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Hysteresis Hypothesis in Unemployment: Evidence from Iran's Labor Market

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Abstract

Nowadays, the study of unemployment properties is particularly important as a result of the increase of this variable in recent years. This phenomenon is a serious problem in Iranian economy and government try to reduce it, while, the economy performance indicates this phenomenon is an economic challenge at the present and may be in the future. This paper tests the hysteresis hypothesis in youth unemployment at the urban, rural, regional, and general level by using quarterly data in period 2000- 2018. In addition, this paper investigates the stochastic nature of unemployment for thirty regions of Iran. We first employ the ADF and KPSS methods to test the hysteresis hypothesis at the urban, rural and general levels. Second, we apply the IPS, Chio and Fisher methods to examine this test for thirty regions using quarterly data in the period 2005-2020. Finally, the PANIC method is applied to identify the common and idiosyncratic components of unemployment rates at the regional level. The findings of different methods give support to the existence of hysteresis for the youth unemployment at the urban, rural and general level. Also, our empirical findings provide that the evidence is favorable to the existence of hysteresis in some regions. These results implicate supply side policies are effective to reduce youth unemployment at different levels.

Highlights

- In this paper, we tested the hysteresis hypothesis for the youth unemployment rates at the urban, rural and general levels, and then examined the hysteresis hypothesis in regional unemployment rates.
- The results indicate that the youth unemployment in Iran take a prolonged time period to return to its trend level, when an economic shock happens.
- A noteworthy implication of these consequences is that global or domestic shocks upon the urban and rural labor markets would not have impermanent effects.

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1. Introduction

In macroeconomic literature, persistence in the unemployment rate is known as unemployment hysteresis. This characteristic of unemployment is a much-discussed topic in theoretical and empirical macroeconomics and there is an ongoing academic debate about it. This phenomenon in labor market happen due to scarring effect on unemployed workers and changes in the number of insiders in wage bargaining. These factors shift the aggregated demand that have long-term effects on unemployment (Ball & Onken, 2021). In the hysteresis unemployment situation, the unemployment rate will not return to the equilibrium level. This means that an economic shock will have an imminent effect on the labor market. This effect can lead to economic and social threats.

In the empirical literature, the existence of hysteresis in unemployment has been studied by testing of the hysteresis hypothesis (HH). This hypothesis has been tested in the empirical literature assessing the time series properties of unemployment rates. There are a number of empirical studies on unemployment hysteresis; however, the findings are contradictory and inconclusive.

Ledesma & McAdam (2003) used monthly data for 12 CEE and 15 European countries from January 1991 to May 2001. They obtained the evidence against the hysteresis hypothesis. Garcia et al. (2005) employed the PANIC method to investigate the stochastic properties of Spanish regional unemployment rates by using quarterly data. They found some evidence for the hysteresis hypothesis, which appears to be caused by a common stochastic trend in all the regional series.

Chang et al. (2005) employed a panel test to examine unemployment hysteresis in some European countries over the period 1991-1999. The results indicated that, with the exception of Belgium and the Netherlands, hysteresis was supported for all of those countries. Camarero & Tamarit (2006) used panel tests to examine unemployment hysteresis in 19 OECD countries over 1956- 2001 period. They concluded that the unemployment rates were stationary and that no hysteresis was found in almost all of the selected OECD countries.

Sephton (2009) tested the existence of unemployment hysteresis in the US. The findings from this study indicated that unemployment rates in the US could be described as a stationary fluctuation around a shifting trend.

Cheng et al. (2012) investigated the stochastic nature of the unemployment rate by using the PANIC method to identify the common and idiosyncratic components. The findings of this study supported the evidence for a non-stationary common component for the recent recession period. Gozgor (2013) examined the hysteresis hypothesis in ten Central and Eastern European (CEE) countries by using the panel tests. Although the results indicated that there was no mean-reverting process in the unemployment rates for ten CEE countries, but they did support the validity of the hysteresis hypothesis in the selected countries.

Gallegos et al. (2012) analyzed the presence of hysteresis in Mexico by using the PANIC method for thirty-two states. They identified the presence of hysteresis in the common components of the series as well as in some of the idiosyncratic errors specific to each state. Kula & Aslan (2014) examined the empirical validity

of the hysteresis hypothesis in unemployment rates in Turkey. Their empirical findings showed that the time series properties of high and vocational high school-educated unemployment rates are different from the overall unemployment rate. Furuoka (2014) studied the existence of unemployment hysteresis for the 14 regions of the Czech Republic. The empirical findings of the ADF test suggested that unemployment in all 14 regions could be described as a non-stationary process.

