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

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Abstract

This paper examines the hysteresis hypothesis for youth unemployment at the urban, rural, regional, and overall level by using quarterly data in the period of 2005- 2020. In addition, the paper describes 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 overall levels. Second, we apply the IPS, Chio and Fisher methods to examine this test for thirty regions. Finally, the PANIC method is employed for identifying 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 overall level. Also, our empirical findings show the evidence of the existence of hysteresis in some regions. These results implicate supply side policies are effective to reduce youth unemployment at different levels.

Keywords: Labor market, Unemployment, Hysteresis, PANIC method.

JEL classification: J21 ,J64 ,C32 ,C33.

Highlights:

- 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, hysteresis in unemployment is the situation of unemployment that lasts in the economy. This characteristic of unemployment is discussed more in the theoretical and empirical macroeconomics and there is a growing academic argument about it. This phenomenon in the labor market happens due to scarring effect on unemployed workers and adjustments in the number of insiders in wage bargaining. These factors shift the aggregated demand that have long-term effects on unemployment (Ball and Onken, 2021). In the situation of hysteresis unemployment, the equilibrium level of unemployment rate will not attain. This means that an economic shock leads to an immediate effect on the labor market. This effect can lead to economic and social threats.

In the empirical literature, examining the hysteresis in unemployment has been studied by testing the hysteresis hypothesis (HH). Assessing the time series properties of unemployment rates is one of the methods for testing hysteresis hypothesis in the empirical literature. The findings of empirical testing about hysteresis hypothesis are incompatible and ambiguous.

Ledesma and McAdam (2003) employed monthly data for 12 CEE and 15 European countries for the period of 1991M1- 2001M4. The results rejected the hysteresis hypothesis. Garcia et al., (2005) applied the PANIC method to investigate the stochastic characteristics of unemployment rates for regions in Spain by using quarterly data. They did not reject the hysteresis hypothesis, which presents a common stochastic trend in the series of regions.

Chang et al. (2005) used a panel test for examining unemployment hysteresis in some European countries during 1991-1999. They found hysteresis phenomenon for all of the countries except Belgium and the Netherlands. Camarero and Tamarit (2006) employed panel tests to check unemployment hysteresis in 19 OECD countries over 1956- 2001 period. The results indicated that the unemployment rates had stationary property and the hysteresis hypothesis is rejected for almost all of the studied countries. Sephton (2009) tested the unemployment hysteresis in the US. He found unemployment rates in the US had stationary nature around a shifting trend. Cheng et al. (2012) investigated the stochastic nature of the unemployment rate by using the PANIC method for identifying 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) employed the panel tests to examine the hysteresis hypothesis in ten Central and Eastern European (CEE) countries. The results indicated that the unemployment rates in ten CEE countries had not property of reverting process, but they did not rejected the hysteresis hypothesis in the selected countries.

Gallegos et al. (2012) used the PANIC method for analyzing the existence of hysteresis in the thirty-two states of Mexico. They found the hysteresis in the common components of the series and in some of the idiosyncratic errors for each state. Kula and Aslan (2014) analyzed the hysteresis hypothesis in unemployment rates in Turkey. They found that characteristics unemployment rates in high and vocational high school are different from the overall unemployment rate. Furuoka (2014) studied the presence of unemployment hysteresis for the

14 regions of the Czech Republic. The findings of the ADF test indicated that series of unemployment rate in all 14 regions had property of a non-stationary process.

Akdogn (2016) employed linear and nonlinear unit root tests to examine the unemployment hypothesis for 31 European countries, the US and Japan. The results indicated that there is not hysteresis in unemployment for 60 percent of the studied countries. Bekmez and Ozpolat (2016) examined the hysteresis in unemployment for men and women separately using panel unit root tests. They found the hysteresis effect on unemployment is different both at the gender and country level.

