International Journal of Asian Social Science, 2013, 3(8):1717-1724

International Journal of Asian Social Science
ISSN(e): 2224-4441/ISSN(p): 2226-5139

journal homepage: http://www.aessweb.com/journal-detail.php?id=5007

DOES UNEMPLOYMENT HYSTERESIS EXIST IN ECONOMY OF IRAN?

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ABSTRACT

This paper aims to investigate the unemployment hysteresis hypothesis for Iran, by using annual data of actual unemployment rate, during period 1959-2011. We first apply traditional methods of unit root test without considering structural breaks such as ADF and Phillips and Perron (1988) tests and fail to reject the hysteresis hypothesis in unemployment time series. When one structural break is incorporated, we again fail to reject hysteresis hypothesis. Since the mentioned tests have little power, we employ unit root tests that consider multiple structural breaks as analysis of the unemployment time series. Our empirical findings are consistent with the hysteresis hypothesis of unemployment.

Keywords: Unemployment, Hysteresis, Unit root tests, Structural breaks.
JEL: E62, E12, J64

1. INTRODUCTION

The term Hysteresis means dependency to past history; therefore Hysteresis in unemployment implies that unemployment depends on its past history. Having proved this phenomenon in unemployment, all shocks- demand side and supply side- have permanent effect on unemployment path. This subject is opposite of natural rate hypothesis. According to NRH hypothesis, the deviations of actual unemployment rate from the natural rate will not exist in the long-run which lead the unemployment rate to eventually return to the natural rate (Phelps, 1967; Friedman, 1968). By contrast, according to hysteresis phenomenon, economy doesn't reach to long-run equilibrium, as it is changing constantly. In other words, cyclical fluctuations will have permanent effects on the level of unemployment as natural rate of unemployment follows actual unemployment path. If

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ISSN(e): 2224-4441/ISSN(p): 2226-5139

there is hysteresis in unemployment, it follows a random walk or has unit roots and does not revert back to its initial equilibrium level (see (Blanchard and Summers, 1986a; Roed, 1996)). In this case, equilibriums in unemployment are fragile (Blanchard and Summers, 1988). Briefly, unemployment hysteresis represents the influence of past history of unemployment rates on the long-run equilibrium unemployment.

The most important policy implication is that economic policies would have a permanent effect on unemployment. In this regards economic policy makers cannot base their policies on a trade-off between inflation and unemployment, because inflation rate depends on past variations of unemployment rate rather than current unemployment rate.

This paper empirically tests the existence of hysteresis in Iran annual unemployment data for the period of 1959-2011. In the early 1959s, the unemployment rate in Iran was 2.6 percent that with the increasing trend has reached to 12.5 percent in 2011. But during this period, unemployment rate never returned to its initial mean value; while according to neoclassical models, time is reversible and unemployment is homeostatic. It may be because of existence of hysteresis phenomenon in unemployment rate.

The rest of the article is organized as follow: section 2 briefly discusses the literature review. Section 3 explains the data and econometric methodology. Section 4 presents the empirical results. Finally, the section 5 summarizes and conclusions.

2. LITERATURE REVIEW

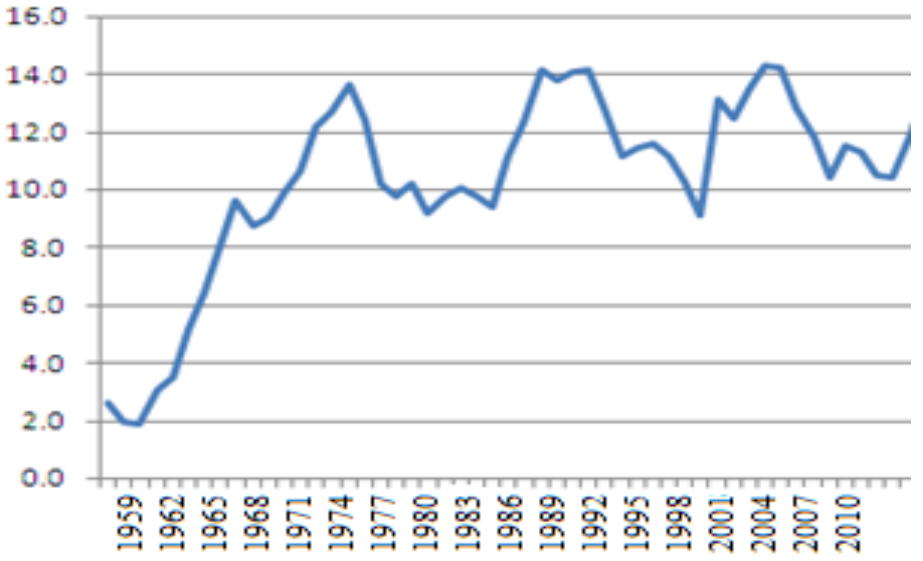
From the theoretical point of view, hysteresis in unemployment can arise from multiple channels in the literature that most known of them are: insider-outsider theory, capital shortage and depreciation of human capital. The first channel has been developed by Lindbeck and Snower (1986), (Blanchard and Summers, 1986a; 1986b) and Gottfries and Horn (1987). In this framework, hysteresis arises because the unemployed lose their influence on wage formation. The next channel is capital shortage. This theory states that a period of high unemployment leads firms to restrain the level of their investment. By contrast, when an economic recovery is beginning, the capital will be saturated, since the necessary investment decisions have not been taken during the previous periods and if labor and capital are rather complementary factors, the unemployment persists because of the capital shortage (see e.g. (Hargreaves Heap, 1980; Bean, 1989). Other potential source of unemployment hysteresis is depreciation of human capital. This theory, that called duration theory, is concerned with the negative effects of unemployment duration on the labor demand and supply of the unemployed and explains the longer an unemployment duration is, the less likely is an unemployed worker to be offered a job, because depreciation of skill reduces the expected profitability for firms and hence, the number of job vacancies coming into market (Pissarides, 1992).