Akdogn (2017) examined the unemployment hypothesis for 31 European countries, the US and Japan, using alternative linear and nonlinear unit root tests. The results indicated that the hysteresis hypothesis is rejected for 60 percent of the countries in the sample. Bekmez & Ozpolat (2016) examined the hysteresis impact on unemployment for men and women separately using panel unit root tests. The findings of this study showed that the hysteresis effect on unemployment is different in terms of both at the gender and country level.

Albulescu & Tiwari (2018) applied a series of bounded unit root tests to revisit unemployment in eight European Union countries. They found strong evidence in favor of the hysteresis hypothesis in all the cases. The results of Jump & Stockhammer (2018) empirical paper for EU 15 verified the existance of hysteresis inunemployment. Akay et al. (2020) showed that the unemployment hysteresis is valid for themajority of transition economics such as Bulgaria, Croatia, Poland, and Litivania. Ball & Onken (2021) studied the synamics of unemployment and its natural rate for 29 countries froem the OECD. The results revaled strong eveidence of heteresis.

In recent decades, the economic situation of Iran led to an increase in the unemployment rate, especially among the youth population. Nowadays, the high unemployment rate is an important problem in the Iranian economy and, in recent years, the Iranian economy has been suffering from unemployment persistence. Therefore, the study of properties of unemployment, such as persistence, is particularly important given its economic and social implications because poverty, emergence and growth of a shadow economy, migration and even violence are related to labor market conditions and the status of unemployment. Therefore, we analyze the chronic character of the unemployment rate in the Iranian labor market at different levels.

There are few studies have focused on the hysteresis hypothesis in Iran. Akbari & Taee (2017) investigated the hysteresis effect in unemployment rate using first and second generations od panel unit root tests during 2005Q1-2015Q3. The results of first-generation test showed that unemployment rate is stationary, while the second generation referred to the non-stationary process and proved the hysteresis effect in unemployment. Eisazadeh & Tabarsi (2013) investigated the unemployment hysteresis hypothesis using annual data during 1959-2011. The results indicated that the hysteresis hypothesis was not rejected when considering the multiple structural breaks in the unemployment time series. Cheratian et al. (2021) analyzed the hysteresis test disaggregated by territory (urban and rural), gender (male and female), and age groups during 2001Q2-

2020Q1. The results supported the hysteresis in unemployment rate in all cases. In this paper, the hysteresis hypothesis tested the youth unemployment rates at the urban, rural and general levels, and then examined the hysteresis hypothesis in regional unemployment rates (thirty provinces)[1].

The innovation of this paper is related to investigate the hysteresis in youth unemployment rate disaggregated by urban, rural, and regions (provinces) using the new methods. In addition, we focus on the hysteresis literature in unemployment, specially. The results of this paper aim to make policy makers aware of the properties of the labor market at different levels and to help them to decide how to confronting youth unemployment and its threats. Therefore, this research is important and useful at the empirical level.

This paper is organized as follows; section 2 includes a literature review concerning unemployment theories. Section 3 describes the data and empirical methods used. Section 4 presents the empirical results. Finally, section 5 gives a brief review of the findings and their policy implications.

2. A Review of the Related Literature

There are main theoretical hypotheses regarding to the behavior exhibited by the unemployment rate. The traditional natural rate theory advocated that the unemployment rate fluctuated around natural or equilibrium rate that implying a fully equilibrated labor market. Therefore, shocks to unemployment are temporary and the unemployment rate is assumed to revert to its equilibrium level (Freidman (1995); Phelps (1967, 1968)).

The developments of the labor market in the 1970s and 1980a gave rise to the structuralist hypothesis as a refinement of the natural rate theory. This hypothesis such support that the natural rate of unemployment has tended to shift upward as a result of changes in structural factors of economy such as slowdown in productivity growth, the rises in oil prices in the seventies and the changes in world interest rate (Hoon & Phelps (1997); Carruth et al. (1998); Phelps & Zoega (1998)). In this hypothesis, most shocks to unemployment appear to be temporary, but sporadically the natural rate permanently changes as a result of uncommon and large shocks.

Blanchard & Summers (1986, 1987) turned their attention to the hysteresis hypothesis since the US unemployment rate reverted back to its pre-shock level while the unemployment rate in Europe steadily rising. In the hysteresis, hypothesis emphasizes that cross differences in institutional arrangements governing the functioning of labor markets lead to marked differences in the path economies adjust to macroeconomic shocks.

