The Unemployment-Labor Force Participation Linkage in Iran's Women Labor Market

Abstract

Purpose - During recent years, the long-run relationship between the unemployment rate and the labor force participation rate has been examined in depth in developed and developing economies. This paper explores this relationship for Iranian women in 31 provinces from 2005Q2 to 2019Q1.

Approach - In order to examine the existence of a long-run relationship between female LFP and UR, the time series cointegration approach has been used. Furthermore, regarding the low power of the univariate cointegration approach, we consider a panel version of the cointegration tests developed by Westerlund (2006).

Findings - The findings show that in 25 provinces there is no long-run equilibrium relationship between female unemployment and participation rate. The results of the panel cointegration test also reveal no long-run relationship between the two variables. Therefore, the unemployment invariance hypothesis is supported for the case of women in Iran.

Originality/Value - This study investigates whether the unemployment invariance hypothesis holds for Iran which it has not been analyzed before for the Iranian labor market. Moreover, the study adopts a regional approach, which takes into account the huge regional differences in Iran.

Keywords: Unemployment, Labor force participation, Unemployment invariance hypothesis, Cointegration, Women, Iran.

JEL CODE: E24,J21,J64.

1. Introduction

The Iranian labor market is characterized by high unemployment and low participation rates, particularly among women. According to the latest labor force survey (LFS) report, female unemployment rate has increased from 17.1% in 2005 to 18.9% at the end of 2018, while the male unemployment rate rose only from 10.0% to 10.4% during the same period. At the same time, female economic participation rate has dropped from 17.0% to 16.1% compared to a nearly constant trend for male participation rate (from 64.7% to 64.8%). Female labor force participation rate is not only very low in comparison with their male counterparts, but also it appears to be much lower than the average of the MENA (20%) and OECD (52%) countries and it is well below the corresponding rate in neighbor countries such as Afghanistan (49%) and Pakistan (24%) (World Bank, 2018). In Iran, employers usually try to avoid hiring women and providing the same employment benefits as their male counterparts. Also, the high unemployment rate has a discouraging effect on women searching for job opportunities (Mollahosseini, 2008). This paper attempts to get more insight into the unemployment-participation rate nexus debate by focusing on Iranian women labor market idiosyncrasies.

The analysis of the relationship between unemployment and participation rate has been a growing concern for national and regional governments when designing labor market policies. On the one hand, the discouraged-worker effect changes the labor force participation over time and over business cycles, so that the informational value of the unemployment rate may be unreliable as an indicator of the labor market situation (Tansel & Ozdemir, 2018).On the other hand, the unemployment invariance hypothesis asserts that any exogenous permanent shock in the total factor productivity, capital stock, or labor force supply has no effect on the long-run unemployment rate (Karanassou & Snower, 2004), because the external effects are offset by the labor market responses such as wage settings or labor demand and supply (Gumata & Ndou, 2017).

In this context, along with political considerations, a growing body of empirical literature has focused on the unemployment-participation rate nexus in both developed and developing countries. However, the current evidence produced mixed and controversial results. For instance, the unemployment invariance hypothesis is not verified for Sweden (Österholm, 2010) and the United States (Emerson, 2011), whereas Tansel et al. (2016) and Oţoiu &Ţiţan (2016) find no long-run relationship between those variables, which supports the unemployment invariance hypothesis for Turkey and Romania respectively.

Our paper extends current empirical literature by presenting new evidence of the long-run relationship between women unemployment and participation rate in Iran. More specifically, we investigate whether the unemployment invariance hypothesis holds for Iran and compare the behavior of women labor market with other developed and developing economies. Furthermore, we adopt a regional approach, which takes into account the huge regional differences in Iran. Also, Iranian provinces are proven to be units that are close to the concept of local labor markets, which is the territorial dimension that matters to firms and workers (Cheratian et al., 2019).

In Iran, women unemployment and participation rates depend on social and cultural norms as well as structural and socioeconomic factors. Historically, after the 1979 revolution and due to the eight years' war with Iraq, public policies encouraged women to limit their participation in economic activities and placed them within the family. During the war years and due to the decline in economic activity, men have been given priority over women in securing jobs (Alaedini & Razavi, 2005). Furthermore, since the 1990s, increasing trend of women enrollment in higher education that postponed their entry into the job market along with higher restrictions to access suitable job opportunities have had a negative impact on women unemployment in particular and in economic activity in general.

Despite its importance, the unemployment-participation rate relationship has not been analyzed for the Iranian labor market in contrast to the growing attention that it has received in developed and developing countries. Therefore, to fill this gap, we investigate the long-run relationship between women unemployment rate and participation rate in Iranian provinces by using data from 2005Q2 to 2019Q1. Our findings show that in 25 provinces (out of 28) there is no long-run equilibrium relationship between women unemployment and participation rate. This result is robust along different specifications and various panel cointegration tests. Therefore, unlike developed economies, the unemployment invariance hypothesis is supported for women labor market in Iran.

The structure of the paper is as follows. In section 2 we expose the theory and literature review. In Sections3 and 4 we describe the data and methodology, while in the next section we present and analyze the econometric results. We conclude by discussing the policy implications in section 6.

2. Unemployment and labor force participation: Theory and evidence

Both policy makers and academics are extremely concerned on reducing unemployment rate and exploring which policy is the best to reduce it in the long run. For example, policies that induce an increase in the capital stock or in the labor productivity (such as R&D policies or training programs) may induce firms to employ new workers. Besides, variations in the number of active population may also affect long run unemployment rate (unemployed/active population). This may be the case when retirement conditions are modified, when former inactive population decide to enter into the labor market (additional worker effect), or when unemployed people decide to stop their job search (discouraged worker effect).

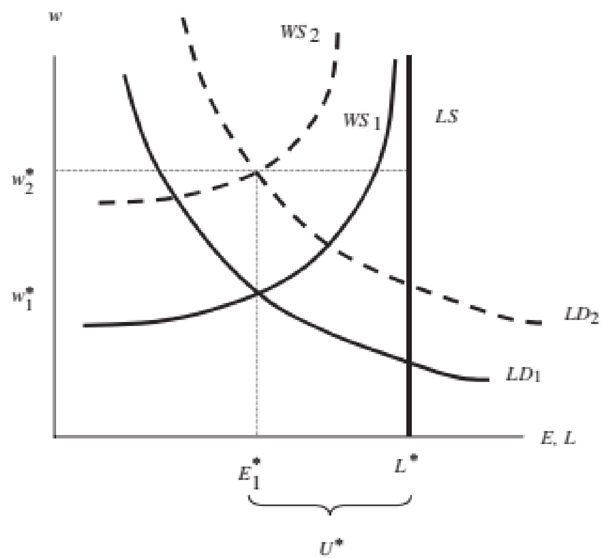
However, unemployment rates in OECD countries seem trendless over the past century even though capital stock, total factor productivity and labor force have grown (Karanassou & Snower, 2004). Scholars have sought for an explanation of this phenomenon, which has led to the so called "unemployment invariance hypothesis" (Layard, et al., 2005). It states that the behavior of the labor market by itself ensures that the size of the capital stock, total factor productivity and the size of labor force do not affect unemployment in the long run. According to Figure 1, this implies, for example, that changes in labor demand curve (LD) due to capital accumulation or technological advance are offset by changes in the wage setting curve (WS), remaining the unemployment rate constant[1].