Albulescu and Tiwari (2017) applied a series of bounded unit root tests to examine hysteresis in unemployment for eight European Union countries. The results indicated that the hysteresis hypothesis was not rejected in all selected countries. The results of Jum and Stockhammer (2018) as an empirical paper for EU 15 verified the existence of hysteresis in unemployment. Akay et al. (2020) showed that the validity of unemployment hysteresis for the majority of transition economics such as Bulgaria, Croatia, Poland, and Litivania. Ball and Onken (2021) studied the dynamics of unemployment and its natural rate for 29 OECD countries. The results revealed strong evidence of hysteresis.

In recent decades, the economic situation of Iran has been 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 important due to poverty, evolution and growth of unregulated economic activities, migration, and even violence are correlated with status of labor market such as unemployment rate. 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. Eisazadeh and Tabarsi (2013) investigated the unemployment hysteresis hypothesis using annual data during 1959-2011. The results indicated that the hysteresis hypothesis is not rejected when considering the multiple structural breaks in the unemployment rate. Akbari and Taei (2017) employed the first and second generations of panel unit root tests for examining the hysteresis effect in unemployment rate during 2005Q1-2015Q3. The results of first-generation test showed that unemployment rate has stationary property, while the second generation indicated that there is a non-stationary process and verifies the hysteresis effect in unemployment. Cheratian et al. (2021) analyzed the hysteresis test for different groups such as urban and rural, male and female, and age groups during 2001Q2-2020Q1. The results supported the hysteresis in unemployment rate in all cases. In this paper, we examine the hysteresis hypothesis for the youth unemployment rates at the urban, rural and overall levels, and then test the hysteresis hypothesis in regional unemployment rates (thirty provinces)¹.

1 - We added Alborz province to the data of Tehran province.

The innovation of this paper is related to consider 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 confront youth unemployment and its threats. Therefore, this research is important and useful at the empirical level.

This paper is formed 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 policy implications.

2. Literature Review

In the theoretical literature, there are many hypotheses about the behavior of the unemployment rate. The traditional natural rate theory approved the fluctuation of the unemployment rate around natural or equilibrium rate that leads to a fully equilibrated labor market. Therefore, the effect of shocks on unemployment rate is temporary and the unemployment rate goes back to its equilibrium level (Freidman (1968) and Phelps (1967, 1968)).

The developments of the labor market in the 1970s and 1980a leaded to the structuralist hypothesis as an alternative to the natural rate theory. This hypothesis emphasizes that the natural rate of unemployment shifts upward corresponding changes in structural economic factors such as slowdown in productivity growth, the rises in oil prices, and the changes in world interest rate (Hoon and Phelps (1997), Carruth et al. (1998), Phelps and Zoega (1998)). In this hypothesis, the effect of most shocks on unemployment will be temporary, but occasionally the natural rate permanently changes corresponding uncommon and large shocks. Blanchard and Summers (1986, 1987) focused on the hysteresis hypothesis since the unemployment rate in Europe steadily rising, while the US unemployment rate shifted to its pre-shock level. They emphasized that different institutional arrangements governing the functions of labor markets induce to considerable differences in the path of economies response to macroeconomic shocks, which is known as hysteresis hypothesis.

The hysteresis hypothesis signifies the path-dependence of unemployment rate as such as the significant correlation between current and past levels of unemployment, and is opposed to the natural rate hypothesis. Hysteresis in unemployment suggests dependency of equilibrium level of unemployment to the actual path of unemployment (Carlin and Soskice, 1990). In other words, cyclical fluctuations in an economy affect permanently the level of unemployment under the hysteresis hypothesis (Symth, 2003). This suggest that the government interventions are necessary to solve the unemployment problem, and without these interventions, a non-accelerating inflation rate of unemployment (NAIRU) will not attain in the long-term.

Several theoretical frameworks aimed to investigate hysteresis in unemployment. The membership theory is the most widely verified among them (Lindbeck and Snower, 1985;

Blanchard and Summers, 1986; Gregory, 1986). On the base of membership theory, the insiders in a firm determined mainly the wage setting rather than 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 and m^e are the actual and expected nominal money, respectively. Therefore, previous period employment plus a random disturbance form employment at a certain point in time. In Eq. (1), the unanticipated movement in the nominal money constructs the disturbance. This equation implies quite drastic as the formula assumes that the employment has a random walk process (Blanchard and Summers, 1986a).