The hysteresis hypothesis implies that the unemployment rate is path-dependent so that current unemployment levels heavily depend on past levels; it is opposed to the natural rate hypothesis. Unemployment hysteresis means that equilibrium level of unemployment tends to depend on the actual path of

[1] We added Alborz province to the data of Tehran province.

unemployment and, therefore, the equilibrium rate of unemployment is path-dependent (Carlin & Soskice, 1990). In other words, under the hysteresis hypothesis, cyclical fluctuations in an economy have permanent effects on the level of unemployment (Symth, 2003). This implies that without government interventions to solve the unemployment problem, high unemployment rates will not revert to a non-accelerating inflation rate of unemployment (NAIRU) in the long-term.

Several theoretical frameworks have been developed to explain hysteresis in unemployment. The most widely accepted among them is the so-called membership theory (Lindbeck and Snower, 1988; Blanchard and Summers, 1986; Gregory, 1986). The membership theory assumes that wage setting is mainly determined by the insiders in a firm rather than by outsiders. The employment function is presented as follows:

$$n_t = n_{t-1} + (m - m^e) \quad (1)$$

Where n_t is employment in the year *t*, *m* is the nominal money, m^e is the expected nominal money. Thus, employment at a certain point in time is equal to employment in the previous period plus a random disturbance. In Eq. (1), the disturbance is equal to the unanticipated movement in the nominal money. Implications of this equation are quite drastic as the formula assumes that the employment follow a random walk (Blanchard & Summers, 1986a).

From an econometric perspective, the hysteresis hypothesis views unemployment as a near non-stationary process where unemployment will not revert to NAIRU. This means that the unemployment time series contains a unit root. Contrary to this perspective, the natural rate hypothesis views unemployment as a stationary process in which the level of unemployment will eventually revert to the NAIRU. There exists yet another hypothesis about the unemployment dynamics, which is the persistence hypothesis. It is similar to the hysteresis hypothesis because it postulates that it would take many periods for the unemployment rate to revert to the NAIRU. Under the persistence hypothesis, unemployment could be described as a near unit root process (Smyth, 2003).

In view of the fact that there are many contradictory opinions about the behavior of the unemployment rate and that persistent higher than normal unemployment entails serious socio-economic political consequences, therefore, the question of whether unemployment hysteresis exists is an important topic in macroeconomic literature. In this study, on the bases of theoretical literature, we study urban, rural and 30 regions of Iran to examine the existence of hysteresis in their unemployment rates.

3. The Study Model
3. Data and empirical method
3.1. Data

In this paper we focus on the three types of data, first, the total and youth unemployment rate (14-25 years old) in the period of 2000 (1380) to 2020 (1399). Second, we focus on the youth unemployment rate in the urban and rural regions

of Iran in the same period. Third, our data cover the unemployment rate in 30 provinces of Iran in period of 2004 (1384) to 2020 (1399). It should be mentioned that the frequency of data is quarterly from first quarter to second quarter in the end year.

We extract the data from the reports of the unemployment rate from the Iranian Statistical Center. The tables 1 and 2 report the summary of the descriptive statistics that we used in this paper.

Table 1. Summary of Descriptive Statistics of the Unemployment Rates in Iran

Statistics	Total	Youth (14-25 old)	Urban youth (14-25 old)	Rural youth (14-25 old)
Mean	11.65	18.21	30.35	25.7
Median	11.53	17.84	29.2	25.5
Maximum	14.7	30.9	38.6	34.2
Minimum	9.5	9.8	24.8	20.1
Standard Deviation	1.33	4.57	3.09	3.13
Observation	78	78	78	78

***Source**: results of paper*

Table 2. Summary of Descriptive Statistics of the Unemployment Rates in Regions*

Statistics	EAZ	WAZ	ARD	ESF	ILM	BOS	TEH	CHE	SKH	RKH
Mean	8.54	10.54	12.21	12.30	13.86	12.71	11.3	13.6	9.05	9.84
Median	8	9.6	11.9	12.3	13.7	10.54	11.3	13.44	8.6	9.1
Maximum	15.7	21.5	18.1	19.4	21.6	15.3	14.9	21.7	14.7	15.2
Minimum	4	6	8.5	8	8.5	6.9	5.1	7	5.4	6.6
Standard Deviation	2.8	3.44	2.31	2.37	2.96	2.16	2.31	3.25	2.33	2.52
Observation	78	78	78	78	78	78	78	78	78	78
Statistics	NKH	KHO	ZAN	SEM	SIS	FAR	QAZ	QOM	KUR	KER
Mean	9.46	12.2	9.67	9.60	11.24	14.36	11.2	10.31	12.2	10.31
Median	9.1	12.1	8.96	9.7	11.3	13.95	11.2	10.4	11.96	10.07
Maximum	17.9	20.8	18.1	17.4	14.2	23.9	16.8	14.3	23.7	17.3
Minimum	4.2	6.9	6.1	5.9	6.1	7.1	7.4	7.3	5.7	5.2
Standard Deviation	3.17	2.5	2.27	2.29	1.98	3.71	1.85	1.67	3.92	3.43
Observation	78	78	78	78	78	78	78	78	78	78
Statistics	KERM	KOH	GOL	GIL	LOR	MAZ	MAR	HOR	HAM	YAZ
Mean	15.34	15.3	9.11	13.7	16.8	9.85	10.16	9.8	11.7	8.41
Median	14.44	15.16	8.73	13.62	16.76	9.97	9.8	9.8	10.7	8.1
Maximum	23.1	23	15	21	25.5	15.3	18.4	15.6	23	13.6
Minimum	10.2	9.8	4	8.4	10.7	5.8	5	3.6	5.8	4.3
Standard Deviation	3.2	2.88	2.47	2.9	3.22	2.34	2.79	2.36	4.38	2.12
Observation	78	78	78	78	78	78	78	78	78	78

