Regional Unemployment Disparities in Turkey

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Abstract

This article investigates the disparities in regional unemployment rates and its relationship with labor market variables in Turkey. We first investigate the relationship between regional unemployment and national unemployment and second how regional labor market variables affect regional unemployment. The results demonstrate that: (1) there is a long run causality from the national unemployment rate to regional unemployment rates; (2) the response of the market variables to the regional unemployment is not significant; (3) the 2009 shock has transitory effects and regional unemployment rates get back to equilibrium in about seven years; and (4) regional unemployment rates are persistent.

Keywords: *Unemployment, Regional disparities, Persistence, Panel cointegration, Equilibrium*

Türkiye'de Bölgesel İşsizlik Farklılıkları

Öz

Bu makale Türkiye'de bölgesel işsizlik oranlarındaki farklılıkları ve bu farklılıkların işgücü piyasasındaki değişkenler arasındaki ilişkisini araştırmaktadır. İlk olarak ortalama işsizlik ile bölgesel işsizlik arasındaki ilişki ve ikinci olarak bölgesel işgücü piyasası değişkenlerin bölgesel işsizliği nasıl etkilediği araştırılmaktadır. Sonuçlar (1) ortalama işsizlik oranı ile bölgesel işsizlik oranları arasında uzun vadeli bir ilişki olduğunu; (2) piyasa değişkenlerinin bölgesel işsizliğe anlamlı bir tepkisi olmadığını; (3) 2009 şokunun geçici etkilere sahip olduğunu ve bölgesel işsizlik oranlarının yaklaşık yedi yılda dengelendiğini ve (4) bölgesel işsizlik oranlarının kalıcı olduğunu göstermektedir.

Anahtar Kelimeler: *İşsizlik, Bölgesel farklılıklar, Kalıcılık, Panel eşbütünleşme, Denge*

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1. Introduction

Suspension of membership talks between the EU and Turkey by the European Parliament and in response a threat to open the gate to Europe for about three million refugees sparked a hot debate in the region. The threat includes influx of millions of Syrian refugees and Turkish unemployed into Europe. In addition, about 20% increase in the TL/dollar exchange rate reflect an increase in inflation rates, therefore an increase in unemployment rate is expected. In order to prevent this increase, short term economic policies are implemented. The government is planning to lower unemployment rates by putting pressure on the private sector to over-hire workers which in turn can lower the wages and the productivity.

Employment of the unemployed has been on the agenda in Turkey since the 1950s, more explicitly with the 1961 constitution (Yılmaz, 2005). The global crisis, which had erupted in the summer months of 2007, had started to take its toll on the Turkish economy beginning in the third quarter of 2008. After contracting by 6,8% in the fourth quarter of that year, Turkey entered 2009 with a new record of contraction of 13,8% in its gross domestic product. As export markets contracted and both consumption and investment expenditures dwindled, aggregate expenditures fell sharply (Yeldan and Ercan, 2011). This brought a high 14% national unemployment rate in 2009.

Disparities in regional unemployment rate or in a labor market variable measured by absolute dispersion, relative dispersion, standard deviation or coefficient of variation show similar behavior. The response of regional labor market variables to exogenous unemployment or employment shocks is expected to be slow to adjust back to equilibrium, which can be measured by the impulse response function or by the error correction mechanism. Persistence can be determined from cointegration tests or using transitions between the states of a regional labor market variable.

The analysis in this study is mainly based on two panel data of 12 regions in Turkey. The first panel includes the regional unemployment deviations and national unemployment rate over the 2004-2015 period and the second panel includes the regional unemployment deviation, labor participation and net migration rates over the 2009-2015 period to analyze the variables after the 2009 shock. How regional labor market variables affect regional unemployment is investigated. Methodology of this study is as follows: (1) Simple regression models are estimated to explain the proportion of variations in the mean unemployment rates; (2) Autoregressive Distributed Lag (ARDL) model is used to estimate the long run equation and adjustment coefficients; (3) Unrestricted VAR method is used to find the response of labor market variables to regional unemployment deviations; (4) Markov model is used to analyze the change in regional unemployment and in persistence of unemployment states.

The main objective of this article is to investigate (1) the disparities in regional unemployment; (2) the relationship between regional unemployment deviations and national unemployment rate; (3) how regional unemployment rates are affected by labor participation and net migration; and (4) the persistence and expectations of regional unemployment rates using a Markov chain model.

The remainder of the article is organized as follows. Literature review is given in the next section, the analysis on the regional unemployment rates are given in section three, model estimations are provided in section four, persistence analysis is given in section five and the paper is concluded in section six.

2. Literature Review

There are a considerable number of studies in the literature analyzing the relationships among labor market variables. We provide some studies related to our study as follows.