3. DATA AND METHODOLOGY

As mentioned above, the data includes annual observations of the unemployment rate in economy of Iran. Our dataset comes from the Iranian government statistics publication. Figure 1 illustrates the unemployment rate trend during period 1959-2011. As it is clear, unemployment shows no sign of getting back to any unique natural or equilibrium level. This paper uses a number

of univariate unit root tests; such as ADF, Phillips and Perron (1988), Perron (1989), Zivot and Andrews (1992), Lumsdaine and Papell (1997); and Lee and Strazicich (2003).

Figure-1. The unemployment rates in Iranian economy (1959-2011)



Briefly, econometric methods of these tests are given below.

3.1. ADF test

By using of ADF test, we estimate following regression:

$$\Delta u_t = \mu + \beta t + \alpha u_{t-1} + \sum_{i=1}^{k} c_i \Delta u_{t-i} + \varepsilon_t$$

Where u, t, k and Δ are the unemployment rate, trend variable, number of lags used in the model and first difference linear operator, respectively. Under null hypothesis, there is unit root and existence of hysteresis in unemployment rate is confirmed. On the other hand, alternative hypothesis corroborates natural rate hypothesis.

3.2. Phillips and Perron (1988) unit root test

This method estimates above regression, with difference that serial correlation and heteroskedasticity in the error terms are considered here.

3.3. Perron (1989) unit root test with one known structural break

According to this test, following regression is evaluated:

$$u_t = \alpha_0 + \alpha_1 DU_t + d(DTB)_t + \gamma DT_t + \beta t + \rho u_{t-1} + \sum_{i=1}^{k} \theta_i \Delta u_{t-i} + e_t$$

Where u,DU_t and DT_t are unemployment rate, virtual variables indicating changes in intercept and trend in break time TB, respectively. Virtual variable DTB is equal to one if t=TB and to zero, otherwise. DU_tandDT_t variables are defined as follow:

$$DU_t = \begin{Bmatrix} 1 & if & t = TB \\ 0 & otherwise \end{Bmatrix} \text{and} DT_t = \begin{Bmatrix} t & if & t = TB \\ 0 & otherwise \end{Bmatrix}$$

Again, null hypothesis implies existence of hysteresis in unemployment time series.

3.4. Zivot and Andrews (1992) unit root test with one unknown structural break

The proposed regression model by Zivot and Andrews (1992) is:

$$u_t = \hat{\mu} + \hat{\theta} DU_t(\widehat{T_b}) + \hat{\beta} t + \hat{\gamma} DT_t(\widehat{T_b}) + \hat{\alpha} u_{t-1} + \sum_{j=1}^{k} \hat{c_j} \Delta u_{t-j} + \hat{e_t}$$

Again, u,DU_t and DT_t are unemployment rate, virtual variables showing changes in intercept and trend in break time T_b, respectively. Virtual variables DU_t and DT_t are defined as follow:

$$DU_t = \begin{Bmatrix} 1 & if & t > TB \\ 0 & if & t \leq TB \end{Bmatrix} \text{and} DT_t = \begin{Bmatrix} 1 - TB & if & t > TB \\ 0 & if & t \leq TB \end{Bmatrix}$$

3.5. Lumsdaine and Papell (1997) unit root test with two unknown structural break

Considered model for this test is:

$$\Delta u_t = \mu + \beta t + \theta DU1_t + \gamma DT1_t + \omega DU2_t + \varphi DT2_t + \alpha\, u_{t-1} + \sum_{i=1}^{k} c_i \Delta u_{t-i} + \varepsilon_t$$