* EAZ (East Azerbaijan), WAZ (West Azerbaijan), ARD (Ardabil), ESF (Esfahan), ILM (Ilam), BOS (Bushier), THE (Tehran), CHE (Charah Mahal), SKH (South Khorasan), RKH (Razavi Khorasan), NKH (North Khorasan), KHO (Khuzestan), ZAN (Zanjan), SEM (Semnan), SIS (Sistan & Baluchistan), FAR (Fars), QAZ (Qazvin), Qom (Qom), KUR (Kurdistan), KER (Kerman), KERM (Kermanshah), KOH

(Kohkiloye & Boyer Ahmad), GOL (Golestan), GIL (Gilan), LOR (Lorestan), MAZ (Mazandaran), MAR (Markazi), HOR (Hormozghan), HAM (Hamadan), YAZ (Yazd).
***Source**: results of paper*

3.2. Empirical model and testing

We present a simple insider-outsider model of the labor market to drive our empirical analysis based on Blanchard and Summers (1986). According to unemployment theory, hysteresis may arise as a consequence of the division insider workers (currently employed) and outsiders (unemployed). Insiders are unionized or simply have all the bargaining power.

Outsiders are disenfranchised and wages are set with a view to ensuring the jobs of insiders. Shocks which lead to reduced employment change the number of insiders and thereby the sequence equilibrium wage rate, giving rise to the hypothesis (Blanchard and Summers, 1986).

Let y_t be aggregate demand, m_t money supply and p_t the price level. Demand level depends on real money balances as follows:

$$y_t = c(m_t - p_t) \quad (2)$$

We assume the production is constant returns to scale and use labor, n_t. Since $y_t = n_t$, then profit maximization leads to $p_t = w_t$, where w_t is the nominal wage. Insiders expect employment to be a function of the past period employment so that $n_t^E = \Phi n_{t-1}$, with $0 < \Phi \leq 1$. In equilibrium, aggregate supply equals demand and we have:

$$n_t = c(m_t - w_t) \quad (3)$$

Taking expected values and subtracting from (3), we get:

$$n_t - n_t^E = c(m_t - m_t^E) - c(w_t - w_t^E) \quad (4)$$

Since wages are set by the union in advance, $w_t = w_t^E$, and the union's expectations are such that $n_t^E = \Phi n_{t-1}$, therefore, we can write:

$$n_t = \Phi n_{t-1} + c(m_t - m_t^E) \quad (5)$$

The unexpected shocks to money supply can be considered to be random or unexplainable, hence we obtain $n_t = \Phi n_{t-1} + \varepsilon_t$, where ε_t. is i.id. error term. From this theoretical base, we can consider the unemployment rate as a random walk with shocks affecting on permanent basis, if and only if $\Phi = 1$, otherwise, the model would predict persistence.

We assume that a stochastic representation for the unemployment rate. Let u_{it} be the unemployment rate of region $i \, \epsilon \, [1.N]$ at time $t \, \epsilon \, [1.T]$. Under the hysteresis hypothesis, u_{it} can be represented by the following unit root process:

$$\Delta u_{i.t} = \varepsilon_{i.t} \quad (6)$$

$$\varepsilon_{i.t} = \sum_{j=1}^{k} \alpha_{i.j} \varepsilon_{i,t-j} + e_{i.t} \quad (7)$$

where Δ is the difference operator, $\left|\sum_{j=1}^{k} \alpha_{i.j}\right| < 1$, and $e_{i.t}$ is a zero-mean white noise process. Equations (5) and (6) can be jointly represented by:

$$\Delta u_{i.t} = \sum_{j=1}^{k} \alpha_{i.j} \Delta u_{i.t-j} + e_{i.t} \quad (8)$$