This hypothesis is relevant not only for policy issues, but also for academic reasons. From the initial contributions that suggest this phenomenon (Layard et al., 2005), macroeconomic labor market models usually impose restrictions that assure the unemployment invariance, in both theoretical and empirical studies. From this seminal contribution, two strands of literature have emerged. On the one hand, some authors aim to prove that the mechanisms that assure the unemployment invariance in the long run do not come solely from the labor market, but other markets may be jointly responsible for this phenomenon (Karanassou & Snower, 2004). This implies that invariance restrictions do not have to be imposed, necessarily, to the functioning of labor markets in theoretical models. On the other hand, a group of empirical studies delved into the long-run relationship between unemployment rate and labor force participation rate by means of cointegration analysis. Interestingly, results are

[1] Labor demand curve (LD) shows the aggregate employment at any given real wage, wage-setting curve (WS) shows the equilibrium real wage at any given aggregate employment level, and labor supply curve (LS) shows the size of the labor force at any given real wage. WS coincides with LS if the labor market clears, but if it does not – for efficiency wage, insider–outsider, labor union or other reasons – WS lies to the left of LS (Karanassou & Snower, 2004). In the figure, E^*_1 refers to the equilibrium employment level and U* to the equilibrium unemployment level.

inconclusive as they strongly depend on the country: while a robust long-term relationship between these two variables was found for Sweden, Japan, Canada and the United States (US), the empirical evidence sustains the invariance hypothesis for Turkey, Romania, Australia and Spain (Table 1).

Figure 1. The unemployment invariance hypothesis



Source: Karanassou & Snower (2004)

In addition, most of these contributions use both aggregate and gender-specific data. Despite there are usually no differences among aggregated results and results by gender, female unemployment rate has some particular features in Japan and Spain. This means that labor policies designed to change the labor participation rate, the labor productivity or the capital stock may have distinct effects by gender. Besides, when a long-run relationship between unemployment rate and labor force participation rate exists, evidence on both added worker effect and discouraged worker effect was found, alternatively, for male and female data.

At last, most of these contributions ignore the regional perspective within a single country, and only Liu (2014), Apergis & Arisoy (2017) and Palamuleni (2017) examine this relationship from a geographical location perspective (Table 1). A regional breakdown may shed light into the inconclusive results that literature has provided so far, and may also provide useful information for labor policy design. That is, if the evidence on the unemployment invariance differs among regions, a more regional design could be appropriate. However, if there is a long run relationship between these variables across regions, a more centralized policy would be recommended.

Table 1. Literature review on unemployment-labor force participation relationship

Author(s) and Year	Sample size and Time period	Econometric method	Unemployment invariance hypothesis
		Developed countries	
Österholm (2010)	Sweden (1970m1-2007m4)	Johansen cointegration	Rejected
Emerson (2011)	US (1948m1-2010m2)	Johansen cointegration	Rejected
Kakinaka & Miyamoto (2012)	Japan (1980Q1-2010Q4)	Johansen cointegration	Rejected for men Supported for women
Ozerkek (2013)	European countries (1983-2009)	Panel cointegration	Rejected for women Supported for men
Liu (2014)	Japan (1983-2010)	Panel cointegration	Rejected
Kleykamp & Wan (2014)	US (1948m1-2013m8)	Threshold cointegration	Rejected
Nguyen Van (2016)	Australia (1978m2-2014m12)	VAR	Supported
Palamuleni (2017)	US (1976-2015)	Panel cointegration	Rejected
Apergis & Arisoy (2017)	US (1976-2014)	Panel cointegration	Rejected
Nemore (2018)	Italy (1998m1-2014m12)	Johansen cointegration	Rejected
Tansel & Ozdemir (2018)	Canada (1976Q1-2015Q4)	Multivariate cointegration	Rejected
Altuzarra et al. (2019)	Spain (1987Q2-2016Q4)	Johansen cointegration	Rejected for women Supported for men
		Developing countries	
Yildirim (2014)	Turkey (1989Q1-2012Q2)	ARDL and cointegration	Rejected for better-educated women Supported for less-educated women
Tansel et al. (2016)	Turkey (1988Q1-2013Q4)	Multivariate cointegration	Supported
Oțoiu & Țițan (2016)	Romania (1996-2012)	Johansen cointegration	Supported
Gumata & Ndou (2017)	South Africa (2000Q1-2016Q1)	Johansen cointegration & VAR	Rejected
Arisoy (2018)	Turkey (2000Q1-2011Q3)	ARDL and Gregory and Hansen cointegration	Supported

3. Data

We employ seasonally adjusted data on the Iranian female unemployment rate (UR) and labor force participation rate (LFP) for 31 provinces over the period 2005:Q2-2019:Q1. Data are taken from the Labor Force Survey (LFS) carried out by the Statistical Center of Iran (SCI). The LFS was first conducted in 2005 and since then it was regularly conducted in the middle month of each season.[2] According to the SCI definition, the unemployment rate is the ratio of unemployed population aged 15 and above to the economically active population at age 15 and above, multiplied by 100. Furthermore, labor force participation is defined as the ratio of economically active population at age 15 and above to the total population at the same age, multiplied by 100. A data summary is provided in Table 2. A descriptive analysis of research variables shows that the highest mean of LFP (22.8) is in Ardebil, whereas lowest mean (10.6) and volatility (1.4) (defined as Std.Dev.) are in Qom. It is also noted that the Sistan province is very volatile in terms of female participation rate (6.3). In addition, Kohkiloyeh has the highest mean (33.2) and volatility (9.5) of UR. However, the lowest mean (10.6) and the least volatility (3.2) are found in West Azerbaijan province.