Econometricians consider the hysteresis in unemployment as a near non-stationary process where NAIRU will not attain. This means that a unit root can be seen in the unemployment time series. Contrary to this viewpoint, the unemployment is a stationary process in the natural rate theory, which the NAIRU level of unemployment will be obtain. The persistence hypothesis is another hypothesis about the unemployment dynamics, which is similar to the hysteresis hypothesis due to the NAIRU will be obtain after many periods. In this hypothesis, unemployment could be investigated as a process that has near unit root (Smyth, 2003).

Considering many contradictory opinions about the behavior of the unemployment rate and serious socio-economic political consequences as results of persistence in unemployment, therefore, the question of whether existence of hysteresis in employment is an important topic in macroeconomic literature. In this study, on the bases of theoretical literature, we examine the hysteresis hypothesis in urban, rural, and 30 regions of labor market for Iran.

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 (1385) 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 data details that we used in this paper.

Table 1
Summary of unemployment rates details 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

Table 2
Summary of unemployment rates details 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	11.36	13.63	9.05	9.84
Median	8	9.6	11.93	12.37	13.75	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	12.22	9.67	9.60	11.24	14.36	11.2	10.31	12.23	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	15.32	9.11	13.75	16.82	9.85	10.16	9.8	11.76	8.41
Median	14.44	15.16	8.73	13.62	16.76	9.97	9.8	9.8	10.76	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).

3.2. Empirical model and testing

We employ a simple insider-outsider model to study the labor market for analyzing empirical evidences based on Blanchard and Summers (1986). Based on unemployment theory, hysteresis is a consequence of the distribution insider workers (currently employed) and outsiders (unemployed), which insiders have all the bargaining power.

Outsiders are depriving and setting of wages obtains ensuring the jobs of insiders. The reduced employment as consequences of shocks changes the number of insiders and leads to the equilibrium wage rate, sequentially, which induce to the hysteresis (Blanchard and Summers, 1986).

Let y_t as the aggregate demand, m_t as the money supply and p_t as 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 has the constant returns to scale property 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. The expectation of insiders is employment as a function of the past period employment, therefore, $n_t^E = \Phi n_{t-1}$, with $0 < \Phi \leq 1$. Aggregate supply equals demand in the equilibrium and we have:

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

Using 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 setting of wages is provided by the union in advance, $w_t = w_t^E$, and the expectations of union are such that $n_t^E = \Phi n_{t-1}$, therefore, we can write:

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

Considering the unexpected shocks to money supply includes a random or unexplainable property, we obtain $n_t = \Phi n_{t-1} + \varepsilon_t$, where ε_t is i.i.d. error term. From this theoretical base, we can consider the unemployment rate as a random walk process which shocks affects it, permanently, otherwise, if and only if $\Phi = 1$, the model would predict perdurability.

We assume that a stochastic representation for the unemployment rate. Let u_{it} be the regional unemployment rate $i \in [1, N]$ at time $t \in [1, T]$. The u_{it} means a unit root process in the framework of hysteresis hypothesis:

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

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

where Δ is the difference operator, $|\sum_{j=1}^k \alpha_{i,j}| < 1$, and $e_{i,t}$ has the property of a zero-mean white noise process. The joint Equations (5) and (6) can be 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) indicates that the long-term changes of the level of unemployment rate occurs through $(1 - \sum_{j=1}^k \alpha_{i,j})^{-1} e_{i,t}$ as consequence of a shock $e_{i,t}$ at time t . Assuming the property of permanent effect of the shock, the situation investigates the hysteresis in unemployment. On the other hand, the natural rate hypothesis indicates the short-living and eventually dying out the deviations of $u_{i,t}$ from u_i^* as the natural rate of unemployment of region i . That is, under natural theory, the level unemployment ($u_{i,t}$) reverts to equilibrium, which we can imply as a following stationary process:

$$u_{i,t} = u_i^* + \varphi_{i,t} \quad (9)$$

$$\varphi_{i,t} = \sum_{j=1}^{k+1} \beta_{i,j} \varphi_{i,t-j} + e_{i,t} \quad (10)$$