Eq. (8) implies that the level of unemployment rate changes in the long-term by $(1-\sum_{j=1}^{k}\alpha_{i.j})^{-1}e_{i.t}$ when there is a shock $e_{i.t}$ at time *t*. Simply put, the shock has a permanent effect, which is consistent with the hysteresis hypothesis of the unemployment. On the other hand, the natural rate hypothesis implies that deviations of $u_{i.t}$ from u_i^*, the natural rate of unemployment of region *i*, are short-lived and eventually die out. That is, under this hypothesis, the level unemployment ($u_{i.t}$) should be mean-reverting, which implies the stationary process as follows:

$$u_{i.t} = u_i^* + \varphi_{i.t} \tag{9}$$

$$\varphi_{i.t} = \sum_{j=1}^{k+1}\beta_{i.j}\varphi_{i.t-j} + e_{i.t} \tag{10}$$

where $\left|\sum_{j=1}^{k+1}\beta_{i.j}\right| < 1$ and $e_{i.t}$ is a zero-mean white noise process as defined earlier. The joint of (9) and (10), imply the stationary process as follows:

$$u_{i.t} = c_i + \sum_{j=1}^{k+1}\beta_{i.j}\,u_{i.t-j} + e_{i.t} \tag{11}$$

where $c_i = u_i^*(1-\sum_{j=1}^{k+1}\beta_{i.j})$. Or equivalently as follows:

$$\Delta u_{i.t} = c_i - \lambda_i u_{i.t-1} + \sum_{j=1}^{k}\alpha_{i.j}\Delta u_{i.t-1} + e_{i.t} \tag{12}$$

where;

$\lambda_i = 1-\sum_{j=1}^{k+1}\beta_{i.j}.\ \beta_{i.1} = 1-\lambda_i+\alpha_{i.1}.\ \beta_{i.j} = \alpha_{i.j}-\alpha_{i.j-1}.\ for\ j = 2.\ldots.k.\ and\ \beta_{i.j} = -\alpha_{i.k}.$

Eq. (12) is the conventional ADF regression equation. The result of testing the null hypothesis $H_0: \lambda_i = 0$. indicates the stochastic nature of unemployment rates. We apply unit root tests to empirically examine the hysteresis hypothesis in the unemployment rate in third steps. First, we use the HEGY and Conova Hansen approach to test hysteresis hypothesis (HH) on the urban, rural and whole level of unemployment rates. Second, we employ panel unit root tests proposed by Choi (2002) and Im, Pesaran & Shin (2003) to examine HH in thirty regions. Finally, we use the PANIC (Panel Analysis of non –Stationary in Idiosyncratic and Common factors) method proposed by Bai & Ng (2004) to panel unit root test in regional level. This technique involves the calculation of common factors for the panel by using the principal components method as well as the determination of an idiosyncratic error term for each series.

The PANIC method is based on the decomposition of the information in its common and idiosyncratic components. For this purpose, we consider the stochastic process for the unemployment rate as follows:

$$u_{it} = C_{it} + \gamma_i F_i + e_{it} \tag{13}$$

where C_{it} represents a polynomial trend function of order $p.F_t$ includes a $R\times 1$ vector of common factors, γ_i is a factor-loading vector and finally, e_{it} represents an idiosyncratic variable.

Estimations are applied by the method of principal components approach. When e_{it} is stationary, $f_t\ and\ \gamma_i$ can be consistently estimated irrespective of the

order of F_t. If e_{it} in integrated, however, the estimator is inconsistent because a regression of $u_{i,t}$ on F_t is spurious. This problem is solved by applying the method of PANIC. This method is based on the principal component methodology to the first-differenced data as follows:

$$\Delta u_{it} = \gamma_i \Delta F_t + \Delta e_{it} \qquad for\ t = 2.3. \ldots . T$$

On the basis of normalization, by applying the principal components approach for $\Delta u_{it} \Delta u_{it}'$, we get the estimates of $\Delta \hat{F}_t$ *and* $\hat{\gamma}_i$, thus $\Delta \hat{e}_{it} = \Delta u_{it} - \hat{\gamma}_i \Delta \hat{F}_t$. Re-accumulating the estimators, it is yielded:

$$\hat{F}_t = \sum_{s=2}^{t} \Delta \hat{F}_s \tag{14}$$

$$\hat{e}_{it} = \sum_{s}^{t} \Delta \hat{e}_{it} \tag{15}$$

4. Empirical Results

In this section, we report the empirical findings of hysteresis test in two steps, first, time series of youth unemployment rates at the urban, rural and whole level, second, panel data of unemployment rates in the regional level.