Table 2. Summary statistics

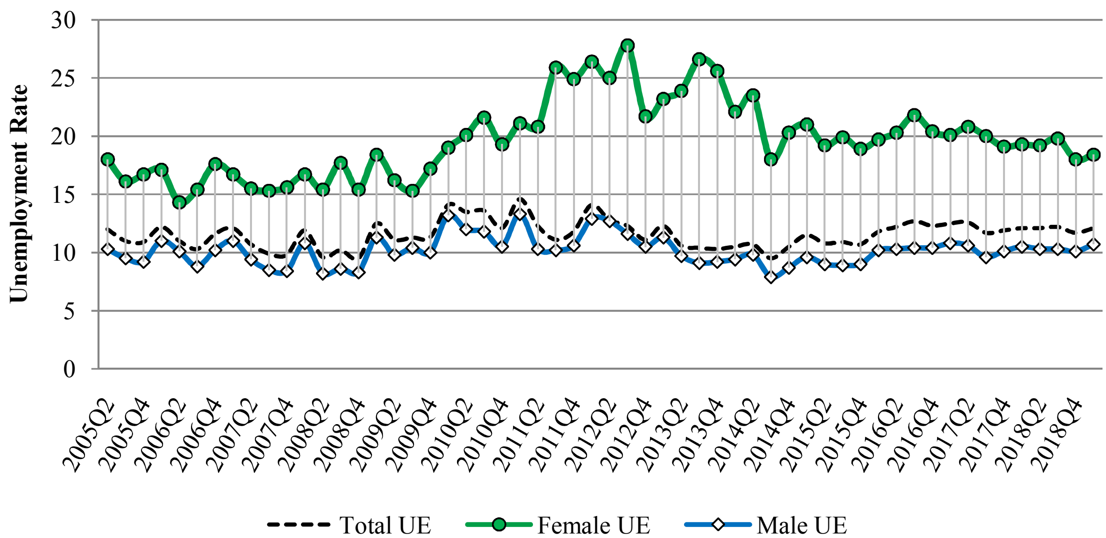
Provinces	LFP					UR				
	Mean	Median	Max.	Min.	Std. Dev.	Mean	Median	Max.	Min.	Std. Dev.
E. Azerbaijan	20.2	19.1	30.9	14.3	4.6	12.2	11.3	25.6	3.4	4.9
W. Azerbaijan	18.5	18.9	23.4	13.4	2.6	10.6	10.4	17.5	4.9	3.2
Ardebil	22.8	21.8	31.7	16.5	3.6	13.9	13.9	20.2	5.9	3.5
Alborz	12.3	12.2	15.6	9.7	1.5	28.7	28.3	38.6	19.3	4.7
Isfahan	18.0	17.4	25.4	13.1	2.5	21.6	22.8	35.8	13.5	4.5
Ilam	17.9	17.2	25.5	12.5	3.0	22.6	22.2	35.9	13.1	5.7
Bushehr	12.7	12.8	16.9	9.0	1.8	15.2	14.3	26.7	6.8	4.7
Tehran	13.7	13.8	17.8	8.1	2.3	20.7	21.0	27.1	10.6	3.8
Bakhtiari	14.2	14.0	24.7	7.8	2.9	21.8	22.2	31.4	9.0	4.9
S. khorasan	22.4	21.7	36.2	15.2	4.7	14.7	14.9	26.1	5.4	4.4
R. khorasan	18.9	19.1	28.5	9.6	3.7	14.8	13.7	26.3	5.4	4.7
N. khorasan	20.5	19.9	28.7	13.3	4.2	12.4	12.0	22.0	6.4	3.7
Khuzestan	13.1	13.4	17.6	8.0	2.5	22.9	22.4	32.1	11.0	4.6
Zanjan	20.7	20.7	29.5	12.7	4.9	13.0	12.4	27.3	5.1	4.2
Semnan	13.2	12.7	20.5	8.2	2.9	18.5	18.4	35.0	7.6	5.9
Sistan	14.2	11.8	30.6	6.4	6.3	12.7	12.6	24.0	2.2	5.8
Fars	14.1	14.5	18.6	8.3	2.4	24.7	23.6	39.5	10.4	6.9
Qazvin	14.4	14.6	20.6	8.0	2.6	16.0	16.0	26.3	6.6	4.7
Qom	10.6	10.8	13.9	7.8	1.4	18.9	18.6	34.0	7.4	5.5
Kurdistan	15.2	15.3	20.1	10.9	1.9	16.8	17.1	29.0	5.8	6.2
Kerman	14.4	13.3	26.3	8.3	4.3	23.6	23.8	47.8	10.5	7.7
Kermanshah	14.5	14.1	20.9	8.5	3.0	21.9	22.0	29.1	10.3	4.1
Kohkiloyeh	12.4	9.9	22.8	4.9	5.2	33.2	34.0	56.4	16.9	9.5
Golestan	18.9	17.6	30.1	13.1	4.0	17.8	15.5	30.9	4.4	6.4
Gilan	20.1	19.8	28.2	14.5	2.9	20.9	20.0	30.1	12.1	4.6
Lorestan	13.1	12.6	20.7	8.2	2.7	27.0	25.3	40.4	15.0	6.1
Mazandaran	15.8	16.3	21.2	10.0	2.6	23.9	23.6	39.3	12.6	6.0
Markazi	10.8	10.4	18.0	6.4	3.0	17.1	17.5	32.5	4.8	5.2
Hormozgan	12.9	10.8	25.2	6.5	4.5	14.8	14.5	35.0	4.4	6.4
Hamedan	15.1	15.1	22.4	8.3	3.4	14.0	12.9	30.2	5.0	5.3
Yazd	16.6	16.0	25.5	9.2	5.0	19.0	17.6	32.7	6.5	7.0

Figure 2 depicts the trend in the gender unemployment gap in Iran. Remarkably, female unemployment rate is consistently higher compared to the male unemployment rate all over

[2]The Iranian year begins on March 21st of the Christian year and ends on March 20th of the next year. Therefore, to convert the Iranian year to the Christian one, we consider the beginning of our sample to be the second quarter of 2005.

the sample period. Also, the unemployment crisis has deepened and the gender unemployment gap rises significantly after 2011.

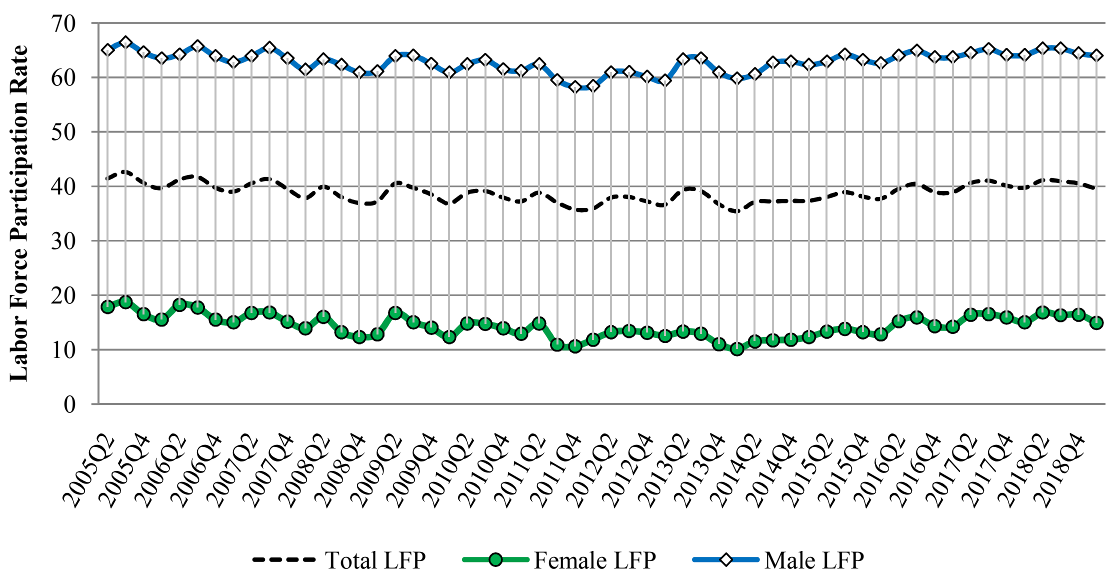
Figure 2. Trends of female and male UR in Iran (2005Q2-2019Q1)