Where u denotes unemployment rate. Virtual variables $DU1$, $DU2$, $DT1$ and $DT2$ are defined as gollow:

$$DU1_t = \begin{Bmatrix} 1 & if & t > TB1 \\ 0 & if & t \leq TB1 \end{Bmatrix} \text{and} DU2_t = \begin{Bmatrix} 1 & if & t > TB2 \\ 0 & if & t \leq TB2 \end{Bmatrix}$$

$$DT1_t = \begin{Bmatrix} t - TB & if & t > TB1 \\ 0 & if & t \leq TB1 \end{Bmatrix} \text{and} DT2_t = \begin{Bmatrix} t - TB2 & if & t > TB2 \\ 0 & if & t \leq TB2 \end{Bmatrix}$$

Where $TB1$ and $TB2$ refer to structural break times that are determined endogenously.

3.6. Lee and Strazicich (2003) unit root test with two unknown structural break

As the critical values reported by Lumsdaine and Papell have been criticized, we use Lee and Strazicich (2003) unit root test. Fot this reason, following model is estimated:

$$\Delta u_t = \delta \Delta Z_t + \emptyset \widehat{S_{t-1}} + v_t, \quad \widehat{S_t} = u_t - \widehat{\varphi_x} - Z_t \hat{\delta} \quad , t = 2, \dots, T$$

Where u and Z_t are unemployment rate and vector of exogenous variables, respectively.$Z_t$is defined as follow:

$$Z_t = [1, t, D_{1t}, D_{2t}, DT_{1t}, DT_{2t}]$$

Virtual variables D_{jt} and DT_{jt} indicate structural changes occurred in the intercept and trend in break time j, respectively. These variables are defined as follow:

$$D_{jt} = \begin{Bmatrix} 1 & if & t \geq T_{bj} + 1 \,, j = 1,2 \\ 0 & if & otherwise \end{Bmatrix} \text{and} DT_{jt} = \begin{Bmatrix} t - T_{bj} & if & t \geq T_{bj} + 1 \,, j = 1,2 \\ 0 & if & otherwise \end{Bmatrix}$$

δare coefficients of regression of Δu_t on ΔZ_t. $\widehat{\varphi_x}$are obtained from $u_1 - Z_1\delta$ (u_1 and Z_1 are initial observations of u_t and Z_t). LM unit root test null hypothesis t-statistic (that is defined $LM_t = \inf\tau(\lambda)$), when $\emptyset$=0, is equal to τ.

In all above cases, null hypothesis confirms existence of unit root (hence hysteresis) in unemployment time series.

4. EMPIRICAL RESULTS

To perform our tests, we employ annual data on unemployment rates over the period of 1959-2011. In all tests, we apply models that have both constant and trend. The results of ADF and Phillips & Perron are reported in Table 1.

Table-1. The ADF and Phillips & Perron (1988) tests

Tests	t-statistic	Optimal lag
ADF	-2.17	0
PP	-2.17	0

Note: critical values at 1, 5 and 10 percent levels are -4.14, -3.49 and -3.17, respectively.

The ADF and PP tests results presented in above table indicate that unit root hypothesis of unemployment rate cannot be rejected at the 1%, 5% and 10% significance levels. Since the ADF and PP tests do not allow for possible structural breaks, the failure of rejecting the unit root hypothesis may be due to a structural change, which is an important property of the economy of Iran. As a result, we use the Zivot and Andrews (1992) and Perron (1989) unit root tests that consider a structural break. The results of Zivot & Andrews unit root test are given in Table 2.

Table-2. The Zivot and Andrews (1992) test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
α	-0.414157	0.109155	-3.794196	0.0004
μ	0.717198	0.629527	1.139265	0.2606
β	0.351053	0.113950	3.080771	0.0035
θ	-1.586773	0.645936	-2.456549	0.0180
γ	-0.329493	0.112696	-2.923744	0.0054
c	0.245195	0.138462	1.770853	0.0834
Lags(k):1	break (TB) =17			

Note: critical values at 1, 5 and 10 percent levels are -7.19, -6.75 and -6.48, respectively.

According to obtained results, structural break time for unemployment rate variable is reported Seventeenth year of the study period (1975). The calculated time corresponds to oil shock during 1974-1975s. Since the estimated coefficients for virtual variables are significant statistically (for the both of the intercept and trend), we can conclude that structural break determined endogenously is significant. But most important reported statistic is about u_{t-1} variable coefficient that determines presence or absence of unit root in unemployment rate time series. Calculated t-statistic for coefficient α, (-3.79), is lower than reported critical values by Zivot and Andrews (1992), at all levels. Hence, test above results indicate that, even with considering an endogenous structural break, unemployment rate variable has a unit root during the period of study. This result is

consistent with the results of ADF and PP tests. As Perron (1989) unit root test is criticized due to exogenous determination of break time, we set structural break determined by Zivot and Andrews (1992) into Perron model. Again, the results corroborate existence of the unit root in unemployment time series.

