothesis is to stand for the existence of correlation. In such a situation, the fixed effect estimator is still consistent, but random effect estimator is not.

According to the test result, the P-value is 0.3975 which is larger than 0.1 at 90% significant level. Therefore, the null hypothesis should not be rejected. We can conclude that there is no significant correlation existed, and both the fixed effect and the random effect models are consistent, but the random effect model is more efficient. Thus, the random effect model is a more appropriate way to analyse the relationship between the unemployment rate and the factors.

5. Conclusion

To sum up, we concluded that the RE estimator is the best in this model and it is efficient and consistent in the RE model. The Pooled OLS estimator is inefficient due to the heterogeneity existed in the regression. The FE model is inefficient due to the individual effect is proved to be varied, subtracting all the individual mean would lead to too much information lose. In contrast, the RE model only subtracts part of the time-invariant effect, it seems to be more efficient. Moreover, there is no significant correlation between the regressors and the individual effect. We concluded that the RE estimator is also consistent.

Therefore, we choose the results from the RE estimator to represent our finding in this paper. In the G7 countries, the change in the GDP per capita and the long term interest rate had a significant positive effect to the unemployment rate while the statistical result in the population growth rate and the inflation rate is significantly negative. Moreover, GDP per capita is the largest contributor to the unemployment rate. The positive effect of the GDP per capita on the unemployment rate against the Okun's law is affected by the omitted variable biased, which could influence the unemployment rate and correlate with the existing regressors. Those omitted variables are not included in this model for simplicity while it leads to a biased estimation result. Besides, there are closed connections among four variables which contributed to the endogeneity problem and it also exists in relevant researches. It may affect the unbiasedness of estimators instead of affecting the consistency of estimators which will not affect the main findings.

A better estimation result might gain if more relevant variables were included. Besides, the period of data is too large to draw the most accurate consequence. Because there are so many factors that affect macro data and they also have varying degrees of influence in a different period. We can improve this thought by dividing the dataset into three or four time period and run the regressions to comparing the changes of coefficients, in which the results may be more accurate.

References

Abounouri, M. & Moshrefi, A. (2009). The effect of macroeconomics measures on price index of Iran's petrochemical industry through ARDL model, Economical Bulletin, Vol. 21.

Alamoudi, Abdulrhman. “Factors Affecting the Rate of Unemployment in GCC Countries.” Journal of Economics Bibliography 4, no. 4 (December 1, 2017): 335–344. http://search.proquest.com/docview/2009340300/.

Blanchard, Olivier (Olivier J.), and Jeffrey R. Sheen. Macroeconomics Australasian edition. Frenchs Forest, NSW: Pearson Australia Group Pty Ltd, 2013.

Jaradat, M.A. (2013). Impact of inflation and unemployment on Jordanian GDP. Journal of Contemporary Research in Business, 4(10), 314-334.

Kasirlou, Fatemeh, and Yadollah Rajaei. “The Impact of Government Debt, Foreign Trade, Population Growth Rate and Unemployment Rate on Iran’s GDP Growth.” International Journal of Economic Perspectives 11, no. 2 (June 1, 2017): 892–898. http://search.proquest.com/docview/2038227831/.

Khajevand, Nikoo, and Rouzbeh Tehrani. “Impact of Population Change and Unemployment Rate on Philadelphia’s Waste Disposal.” Waste Management 100 (December 2019): 278–286.

Lipară Daniel, Gheorghiu Gabriela, and Barbu Corina Aurora. “Is Okun’s Law Valid in Romanian Economy? An Empirical Approach of Unemployment Rate and GDP Relation from 2000 to 2018.” Ovidius University Annals: Economic Sciences Series XVIII, no. 2 (January 1, 2018): 279–284. https://doaj.org/article/ae06504e194c41d88b0d8c84101d96d9.

Mahmood, Yasar, Rabia Bokhari, and Muhammad Aslam. “Trade-Off Between Inflation, Interest and Unemployment Rate of Pakistan: A Cointegration Analysis.” Pakistan Journal of Commerce and Social Sciences 7, no. 3 (September 1, 2013): 482–492. http://search.proquest.com/docview/1518528865/.

Martin, J. P. (2014). Activation and active labour market policies in OECD countries: stylized facts and evidence on their effectiveness, University College Dublin, Geary Institute, Dublin

Naudé, W., & Serumaga-Zake, P. (2001). “An analysis of the determinants of labour force participation and unemployment in South Africa's North-West province”, Development Southern Africa, 18(3), 261-278.

Neely, C. J., 2010. Okun’s Law : Output and unemployment. Federal Reserve Bank of St. Louis Economic Synopses, No. 4

Ngoo Y. T. and Loi S.L. (2011) Okun's Law in Malaysia: An Autoregressive Distributed Lag (ARDL) Approach with Hodrick-Prescott (H.P.) Filter, Journal of Global Business and Economic, Vol. 2, No. 1.

OECD (2020), "Data warehouse", OECD.Stat (database), https://doi.org/10.1787/data-00900-en (accessed on 01 June 2020)

Okun, Arthur M. ‘‘Potential GNP: Its Measurement and Significance.” In: Proceedings of the Business and Economic Statistics Section of the American Statistical Association. Alexandria, VA: American Statistical Association, 1962, pp. 89-104

Okun, Arthur M. Monetary Policy, Debt Management and Interest Rates: A Quantitative Appraisal. Vol. 125. Cowles Foundation for Research in Economics, Yale University, 1961.

Savulea, Dorel. “Particularities of the Correlation Between the Unemployment Rate and the GDP in the Dynamics of the Romanian Economy.” European Research Studies 11, no. 4 (October 1, 2008): 111–120. http://search.proquest.com/docview/89160187/.

Tunah, H. (2010). The analysis of unemployment in Turkey: Some empirical evidence using cointegration test. European Journal of Social Sciences, 18(1), 18-38.

Valadkhani, A. (2003). ”The causes of unemployment in Iran: An empirical investigation”.

Yashiv, E. (2000). “The determinants of equilibrium unemployment”, American Economic Review, 1297-1322.