Source: Statistical Center of Iran (different years)

In contrast, female LFP is significantly lower than male LFP (Figure 3). It seems that the LFP measures the root cause of this crisis. Besides, as female LFP never exceeds 20 percentage points while male LFP is hardly inferior to 60 percent, their differences never vanished during the period.

Figure 3. Trends of female and male LFP in Iran (2005Q2-2019Q1)



Source: Statistical Center of Iran (different years)

4. Estimation strategy

4.1. Time series cointegration test

In order to examine the existence of a long-run relationship between female LFP and UR in a cointegration framework, we apply the vector error correction (VEC) model to these variables by using seasonal time series data for each province. VEC model allows the endogenous variables to converge to a long-run equilibrium and it also includes short-run adjustment dynamics in the analysis. It is a restricted vector auto-regression (VAR) model which can be written as follows:

$$y_t = \alpha + \sum_{i=1}^{k} A_i\, y_{t-i} + \varepsilon_t \qquad (1)$$

where y_t is an n-vector of variables to be examined. ε_t is independent, identically distributed random disturbance term. Equation (1) can be rewritten as:

$$\Delta y_t = \alpha + \pi y_{t-1} + \sum_{t=1}^{k-1} r_i\, \Delta y_{t-i} + \varepsilon_t \qquad (2)$$

where $\pi = \sum_{i=1}^{k} A_i - I$ and $r_i = -\sum_{j=i+1}^{k} A_j$. π has a rank $r(0 \leq r < n)$ where r is the number of cointegrating vectors.We have $\pi = \alpha\beta'$ and $\beta' y_t$ are stationary. As represented by Österholm (2010),β is the $n \times r$ matrix of rank r,being its elements the cointegrating parameters; whileα is the $r \times n$ matrix of rank r, being its elements the adjustment parameters (error-correction terms).

Hjalmarsson & Österholm (2010) further caution that traditional cointegration tests, such as Johansen's trace and maximum eigen value tests (Johansen, 1988; 1995), have size distortions when series have near unit roots. Thus, they suggest testing the two restrictions on the cointegrating vector β such that $\beta = (1\ 0)'$ and $\beta = (0\ 1)'$. If these restrictions are rejected, cointegration is supported. If both of them (if at least one of them) cannot be rejected, cointegration is not supported and it may be due to a single stationary variable.

Afterwards, we consider the short-run dynamics in the relationship between UR and LFP. We test the following restrictions on the error-correction terms of the VEC model. They are $\alpha = (\alpha_1\ 0)'$ and $\alpha = (0\ \alpha_2)'$. The first restriction suggests that the LFP does error correct but the UR does not, while the second restriction implies the opposite. Therefore, if the variables prove to have a cointegrated relationship then the unemployment invariance hypothesis will not be supported.

4.2. Panel cointegration test

In addition to the individual time series analysis, we test the panel cointegration for the country. We use Kao (1999) panel cointegration test, which proposes residual-based DF and ADF tests. It is based on the assumption of homogeneity across panels with:

$$X_{it} = \alpha_i \times Y_{it}\beta + \omega_{it} \ (3)$$

where $i = 1, \ldots, N$ and $t = 1, \ldots, T$. α_i is an individual constant term, β is the slope parameter, ω_i is a stationary distribution term, X_{it} and Y_{it} are integrated processes of order

I(1) for all i. Kao (1999) derives two (DF and ADF) types of panel cointegration tests. Both tests can be calculated from:

$$\overline{\omega}_{it} = \rho\overline{\omega}_{it-1} + V_{it} \qquad (4)$$

and

$$\overline{\omega}_{it} = \rho\overline{\omega}_{it-1} + \sum_{j=1}^{\rho} \emptyset_j \Delta\overline{\omega}_{it-j} + V_{it} (5)$$

The null hypothesis is $H_0: \rho = 1$ (no cointegration), while the alternative hypothesis is $H_1: \rho < 1$. For the next step, the second-generation panel cointegration test of Westerlund (2007) is employed, which includes cross-section dependence in the cointegration equation. It is designed to test the alternative hypothesis that the panel is cointegrated as a whole (panel tests: P_t and P_a), whereas the other two test the null hypothesis of no cointegration against the alternative that at least one element in the panel is cointegrated (group-mean tests: G_t and G_a). This test assumes the following data generating process:

$$\Delta y_{it} = \delta'_i d_t + \alpha_i\left(y_{i,t-1} - \beta'_i x_{i,t-1}\right) + \sum_{j=1}^{p_i} \alpha_{ij}\Delta y_{i,t-j} + \sum_{j=-q_i}^{p_i} y_{ij}\Delta x_{i,t-j} + e_{it} \qquad (6)$$

where $t = 1, \dots, N$ and $i = 1, \dots, N$ index the time-series and cross-section units respectively, and d_t contains the deterministic components. Moreover, Westerlund (2007) employed the bootstrap method used by Chang (2004). Thus, the equation (6) can be re-written as:

$$\Delta y_{it} = \delta'_i d_t + \alpha_i y_{i,t-1} + \lambda'_i x_{i,t-1} + \sum_{j=1}^{p_i} \alpha_{ij}\Delta y_{i,t-j} + \sum_{j=-q_i}^{p_i} y_{ij}\Delta x_{i,t-j} + e_{it} \qquad (7)$$

where $\lambda'_i = -\alpha_i\beta'_i$. The parameter α_i determines the speed at which the system corrects back to the equilibrium relationship $y_{i,t-1} - \beta'_i x_{i,t-1}$ after a sudden shock. Thus, the null hypothesis of no cointegration can be implemented as $H_o: \alpha_i = 0\ \forall i$. The alternative hypothesis depends on what is being assumed about the homogeneity of α_i.