Table-3. The Perron (1989) test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
α_0	0.826317	0.686188	1.204214	0.2349
α_1	3.086885	1.609866	1.917480	0.0617
d	-1.471323	1.137103	-1.293922	0.2024
γ	-0.246756	0.114584	-2.153500	0.0368
β	0.259099	0.117898	2.197664	0.0333
ρ	0.211391	0.145582	1.452039	0.1536
θ	0.629900	0.118934	5.296232	0.0000

Note: critical values at 1, 5 and 10 percent levels are -4.78, -4.17 and -3.87, respectively.

Considering the data of Table 3, shows the coefficient of lagged dependent variable (ρ) is equal to 0.21. Hence, test statistic that is calculated via relation $t\hat{\rho}=\frac{\hat{\rho}-1}{s(\hat{e})}$is equivalent to -0.76. As it is clear, absolute value of the test statistic, ($t\hat{\rho}$), is less than of the critical values provided by Perron, at the 1%, 5% and 10% significance levels. Accordingly, the unit root null hypothesis cannot be rejected. The ZA and Perron unit root tests determine most important break year, only. When one break is considered in model, failure of rejecting unit root hypothesis may be due to existence of multiple structural breaks, specially, in country as Iran that has been faced numerous upheavals. For this reason, we use Lumsdaine and Papell (1997) method for unemployment rates, empirically. The results of estimated model are reported in Table 4.

Table-4. The Lumsdaine and Papell (1997) test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
α	-0.257479	0.061684	-4.174174	0.0001
μ	2.592943	0.581890	4.456068	0.0001
β	2.136346	0.617290	3.460847	0.0012
θ	1.944184	0.662400	2.935061	0.0054
γ	-0.207028	0.076297	-2.713455	0.0096
ω	2.188226	0.761752	2.872623	0.0064
φ	0.115165	0.096182	1.197372	0.2379
c_1	0.074053	0.126699	0.584480	0.5620
c_2	0.035972	0.128124	0.280758	0.7803
Lag(k): 2	break(TB1) =17	break(TB2) =26		

Note: critical values at 1, 5 and 10 percent levels are -7.19, -6.75 and -6.48, respectively.

Results show the coefficients θ, γ and ω are significant statistically, but φ is not, that imply the first break occurred in $TB1$ is effective on the both intercept and slope whereas second break affects intercept, only. TB1 and TB2 are corresponding to oil shock during 1974-1975s and middle of war (1984). By comparing the critical values at 1, 5 and 10 percent levels with the t-statistic for

coefficient α is clear that unit root null hypothesis is confirmed. As the critical values reported by Lumsdaine and Papell are criticized, we perform Lee and Strazicich (2003) unit root test that has no any objection. Model estimation results are presented in Table 5.

Table-5. Lee and Strazicich (2003) test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
constant	-0.25	0.03	-6.91	0.00
$D1$	9.90	0.51	19.23	0.00
$D2$	-0.20	0.07	-2.71	0.00
$DT1$	0.12	0.007	16.72	0.00
$DT2$	0.22	0.19	1.19	0.23
Lag (k): 1	break(TB1) = 1353	break(TB2) =1365	t = -3.95	

Note: critical values at 5 and 10 percent levels are -5.29 and -4.99, respectively.

LM unit root test null hypothesis t-statistic (τ) is equal to -3.95 that if is compared with the critical values reported by Lee and Strazicich (2003), can conclude that unemployment time series has a unit root, despite taking two structural breaks into account. The virtual variables coefficients are interpreted as before, also.

5. CONCLUSIONS

Iran is one of the countries that has experienced persistent high rate of unemployment in recent decades. Unemployment trend in Iran shows that this variable has remained at high level permanently and even continued to rise. Moreover, employment policies of government in order to reduce unemployment, has not been successful. This led us to examine existence of hysteresis phenomenon in unemployment rate of economy of Iran. This study examines presence of hysteresis in unemployment rate of economy of Iran during period 1959-2011 with using of time-series data and traditional and modern methods of unit root test that consider structural breaks exogenously and endogenously. Results corroborate existence of this phenomenon in unemployment rate of Iran. This result implies that in Iran, during the period of study, the natural rate of unemployment follows current unemployment rate path. Moreover, the failure of government's policies in reducing unemployment rate may be due to existing of hysteresis phenomenon, and in this situation monetary and fiscal policies change long-run equilibrium rate of unemployment, also.

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