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

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

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

$$\Delta u_{i,t} = c_i - \lambda_i u_{i,t-1} + \sum_{j=1}^k \alpha_{i,j} \Delta u_{i,t-1} + e_{i,t} \quad (12)$$

where;

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

Eq. (12) is the regression of conventional ADF 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 study the hysteresis hypothesis in the unemployment rate in third steps. First, we use the HEGY and Conova Hansen (CH) 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 and 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 and Ng (2004) to test panel unit root in regional level. This technique adopts principal components method for calculating common factors for the panel as well as the determining an idiosyncratic error term for each series.

The basis of the PANIC method is decomposing the information in its common as well as idiosyncratic components. For this purpose, we consider the stochastic process for the unemployment rate as follows:

$$u_{it} = C_{it} + \gamma_i F_t + e_{it} \quad (13)$$

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.

The principal components approach is applied for estimation. When e_{it} is stationary, we can obtain the consistent estimator of f_t and γ_i , irrespective of the order of F_t . The estimator is inconsistent when e_{it} is integrated because of spurious property of a regression of $u_{i,t}$ on F_t . This problem is solved by employing the method of PANIC. This method is based on the principal component methodology to the first-differenced data as follows:

$$\Delta u_{it} = \gamma_i \Delta F_t + \Delta e_{it} \quad \text{for } t = 2, 3, \dots, T$$

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:

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

$$\hat{e}_{it} = \sum_s^t \Delta \hat{e}_{it} \quad (15)$$

4. Empirical Results

This section reports the empirical findings of hysteresis test in two steps, first, time series of youth unemployment rates at the urban, rural and overall 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 examine whether the youth unemployment rates have a unit root. The tests were failed to reject the null hypothesis of a unit root for youth unemployment rates. In other words, the empirical findings of individual linear unit roots test indicates that youth unemployment in Iran could be explained as a nonstationary process at the all 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, we cannot reject the null hypothesis.¹

Table 3
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.

In the second step analysis, we employed the individual root- IPS (Im, Pesaran and Shin, 2003), Fisher and Choi (2002) tests that results are presented in Table 4. The tests were able to reject the null hypothesis of unit root in the unemployment rates for thirty regions in panel form. Therefore, the unemployment rate in a panel of regions is stationary and it is in contrast to youth unemployment rate. The findings of unit root test for thirty regions show that unemployment rate in eight regions, namely West Azerbaijan, Khorasan Razavi, Khorasan Shomali, Fars, Kurdistan, Kermanshah, Ghilan, and Hamadan, are non-stationary at the 5% level and unemployment rate 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.