5. Empirical results

5.1. Regional Analysis

Our analysis begins with the examination of the stationary properties of the variables by employing a battery of unit root tests. If the series are integrated of the same order one can proceed with the cointegration tests. However, there are a variety of unit root tests that sometimes yield conflicting results. In order to have robust results, we examined three different unit root tests, namely Augmented Dickey-Fuller test with GLS detrending test (Elliott et al., 1992), the KPSS test (Kwiatkowski et al., 1992) and Ng-Perron test (Ng & Perron, 2001). The DF-GLS and NP tests assume nonstationarity under the null hypothesis whereas the KPSS test assumes stationarity under the null hypothesis. Table 3 reports the results for both variables. We conclude that the null hypothesis of nonstationarity cannot be rejected for all samples, except for Ilam, Khuzestan and Lorestan provinces.

Table 3. Unit root test

provinces	LFP						UR					
	DF-GLS	KPSS	NP (MZa)	NP (MZt)	NP (MSB)	NP (MPT)	DF-GLS	KPSS	NP (MZa)	NP (MZt)	NP (MSB)	NP (MPT)
E. Azerbaijan	-1.18	24.1*	-2.70	-1.00	0.37	8.52	-1.10	12.04*	-1.75	-0.69	0.39	10.84
W. Azerbaijan	-1.71	8.56*	-5.54	-1.59	0.28	4.62	-2.02*	4.75*	-6.56	-1.72	0.26	4.01
Ardebil	-1.08	20.03*	-2.33	-0.93	0.40	9.58	-1.04	5.81*	-0.84	-0.43	0.51	16.81
Alborz	-1.07	4.92*	-2.96	-1.16	0.39	8.15	-0.68	5.69*	-1.15	-0.75	0.65	20.91
Isfahan	-0.79	11.2*	-1.19	-0.75	0.63	19.89	-1.74	9.02*	-4.13	-1.43	0.34	5.92
Ilam	-0.62	29.25*	-1.34	-0.68	0.50	14.77	-2.86*	0.97*	-12.5*	-2.46*	0.19*	2.09*
Bushehr	0.00	18.48*	-0.37	-0.30	0.79	34.58	-0.99	3.41*	-1.03	-0.49	0.48	14.95
Tehran	-1.19	6.13*	-3.17	-1.08	0.34	7.50	-0.79	5.74*	-1.07	-0.55	0.51	15.95
Bakhtiari	-1.09	6.36*	-2.31	-0.89	0.38	9.42	-1.34	3.56*	-3.12	-1.22	0.39	7.80
S. khorasan	-1.75	11.0*	-5.04	-1.58	0.31	4.86	-1.78	1.80*	-5.37	-1.63	0.30	4.58
R. khorasan	-1.43	3.82*	-4.81	-1.54	0.32	5.10	-1.07	24.84*	-2.68	-1.15	0.42	9.11
N. khorasan	-0.96	36.0*	-1.08	-0.65	0.60	19.20	-1.35	3.92*	-4.37	-1.45	0.33	5.63
Khuzestan	-0.82	5.15*	-3.05	-1.06	0.34	7.72	-3.37*	0.94*	-19.5*	-2.99*	0.15*	1.72*
Zanjan	-1.27	55.14*	-1.82	-0.95	0.52	13.37	0.30	5.99*	0.35	0.33	0.95	56.26
Semnan	-1.56	12.97*	-5.01	-1.55	0.30	4.96	-0.12	14.55*	-0.91	-0.54	0.59	19.74
Sistan	-1.50	8.13*	-4.00	-1.41	0.35	6.11	-0.96	19.04*	-2.34	-0.95	0.40	9.67
Fars	-2.79*	0.74*	-12.15	-2.46	0.20	2.01	-1.68	2.88*	-6.29	-1.68	0.26	4.18
Qazvin	-0.97	2.77*	-2.43	-1.07	0.44	9.88	-1.22	7.29*	-0.95	-0.59	0.61	20.61
Qom	-1.56	1.15*	-6.10	-1.74	0.28	4.01	-3.09*	1.29*	-12.27	-2.45	0.19	2.09
Kurdistan	-1.34	4.38*	-4.28	-1.40	0.32	5.80	-1.19	62.14*	-1.26	-0.71	0.56	17.00
Kerman	-1.67	4.46*	-4.40	-1.48	0.33	5.55	-2.36*	0.99*	-7.76	-1.94	0.25	3.25
Kermanshah	-0.10	36.24*	-0.49	-0.23	0.47	16.52	-1.52	7.00*	-4.00	-1.41	0.35	6.12
Kohkiloyeh	-0.73	10.13*	-1.37	-0.78	0.56	16.52	-0.90	6.64*	-5.42	-1.52	0.28	4.84
Golestan	0.14	76.52*	0.35	0.29	0.84	44.99	-1.97*	7.14*	-7.24	-1.90	0.26	3.38
Gilan	-1.09	7.08*	-2.19	-0.94	0.43	10.37	-0.56	14.72*	-0.89	-0.34	0.38	12.27
Lorestan	-0.12	32.75*	-0.08	-0.06	0.67	28.52	-2.40*	1.51*	-10.1*	-2.13*	0.20*	2.88*
Mazandaran	-1.61	2.13*	-4.36	-1.45	0.33	5.64	-1.08	19.11*	-0.71	-0.38	0.53	17.99
Markazi	0.09	31.12*	-0.11	-0.09	0.76	34.81	0.00	33.80*	-0.00	-0.00	1.03	59.08
Hormozgan	-0.55	45.65*	-1.33	-0.79	0.59	17.57	-1.14	9.26*	-2.20	-1.02	0.46	10.9
Hamedan	-1.63	8.94*	-5.13	-1.58	0.30	4.80	-1.38	5.94*	-4.95	-1.41	0.28	5.31
Yazd	-0.80	11.20*	-1.52	-0.87	0.57	16.05	-0.64	54.9*	-1.12	-0.58	0.51	15.85

Notes: ADF-GLS is the test statistic from the Elliot, Rothenberg, Stock Dickey–Fuller with GLS detrending. KPSS is the test statistic from the Kwiatkowski, Phillips, Schmidt, and Shin test. Ng & Perron (2001) tests, which offer four test statistics, based on GLS de-trended data. The lag length (in levels) is selected according to the modified Akaike information criterion. * indicates significance at 5% level.

Given the results of unit roots, we next establish Johansen's (1988, 1991) maximum eigen-value and trace tests. This analysis is restricted to 28 provinces for which we can examine the existence of a long-run relationship among LFP and UR (Ilam, Khuzestan and Lorestan provinces are excluded due to the results of the unit root tests).

According to Table 4, only one cointegrating vector is supported in 16 provinces. This suggests that there is a long-run relationship between LFP and UR in East Azerbaijan, Ardebil, Alborz, Isfahan, Bushehr, Tehran, Bakhtiari, Semnan, Sistan, Fars, Qom, Kerman, Golestan, Gilan, Mazandaran and Markazi provinces. For the remaining 12 provinces (West Azerbaijan, Razavi khorasan, North khorasan, South khorasan, Zanjan, Qazvin, Kurdistan, Kermanshah, Kohkiloyeh, Hormozgan, Hamedan and Yazd), however, the maximum eigen-value and/or trace statistics fail to reject no cointegration (*r=0*) at the 5% level, indicating that the two variables in those provinces are not cointegrated over the sample period.