Table 3 represents the empirical findings from the HEGY (1990) and CH (1995) tests. The HEGY and CH tests examined whether the youth unemployment rates had a unit root. The tests failed to reject the null hypothesis of a unit root for youth unemployment rates. In other words, the empirical results from individual linear unit roots test implied that youth unemployment in Iran could be explained as a nonstationary process at levels.

The applied tests of HEGY and CH for youth unemployment rates at the urban and rural regions, indicate that youth unemployment rates in rural region have non-stationary characteristic in both tests, but the HEGY test passed the null hypothesis of a unit root for youth unemployment rates at the urban region, while, on the HC test, the null hypothesis cannot be rejected.[1]

Table3. Results of HEGY and CH tests for youth unemployment rates

Region	HEGY Statistic	Critical values			CH Statistic	Critical values		
		1%	5%	10%		1%	5%	10%
Total	-1.96	-3.32	-2.75	-2.46	0.52	1.35	1.01	0.86
Urban	-3.16*	-3.32	-2.79	-2.46	0.15	0.74	0.47	0.35
Rural	-1.87	-3.32	-2.75	-2.46	0.53	1.35	1.01	0.84

*Indicates significance at the 5% level.

Note: the reported results include intercept and trend.

***Source**: results of paper*

Empirical findings from the second step of the analysis, the individual root-IPS (Im, Pesaran and Shin, 2003), Fisher and Choi (2002) tests are reported in Table 4. The tests were able to reject the null hypothesis of unit roots in the

[1] We checked the stationary at none, trend, intercept and trend. Because the results are similar, we reported the results including intercept and trend.

unemployment rates for thirty regions in panel form. Therefore, the unemployment rates in a panel of regions are stationary and it is in contrast to youth unemployment rates. The findings of unit test for thirty regions show that unemployment rates in eight regions, namely West Azerbaijan, Khorasan Razavi, Khorasan Shomali, Fars, Kurdistan, Kermanshah, Ghilan, and Hamadan, are not-stationary at the 5% level and unemployment rates of Esfahan and Elam are non-stationary at the 10% level. For the remaining regions, 20 regions, the ADF tests were able to reject the null hypothesis unit root at the 5% level.

Table4. The results of hysteresis test for unemployment rates in regions

IPS W-stat		ADF- Chio Z-stat		ADF-Fisher Chi-square	
Statistic	P-value	Statistic	P-value	Statistic	P-value
-12.47	0.00	-11.61	0.00	315.75	0.00