Table 4
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

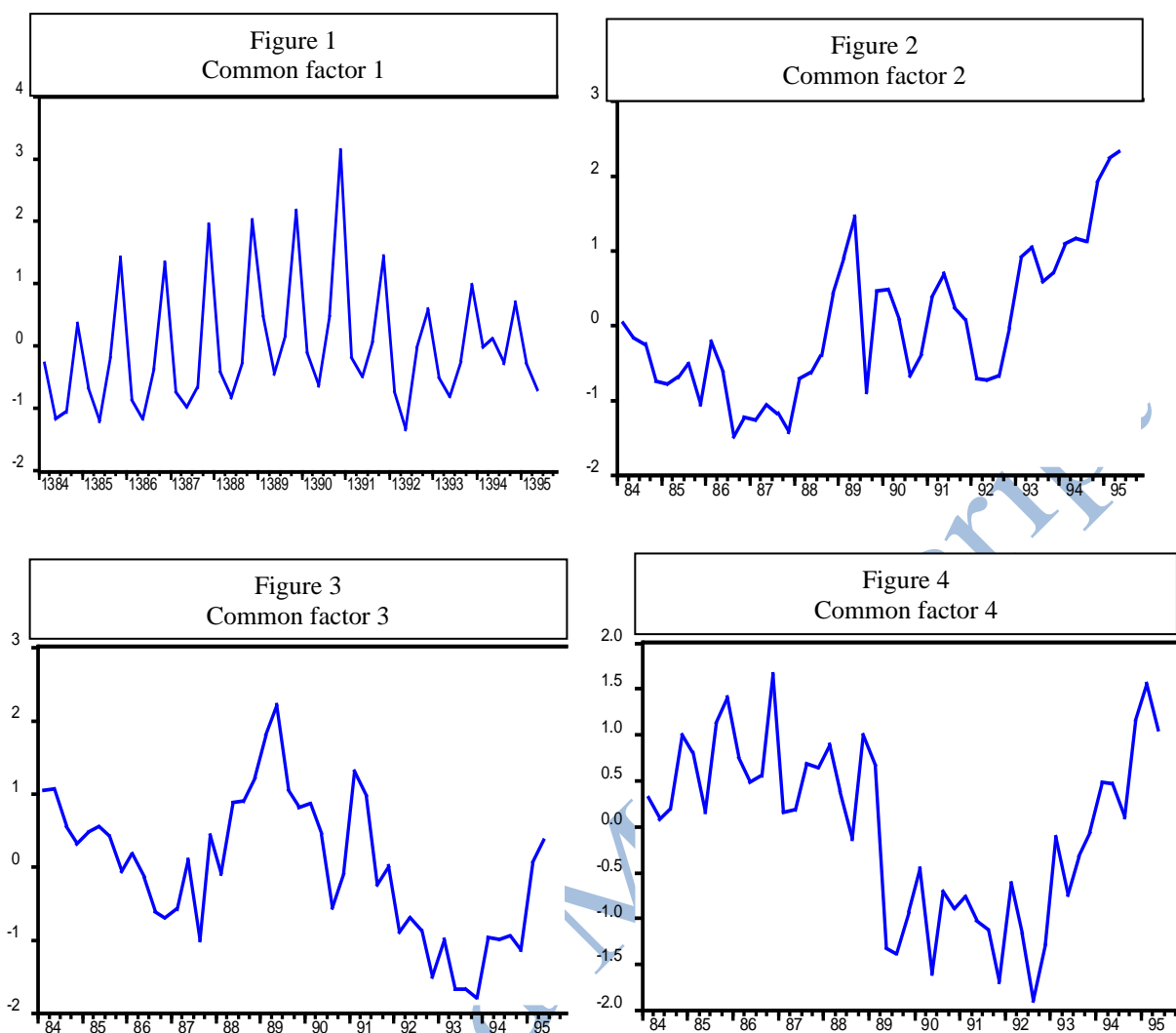
1 - We checked the stationary at none, trend, intercept and trend. Because the results are similar, we reported the results including intercept and trend.

	-12.47	0.00	-11.61	0.00	315.75	0.00	
Intermediate ADF test results on unemployment rates in region							
Regions	East Azerbaijan	East Azerbaijan	Ardabil	Esfahan	Elam	Bushier	Tehran
Statistic Prob.	-2.84 (0.06)	-2.2 (0.2)*	-5.2 (0.00)	-2.75 (0.07)**	-2.76 (0.07)**	-4.91 (0.00)	-3.27 (0.02)
Regions	Chahar Mahal	Khorasan South	Khorasan Razavi	Khorasan North	Khuzestan	Zanjan	Semnan
Statistic Prob.	-4.16 (0.00)	-4.04 (0.00)	-2.47 (0.12)*	-1.16 (0.68)*	-3.93 (0.00)	-6.2 (0.00)	-5.58 (0.00)
Regions	Sistan & Baluchistan	Fars	Qazvin	Qom	Kurdistan	Kerman	Kermanshah
Statistic Prob.	-6.83 (0.00)	-1.5 (0.47)*	-5.06 (0.00)	-4.93 (0.00)	-1.11 (0.69)*	-3.81 (0.00)	-0.95 (0.76)*
Regions	Kohkiloye	Golestan	Gilan	Lorestan	Mazandaran	Markazi	Hormozghan
Statistic Prob.	-5.18 (0.00)	-3.64 (0.00)	-0.63 (0.85)*	-3.83 (0.00)	-3.82 (0.00)	-4.66 (0.00)	-4.28 (0.00)
Regions	Hamadan	Yazd					
Statistic Prob.	-1.43 (0.55)*	-2.87 (0.05)					