Table 4.Cointegration test

provinces	null hypothesis	max-eigen statistic	*p*-value	trace statistic	*p*-value
E. Azerbaijan	H_0: $r=0$	12.19	0.103	16.19*	0.039
	H_0: $r=1$	4.00*	0.045	4.00*	0.045
W. Azerbaijan	H_0: $r=0$	5.11	0.726	7.55	0.514
	H_0: $r=1$	2.43	0.118	2.432	0.118
Ardebil	H_0: $r=0$	13.3	0.068	19.60*	0.011
	H_0: $r=1$	6.22*	0.012	6.22*	0.012
Alborz	H_0: $r=0$	19.70*	0.006	23.02*	0.003
	H_0: $r=1$	3.31	0.068	3.31	0.068
Isfahan	H_0: $r=0$	11.54	0.129	16.55*	0.034
	H_0: $r=1$	5.01*	0.025	5.01*	0.025
Bushehr	H_0: $r=0$	12.05	0.108	19.33*	0.012
	H_0: $r=1$	7.27*	0.007	7.27*	0.007
Tehran	H_0: $r=0$	19.83*	0.006	24.70*	0.001
	H_0: $r=1$	4.87*	0.027	4.87*	0.027
Bakhtiari	H_0: $r=0$	12.67	0.087	18.26*	0.018
	H_0: $r=1$	5.58*	0.018	5.58*	0.018
S. khorasan	H_0: $r=0$	9.10	0.277	12.39	0.139
	H_0: $r=1$	3.28	0.069	3.28	0.069
R. khorasan	H_0: $r=0$	9.61	0.238	13.31	0.103
	H_0: $r=1$	3.69	0.054	3.69	0.054
N. khorasan	H_0: $r=0$	13.68	0.061	13.89	0.085
	H_0: $r=1$	0.21	0.642	0.21	0.642
Zanjan	H_0: $r=0$	7.98	0.380	9.81	0.295
	H_0: $r=1$	1.829	0.176	1.82	0.176
Semnan	H_0: $r=0$	15.30*	0.034	17.88*	0.021
	H_0: $r=1$	2.58	0.107	2.58	0.107
Sistan	H_0: $r=0$	12.62	0.089	16.93*	0.030
	H_0: $r=1$	4.31*	0.037	4.31*	0.037
Fars	H_0: $r=0$	8.25	0.353	14.31	0.074
	H_0: $r=1$	6.05*	0.013	6.05*	0.013
Qazvin	H_0: $r=0$	8.09	0.369	15.52*	0.049
	H_0: $r=1$	7.42*	0.006	7.42*	0.006
Qom	H_0: $r=0$	11.49	0.131	20.34*	0.008
	H_0: $r=1$	8.84*	0.002	8.84*	0.002
Kurdistan	H_0: $r=0$	10.88	0.159	14.35	0.073
	H_0: $r=1$	3.47	0.062	3.47	0.062
Kerman	H_0: $r=0$	17.56*	0.014	23.30*	0.002
	H_0: $r=1$	5.74*	0.016	5.74*	0.016
Kermanshah	H_0: $r=0$	10.15	0.202	11.00	0.211
	H_0: $r=1$	0.85	0.356	0.85	0.356
Kohkiloyeh	H_0: $r=0$	14.11	0.052	17.18*	0.027
	H_0: $r=1$	3.07	0.079	3.07	0.079
Golestan	H_0: $r=0$	10.26	0.194	17.62*	0.023
	H_0: $r=1$	7.36*	0.006	7.36*	0.006
Gilan	H_0: $r=0$	8.71	0.311	13.12	0.110
	H_0: $r=1$	4.41*	0.035	4.41*	0.035
Mazandaran	H_0: $r=0$	12.63	0.089	15.49*	0.013
	H_0: $r=1$	6.45*	0.011	3.84*	0.011

Table 4.Cointegration test

provinces	null hypothesis	max-eigen statistic	*p*-value	trace statistic	*p*-value
Markazi	H_0: $r=0$	15.83*	0.028	21.79*	0.004
	H_0: $r=1$	5.95*	0.014	5.95*	0.014
Hormozgan	H_0: $r=0$	11.42	0.134	13.02	0.114
	H_0: $r=1$	1.59	0.206	1.59	0.206
Hamedan	H_0: $r=0$	6.44	0.556	10.18	0.266
	H_0: $r=1$	3.74	0.053	3.74	0.053
Yazd	H_0: $r=0$	5.11	0.727	7.77	0.489
	H_0: $r=1$	2.66	0.102	2.66	0.102

Notes: Lag lengths in the VAR are selected using the AIC. * indicates significance at the 5% level.

To improve the reliability of the Johansen cointegration test, we thus test the restrictions suggested by Hjalmarsson & Österholm (2010) on the cointegrating relationship. In particular, the authors show that Johansen tests have size distortions when variables do not have exact units root but rather a near unit root. Thus, in our regional analysis, the conclusion of Johansen test could be misleading.

In Table 5 we consider two restrictions on β. If both are rejected, then cointegration is supported and if either one (or both) of them are not rejected, it can be found that the supportive evidences of cointegration are not due to a relationship between the variables but a single stationary variable (LFP in the first case and UR in the second). As can be seen, our results demonstrate that cointegration is supported in 3 provinces out of 16, which include: East Azerbaijan, Alborz and Kerman provinces.

Eventually, we conduct the short-run dynamics in the relationship between LFP and UR. We evaluate the two restrictions of the error-correction terms (α) of the VEC model. The first is $\alpha = (\alpha_1\ 0)$, which suggest that the LFP does error correct but the UR does not, whereas the second restriction ($\alpha = (0\ \alpha_2)$) implies the opposite. The second restriction can be rejected for East Azerbaijan implying that LFP is weakly exogenous at conventional levels and for the Alborz and Kerman provinces both UR and LFP are weakly exogenous.

Table 5.Tests of restrictions in cointegrated VAR

Provinces	$\beta = (1\ 0)'$	$\beta = (0\ 1)'$	$\alpha = (\alpha_1\ 0)'$	$\alpha = (0\ \alpha_2)'$
E. Azerbaijan	7.11*	6.49*	1.87	5.59*
Ardebil	5.87*	3.09	4.44*	2.96
Alborz	16.24*	8.56*	14.59*	16.28*
Isfahan	5.72*	2.49	6.24*	1.01
Bushehr	3.38	1.36	1.97	0.77
Tehran	12.39*	0.45	13.86*	7.39*
Bakhtiari	5.42*	0.63	6.96*	0.43
Semnan	12.00*	2.28	12.69*	0.21
Sistan	6.66*	0.78	3.29	3.85*
Fars	0.44	2.00	0.42	2.09
Qom	1.08	2.37	0.21	2.28
Kerman	9.69*	8.26*	4.91*	7.28*
Golestan	2.78	0.98	2.59	0.40
Gilan	1.87	3.31	0.73	2.41
Mazandaran	0.70	4.74*	1.41	6.07*
Markazi	9.86	3.71	7.77*	0.00

Note: * indicates significance at the 5% level.