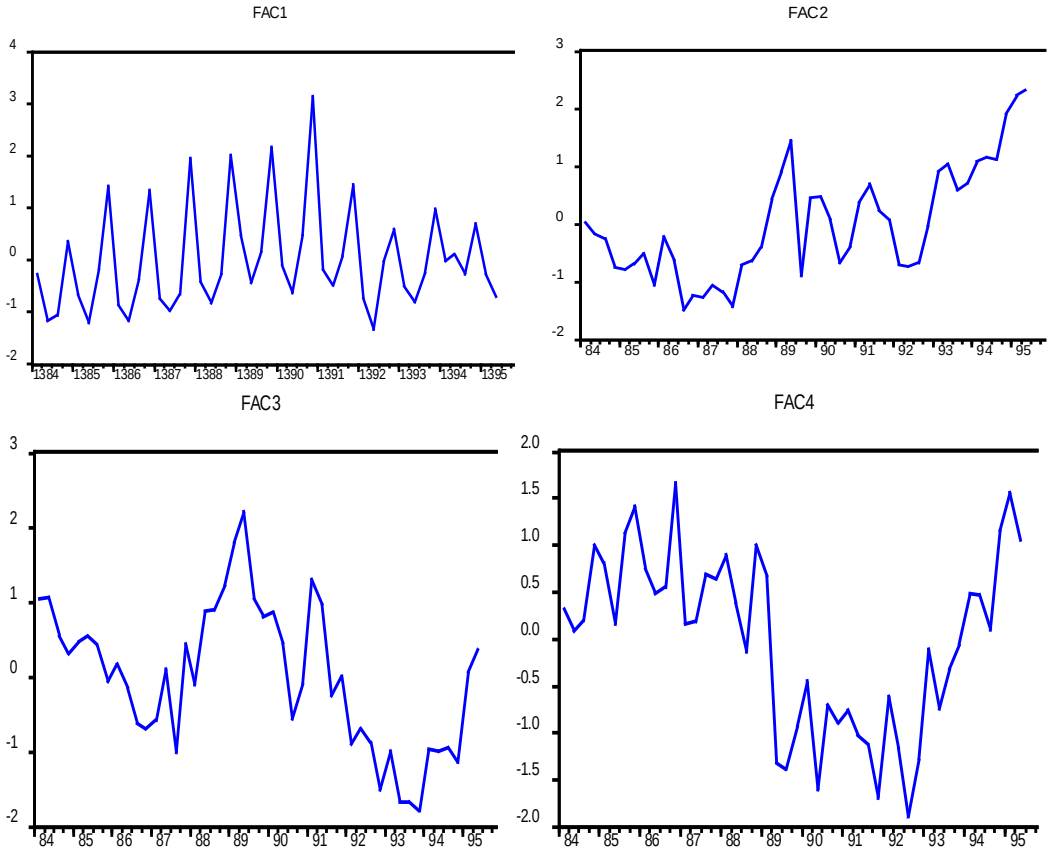
Intermediate ADF test results on unemployment rates in region							
Region	East Azerbaijan	East Azerbaijan	Ardabil	Esfahan	Ilam	Bushier	Tehran
Statistic	-2.84	-2.2	-5.2	-2.75	-2.76	-4.91	-3.27
Prob.	(0.06)	(0.2)*	(0.00)	(0.07)**	(0.07)**	(0.00)	(0.02)
Regions	Chahar Mahal	Khorasan South	Khorasan Razavi	Khorasan North	Ahvaz	Zanjan	Semnan
Statistic	-4.16	-4.04	-2.47	-1.16	-3.93	-6.2	-5.58
Prob.	(0.00)	(0.00)	(0.12)*	(0.68)*	(0.00)	(0.00)	(0.00)
Regions	Sistan & Baluchistan	Fars	Qazvin	Qom	Kurdistan	Kerman	Kermansha h
Statistic	-6.83	-1.5	-5.06	-4.93	-1.11	-3.81	-0.95
Prob.	(0.00)	(0.47)*	(0.00)	(0.00)	(0.69)*	(0.00)	(0.76)*
Regions	Kohkiloye	Golestan	Gilan	Lorestan	Mazandaran	Markazi	Hormozghan
Statistic	-5.18	-3.64	-0.63	-3.83	-3.82	-4.66	-4.28
Prob.	(0.00)	(0.00)	(0.85)*	(0.00)	(0.00)	(0.00)	(0.00)
Regions	Hamadan	Yazd					
Statistic	-1.43	-2.87					
Prob.	(0.55)*	(0.05)					

* indicates insignificance at the 5% level. **indicates insignificance at the 10% level

***Source**: results of paper*

In the third step, we applied the PANIC method for unemployment rates in regions. The calculation of common factors was made on the bases of the previous section. Common factors are calculated using differentiated and standardized time series through the principal component's method (Figures 1 to 4). Then we implied the identification of the optimum common factors to be calculated; using the Eigen value method equal to one, we conclude the existence eight common factors that together explain over the 72% percent information. However, using

the selection criteria proposed by Bai & Ng (2004), we obtained four common factors that collectively 56% panel's information of the panel data.[1]



Figures 1-4. The common factors

***Source**: results of paper*

We re-accumulated the common factors and applied the HEGY unit root test to each one of the four factors. Table 5 represents the results of the test. All the factors are non-stationary and they are stationary in first difference, which shows the presence of hysteresis from the common components.

Table5.Unit root test for common factors

	Level		First diffidence	
Factor	Statistic	P-value	Statistic	P-value

1 On the basis of PANIC method, we pooled the unemployment data and then using principal components method to identify common factors. The applying principal components method resulted that the common factors explain the unemployment data. Finally, we applied the HEGY test for common factors.

1	-2.28	(0.18)*	-3.9	(0.00)
2	-0.27	(0.54)*	-3.67	(0.00)
3	-2.1	(0.23)*	-3.19	(0.00)
4	-2.73	(0.13)*	-3.36	(0.00)

*Indicates insignificance in 5% level
***Source**: results of paper*

We estimated the idiosyncratic error and its re-accumulation. The evaluation of the stationary tests on an idiosyncratic error in regions indicated that the existence of unit roots in ten regions: West Azerbaijan, Esfahan, South Khorasan, North Khorasan, Fars, Kurdistan, Kermanshah, Ghilan, Lorestan, and Hamadan (Table 6). In this way, the phenomenon of hysteresis in ten regions is caused not only attribute to its common factors but also is a consequence of their individual characteristics of each region.