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

In the third step, we applied the PANIC method for unemployment rate in regions. We used the differentiated and standardized time series through the method of principal component for calculating common factors (Figures 1 to 4). Then, we implied equaling the Eigen value method to one, and concluded the existence of eight common factors that explain over the 72% percent information, aggregately. In addition, we employed the selection criteria proposed by Bai & Ng (2002), and obtained four common factors that explain 56% information of the panel data.¹

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.



Finally, we re-accumulated the common factors and applied the HEGY unit root test to each one of the four factors, which Table 5 represents the results of the test. All the factors have property of non-stationary and are stationary in first difference, which indicates the existence of hysteresis existence in the common components.

Table 5
Unit root test for common factors

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

We estimated the idiosyncratic error and its re-accumulation. The analyzing stationary tests on the idiosyncratic error in regions indicates 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). Therefore, the hysteresis phenomenon in ten regions is affected not only aspect to its common factors but also is a result of regional properties.

Table 6
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	Hormozghan	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

5. Conclusion and Discussion

The theory of hysteresis in unemployment as an important research topic in macroeconomic literature entails the important policy implications for economies. In this study, we examined the existence of the hysteresis in unemployment at the urban, rural, regional, and overall level. We employed the HEGY (1990) and CH (1995) tests for time series, and the IPS, Chio, ADF-Fisher and PANIC tests for panel data to obtain the empirical analysis.

The findings resulted from the HEGY and CH tests, indicate youth unemployment rates at the urban, rural and overall level could be explained as a non-stationary process, except for the youth unemployment at the urban level by the ADF test. These results indicate we cannot reject the hysteresis phenomenon in Iran's labor market. This situation presents the fact that the evaluating youth unemployment in Iran is unstable over time; which it cannot satisfy the consent of a natural unemployment rate theory in the long-term. Particularly, we can conclude when an economic shock happens, the youth unemployment takes a long time period to revert to its trend level in Iranian economy.

The results of the IPS, Chio, and ADF-Fisher tests verify that hysteresis hypothesis cannot be rejected in some regions such as West Azerbaijan, Khorasan Razavi, Khorasan Shomali, Fars, Kurdistan, Kermanshah, Ghilan, and Hamadan. These results, also, indicate that the hysteresis phenomenon in regional unemployment (by using PANIC method) is due to the common factors of the variable as well as idiosyncratic properties for each region. These findings verify 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), Ozpolat (2016), and Ball and Onken (2021). The results obtained important insights for policy makers about Iranian labor market. The hysteresis problem indicates that monetary and fiscal policy induce prolonged impacts on the unemployment rates at the urban, rural, and overall level. A noteworthy implication of these findings is that global or domestic shocks upon the urban and rural labor markets would not have impermanent effects. Therefore, the supply side policies are valid 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 findings give some important policy implications for reducing unemployment rates at the regional level. In short, to fight against hysteresis phenomenon in some regional unemployment, it is necessary to employ policies for reducing the sluggishness in the Iranian labor market and for adjusting the common component of the regional unemployment rates. The important rigidities in regional labor, and goods and services markets prevent regional unemployment rates from reverting to pre-shock levels, which improve the permeant property in unemployment rate. 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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