To sum up, as Figure 4 shows, we conclude that there is no long-run relationship between LFP and UR in 25 (out of 28) provinces -only in 3 provinces a long-run relationship was detected and other 3 provinces were excluded from the cointegration test due to initial stationarity of the variables-. This finding supports the unemployment invariance hypothesis in Iran and it is in line with empirical studies of developing countries such as Turkey (Arisoy, 2018; Tansel et al., 2016) and Romania (Oţoiu & Ţiţan, 2016) and it also contrasts with the findings of developed countries such as Sweden (Österholm, 2010), Spain (Altuzarra et al., 2019), Canada (Tansel & Ozdemir, 2018) and the United States (Emerson, 2011). In terms of policy, our results suggest a centralized labor policy design, except for the provinces of East Azerbaijan, Alborz, Kerman, Ilam, Lorestan, and Khuzestan.

Figure 4. Clustering map of provinces' unemployment invariance hypothesis

Source: Authors

5.2. Panel Data Analysis

In this section, we examine the relationship between female UR and LFR by using panel data techniques. In panel data analysis, the first and second generation panel unit root tests and panel cointegration tests have been performed in order to detect whether the variables have a long-run relationship. Table 6 reports the findings of the first generation panel unit root tests of Augmented Dickey-Fuller (ADF) (Dickey & Fuller, 1981), Im, Pesaran and Shin (IPS) (Im et al., 2003), Levin, Lin and Chu (LLC) (Levin et al., 2002), Hadri (Hadri, 2000) and second generation panel unit root test of Pesaran (2007) cross-sectionally augmented IPS test (CIPS).

The null hypothesis in ADF, IPS, and LLC panel unit root tests states that all series are non-stationary, whereas the Hadri test has as the null hypothesis that all panels are stationary. However, as first generation panel tests are subject to several criticisms (particularly when they assume that individual processes are cross-sectionally independent) we use Pesaran CIPS test (second generation of panel unit root test).

Results of panel unit root tests in Table 6indicate that LFP and UR have unit root in levels. Due to non-stationarity of the variables at the same integration order, panel cointegration technique is applied.

Table 6. Panel unit root test

	LFP		UR	
	statistic	*p*-value	Statistic	*p*-value
ADF	66.842	(0.314)	60.334	(0.334)
IPS	-1.107	(0.135)	-1.417	(0.078)
LLC	1.812	(0.965)	0.200	(0.579)
Hadri	11.628	(0.000)	10.441	(0.000)
Pesaran's CIPS	-1.539	(0.924)	-1.789	(0.479)

Note: The lag length (in levels) is selected according to the modified Akaike information criterion.

Initially, we use the Kao panel cointegration test, which was developed by Kao (1999) using DF, ADF, and Johansen-Fisher panel cointegration tests. The results of the cointegration tests are presented in Table 7. They demonstrate that we cannot reject the null hypothesis of Kao residual panel cointegration test and there is no cointegration among the LFP and UR.

We then implement the Westerlund (2007) test. This is a second generation panel cointegration test which employ the bootstrap methodology to robust the model against cross-sectional dependence. According to results presented in Table 8, null hypothesis of no cointegration can be rejected. Hence, it can be inferred that there is no evidence for cointegration between LFP and UR in female Iranian labor market. This finding is consistent with our time series analysis and supports the unemployment invariance hypothesis.

Table 7. Kao (1999) residual cointegration test

	t-statistic	*p*-value
ADF	-0.151	(0.440)

Note: Lag lengths are selected using the AIC.

Table 8.Westerlund (2007)cointegration test

Statistic	value	*z*-value	*p*-value	robust *p*-value
G_t	-1.537	1.488	(0.932)	(0.650)
G_a	-7.102	0.041	(0.517)	(0.927)
P_t	-8.440	-0.382	(0.351)	(0.283)
P_a	-6.216	-2.490	(0.006)	(0.307)

Notes: Lag lengths are selected using the AIC. The Westerlund test with a constant term computed based on 300 bootstrap replications.

6. Conclusion

During recent years, a growing body of empirical studies has explored the long-run relationship between unemployment rate and labor force participation at the national and regional levels. This paper contributes to the current literature by examining such a relationship for women in the Iranian 31 provinces. Using the time series cointegration approach, our findings show that there is no long-run equilibrium relationship between female unemployment and participation rate in 25 provinces (out of 28). Therefore, we conclude that the unemployment invariance hypothesis is supported for women at the provincial level. This result is robust and it holds when we use a panel cointegration approach for the whole sample. Our finding is in line with some of the previous studies for developing countries such as Tansel et al. (2016) and Arisoy (2018) for Turkey and Oţoiu & Ţiţan (2016) for Romania. Furthermore, our finding is in contrast to developed countries such as Sweden (Österholm, 2010), the United States (Emerson, 2011), Japan (Liu, 2014), and Canada (Tansel & Ozdemir, 2018) where there is a long-run relationship between these variables and therefore unemployment invariance hypothesis is not supported.

Regarding the support for unemployment invariance hypothesis in most of the Iranian provinces, it can be said that any changes in female labor force participation will not affect the unemployment rate in the long-run. Therefore, recent policies associated with early retirement and work time restrictions which lead to decrease of effective labor force participation rate may not affect the female unemployment in Iran. In addition, in order to provide a friendly environment for women's participation in the economy, there are some institutional obstacles. The government incentive programs for promoting women's education and enhancing matched skills in female labor market could be the core issues to reduce chronic female unemployment in the country. Moreover, the inability of the private sector to flourish and absorb the increasing number of job seekers has deteriorated female employment conditions (Devarajan & Mottaghi, 2014). Under this situation, promoting the culture of entrepreneurship and facilitating women's entrepreneurship, in particular, may mitigate female unemployment in Iran (Kelley et al., 2011). However, for future studies, should consider different age-groups effects in the estimations as well as examine a nonlinear relationship.

References

Alaedini, P., and Razavi, M. R. (2005), "Women's participation and employment in Iran: a criticalexamination", *Critique: Critical Middle Eastern Studies,* Vol.14 No.1, pp.57-73.

Altuzarra, A., Gálvez Gálvez, C., and González Flores, A. (2019), "Unemployment and labour force participation in Spain", *Applied Economics Letters,* Vol.26 No.5, pp.345-350.

Apergis, N., and Arisoy, I. (2017), "Unemployment and labor force participation across the US States: new evidence from panel data", *SPOUDAI-Journal of Economics and Business,*Vol.67 No.4, pp.45-84.