Table6. Unit root tests for idiosyncratic errors

East Azerbaijan	West Azerbaijan	Ardabil	Esfahan	Elam	Bushier	Tehran	Chahar Mahal
-2.91 (0.05)	-1.54 (0.5)*	-4.76 (0.00)	-1.67 (0.43)*	-3.9 (0.00)	-5.6 (0.00)	-3.75 (0.00)	-4.12 (0.00)
South Khorasan	Razavi Khorasan	North Khorasan	Khuzestan	Zanjan	Semnan	Sistan & Baluchistan	Fars
-2.24 (0.19)*	-3.23 (0.02)	-2.33 (0.16)*	-4.12 (0.00)	-3.82 (0.00)	-4.6 (0.00)	-5.05 (0.00)	-1.89 (0.33)*
Qazvin	Qom	Kurdistan	kerman	kermanshah	Kohkiloye	Golestan	Gilan
-3.57 (0.01)	-6.25 (0.00)	-1.55 (0.49)*	-4.28 (0.00)	-1.31 (0.61)*	-4.11 (0.00)	-2.76 (0.07)	-0.94 (0.76)*
Lorestan	Mazandaran	Markazi	Hormozgan	Hamadan	Yazd		
-2.46 (0.13)*	-3.88 (0.00)	-3.18 (0.02)	-4.82 (0.00)	-0.29 (0.91)*	-4.92 (0.00)		

*Indicates insignificance in 5% level
***Source**: results of paper*

5. Conclusion and Discussion

The theory of unemployment hysteresis is a prominent research topic in economic literature, because of the important policy implications that the issue entails. In this study, we examined existence of the unemployment hysteresis at the urban, rural, regional, and general level. To carry out the empirical analysis has been employed the HEGY (1990) & CH (1995) tests for time series, and the IPS, Chio, ADF-Fisher and PANIC tests for panel data.

According to the findings from the HEGY and CH tests, youth unemployment rates at the urban, rural and general level could be explained as a non-stationary process, except for the youth unemployment at the urban level by the ADF test. These results indicated it cannot be rejected the hypothesis of hysteresis in Iran's labor market. This situation lies in the fact that the evolution of youth unemployment in Iran is unstable over time; therefore, it cannot be assured the compliance of a natural unemployment rate theory in the long-term. In other words, we can conclude that the youth unemployment in Iran take a prolonged time period to return to its trend level, when an economic shock happens.

The results of the IPS, Chio, and ADF-Fisher tests verify that it cannot be rejected the hypothesis of hysteresis in some regions such as West Azerbaijan, Khorasan Razavi, Khorasan Shomali, Fars, Kurdistan the, Kermanshah, Ghilan, and Hamadan. These results, also, indicate that hysteresis phenomenon in regional unemployment (by using PANIC method) is due to the common factors of the variable as to individual idiosyncratic elements for each region. These findings verify the existence of a structural problem in the Iranian labor market. According to the findings from unit root tests for idiosyncratic errors, there is a hysteresis phenomenon in ten regions namely West Azerbaijan, Esfahan, South Khorasan, North Khorasan, Fars, Kurdistan, Kermanshah, Gilan, Lorestan, and Hamadan. In other words, the regional characteristics of afore mentioned regions caused hysteresis problem in addition to the common factors. In remaining twenty regions the common factors determine the nature of hysteresis phenomenon.

The findings of this paper confirmed previous empirical studies about hysteresis hypothesis such as Cheng et al. (2012), Furuoka (2014), Akdogn (2016), Bekmez & Ozpolat (2016), and Ball & Onken (2021). The results obtained important insights for policy makers about Iranian labor market. The hysteresis problem indicates that monetary and fiscal policy would cause long-lasting impacts on the unemployment rates at the urban, rural, and general level. A noteworthy implication of these consequences is that global or domestic shocks upon the urban and rural labor markets would not have impermanent effects. Therefore, the supply side policies can be effective in order to reduce the unemployment rates. Therefore, the government should consider the condition of urban and rural labor market, when monetary and fiscal policies implicated in the economy.

In addition, it is worth outstanding that our results carry some important policy implications for reducing unemployment rates at the regional level. In short, to fight against the source of hysteresis in some regional unemployment, it is necessary to implement policy measures aimed at reducing the sluggishness of the Iranian labor market in adjusting to adverse shocks hitting the common component of the regional unemployment rates. This is because there are important regional rigidities in the labor and goods and services markets that prevent regional unemployment rates from returning to pre-shock levels, thus these rigidities causing unemployment rises largely permanent. Therefore, we

suggest the government should reduce the rigidities of the labor market to control permanent unemployment in the economy, especially at the regional level. In addition, the government should consider the regional characteristics such economic, demographic, geographic, social, and political structure for decreasing and control of hysteresis in youth unemployment.

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