Arisoy, I. (2018), "An empirical examination of unemployment invariance hypothesis, discouraged and added worker effects in Turkey", *International Journal of Economics and Financial Issues,* Vol.8 No.6, pp.11-14.

Chang, Y. (2004), "Bootstrap unit root tests in panels with cross-sectional dependency", *Journal of econometrics,* Vol.120 No.2, pp.263-293.

Cheratian, I., Golpe, A., Goltabar, S., and Iglesias, J. (2019), “The unemployment-entrepreneurship nexus: new evidence from 30 Iranian provinces”, *International Journal of Emerging Markets*, Vol.15 No.3, pp.469-489.

Devarajan, S.,and Mottaghi, L. (2014), “Growth slowdown heightens the need for reforms”, *Middle East and North Africa Quarterly Economic Brief (January)*, World Bank, Washington, DC. doi:10.1596/978-1-4648-0394-9. License: Creative Commons Attribution CC BY 3.0 IGO

Dickey, D. A., and Fuller, W. A. (1981), “Likelihood ratio statistics for autoregressive time series with a unit root”, *Econometrica: journal of the Econometric Society*, Vol.49 No.4, pp.1057-1072.

Elliott, G., Rothenberg, T. J., and Stock, J. H. (1992), “Efficient tests for an autoregressive unit root”, *National Bureau of Economic Research Cambridge*, Mass., USA.

Emerson, J. (2011), “Unemployment and labor force participation in the United States”, *Economics Letters,* Vol.111 No.3, pp.203-206.

Gumata, N., and Ndou, E. (2017), “Does the unemployment invariance hypothesis hold in South Africa?”, *Labour Market and Fiscal Policy Adjustments to Shocks,* Springer, *Palgrave Macmillan, Cham.* pp. 43-56.

Hadri, K. (2000), “Testing for stationarity in heterogeneous panel data”, *The Econometrics Journal,* Vol.3 No.2, pp.148-161.

Hjalmarsson, E., and Österholm, P. (2010), “Testing for cointegration using the Johansen methodology when variables are near-integrated: size distortions and partial remedies”, *Empirical Economics,* Vol.39 No.1, pp.51-76.

Im, K. S., Pesaran, M. H., and Shin, Y. (2003), “Testing for unit roots in heterogeneous panels”, *Journal of econometrics,* Vol.115 No.1, pp.53-74.

Johansen, S. (1988), “Statistical analysis of cointegration vectors”, *Journal of economic dynamics and control,* Vol.12 No.3, pp.231-254.

Johansen, S. (1991), “Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models”, *Econometrica: journal of the Econometric Society*, Vol.59 No.6, pp.1551-1580.

Kakinaka, M., and Miyamoto, H. (2012), “Unemployment and labour force participation in Japan”, *Applied Economics Letters,* Vol.19 No.11, pp.1039-1043.

Kao, C. (1999), “Spurious regression and residual-based tests for cointegration in panel data”. *Journal of econometrics,* Vol.90 No.1, pp.1-44.

Karanassou, M., and Snower, D. J. (2004), “Unemployment invariance”, *German Economic Review,* Vol.5 No.3, pp.297-317.

Kelley, D.J. et al. (2011), “Global entrepreneurship monitor: 2010 women’s report”, The Center for Women’s Leadership at Babson College, Boston, *Global Entrepreneurship Research Association (GERA)*, London.

Kleykamp, D., and Wan, J.-Y. (2014), “Unemployment and participation rates? Revisiting the US data”, *Applied Economics Letters*, Vol.21 No.16, pp.1152-1155.

Kwiatkowski, D., Phillips, P. C., Schmidt, P., and Shin, Y. (1992), “Testing the null hypothesis of stationarity against the alternative of a unit root: How sure are we that economic time series have a unit root?”, *Journal of econometrics*, Vol.54 No.3, pp.159-178.

Layard, R., Layard, P. R. G., Nickell, S. J., and Jackman, R. (2005), “Unemployment: macroeconomic performance and the labour market”, Oxford University Press on Demand.

Levin, A., Lin, C.F., and Chu, C.-S. J. (2002), “Unit root tests in panel data: asymptotic and finite-sample properties”, *Journal of econometrics,* Vol.108 No.1, pp.1-24.

Liu, D.C. (2014), “The link between unemployment and labor force participation rates in Japan: A regional perspective”, *Japan and the World Economy*, Vol.30 No.1, pp.52-58.

Mollahosseini, A. (2008), “Gender and employment in Iran”, *Indian Journal of Gender Studies,* Vol.15 No.1, pp.159-162.

Nemore, F. (2018), “Unemployment and Labour Force Participation in Italy”, Archives personnelles de Muniche (MPRA).

Ng, S., and Perron, P. (2001), “Lag length selection and the construction of unit root tests with good size and power”, *Econometrica,*Vol.69 No.6, pp.1519-1554.

Nguyen Van, P. (2016), “Examining the unemployment invariance hypothesis: The case of Australia”, *Australian Economic Review,* Vol.49 No.1, pp.54-58.

Österholm, P. (2010), "Unemployment and labour-force participation in Sweden", *Economics Letters,* Vol.106 No.3, pp.205-208.
Oţoiu, A., and Ţiţan, E. (2016), "Does the unemployment invariance hypothesis hold for Romania?", *Applied Economics Letters,*Vol.23 No.12, pp.884-887.
Ozerkek, Y. (2013), "Unemployment and labor force participation: a panel cointegration analysis for European countries", *Applied Econometrics and International Development,* Vol.13 No.1, pp.67-76.
Palamuleni, M. L. (2017), "The unemployment invariant hypothesis: heterogeneous panel cointegration evidence from US state level data", *International Journal of Economics and Financial Issues,* Vol.7 No.1, pp.414-419.
Pesaran, M. H. (2007), "A simple panel unit root test in the presence of cross-section dependence". *Journal of applied econometrics,* Vol.22 No.2, pp.265-312.
Tansel, A., & Ozdemir, Z. A. (2018), "Unemployment invariance hypothesis, added and discouraged worker effects in Canada", *International Journal of Manpower,* Vol.39 No.7, pp.929-936.
Tansel, A., Ozdemir, Z. A., and Aksoy, E. (2016), "Unemployment and labour force participation in Turkey", *Applied Economics Letters,* Vol.23 No.3, pp.184-187.
Westerlund, J. (2006). Testing for panel cointegration with multiple structural breaks. *Oxford Bulletin of Economics and Statistics, 68*(1), 101-132.
Westerlund, J. (2007), "Testing for error correction in panel data", *Oxford Bulletin of Economics and Statistics*, Vol.69 No.6, pp.709-748.
Yildirim, Z. (2014), "The unemployment rate and labor force participation rate nexus for female: Evidence from Turkey", *International Journal of Economics and Finance*, Vol.6 No.5, pp.139-146.