Acar, Günalp and Cilasun (2016) compute the transition probabilities of individuals moving across three different labor market states which are employment, unemployment and inactivity. Using a Markov chain model they calculate short run transition probabilities for the 2006-2010 period by gender, age and education groups. They find that the persistence of employment has decreased and moving from employment to unemployment has increased in the Turkish Labor Market following the 2008 global economic crisis. Even though a 2008 reform package intended for young and female workers was extended to include skilled males over 29 years of age, their results show that the transition from unemployment to employment has decreased significantly for males compared to the precrisis period. The authors suggest that the reform package should be launched before a crisis is more effective.

Pehkonen and Tervo (1998) investigate the persistence and turnover in unemployment disparities in Finland by examining time series data on 10 labor districts and 423 municipalities. They use two mean shifts in labor district data to calculate steady-state unemployment rates and show that the steady state unemployment rates differ across the labor districts so that the relative position of a district tends to be rather stable. The authors consider autoregressive AR(1) model $u_t = \mu_0 + \beta u_{t-1} + \eta_t$ to examine persistence and stationarity where η_t=NID(0,σ_η) normally identically distributed with 0 mean and σ_η standard deviation, μ_0 is the mean unemployment rate and β is persistence of unemployment. Based on the hypothesis that steady state unemployment rate of a region depends on the degree of persistence in that region and that the higher the persistence in unemployment to exogenous shocks, the higher the steady-state unemployment rate, the authors run an AR(1) model for municipalitiy data using a dummy and an AR(2) model for labor district data with two mean shift dummy variables both in logarithm to estimate the persistence in regional unemployment rates. Given that the persistence estimators are β and $\Sigma\beta$, these models are $\ln u_{it} = \alpha_{i0} + \beta_{i0} \ln u_{i,t-1} + \gamma_{i2} D91 + \varepsilon_{it,}$ and $\ln u_{it} = \alpha_{i0} + \beta_{i0} \ln u_{i,t-1} + \beta_{i2} \ln u_{i,t-2} + \gamma_{i1} D76 + \gamma_{i2} D91 + \varepsilon_{i,t}$. The authors point out that the districts with less persistence are ranked among the regions with lowest steady state unemployment rates, whereas the districts displaying a higher degree of persistence rank among the districts with the highest unemployment rates. Finally, they use a Markov chain model to estimate the persistence in municipality unemployment rates.

Martin (1997) shows that the pattern of regional unemployment differences exhibits a considerable degree of geographical persistence. He calculates absolute and relative dispersions and finds that up until the late 1980s absolute dispersion tends to vary directly with the movements in national unemployment rate. The author measures regional unemployment difference by $u_r - u_{UK}$, where u_r is the unemployment rate in region r and u_{UK} is the average unemployment rate of the United Kingdom. He constructs time series model $u_{rt} = \alpha_r + \beta_r u_{UKt}$ where u_{rr} is the unemployment rate in region r at time t, u_{UKt} is the average unemployment rate of the United Kingdom at time t, $\alpha_r = u_r - u_{UK}$ and $\beta_r = u_r / u_{UK}$. In case of cointegration of variables, error correction mechanismis defined by $\Delta u_{rt} = c_{r0} + c_{r1} \Delta u_{UKt} - \lambda_r [u_{rt-1} - (a_r + b_r u_{UK-1})] + v_{rt}$ where $\Delta u_{rr} = u_{rr} - u_{rt-1}$ is the first difference, v_{rt} is a random residual series, λ_r is corrected proportion of the disequilibrium and $u_{rt-1} - (a_r + b_r u_{UK-1}) = e_{rt-1}$ is the error correction term. The author estimates correlations to show that the regional unemployment structure does not change dramatically from one period to the next, but instead has been characterized by long periods of relative stability. The author estimates cointegrating regressions and error correction parameters for all regions and finds that all coefficients are significant at 1% and that the parameters are negative, which means a percentage of any divergence between regional and national unemployment is eliminated in the following year. The author estimates the regional unemployment change for two recessions 1980-1983 and 1990-1993, and also for 1993-1995, and finds that after the first recession employment expanded rapidly and that although national unemployment continued to increase, this reflected to structural shock wave of the recession rather than the continuation of the recession. As for the second recession, the author estimates that it was the result of an unusual small rise in joblessness in the traditionally high unemployment northern areas of the country.

Dixon, Shepherd and Thomson (2001) examine the disparities in regional unemployment rates in Australia and their relationship with the national unemployment rate. Using a cointegration approach, the authors show that the relative dispersion of regional unemployment rates is negatively correlated with the national unemployment rate. They find that the differences in the natural rate of unemployment between the regions increase. The authors use error correction form $\Delta Y_t = \sum_{j=1}^{k-1} \left(\Gamma_j Y_{t-j} \right) - \Pi Y_{t-k} + \varepsilon_t$ where Γi(i=1,…,k) and Π represent the parameter matrices on the first differences and levels of the series respectively. They estimate vector error correction model for the sample periods 1978:Q2-1983Q4 as

ΔRD_t=0,667ΔRD_{t-1}–0,003ΔUR_{t-1}–0,418CE_{t-1} and ΔUR_t=0,640ΔRD_{t-1}–0,808ΔUR_{t-1}–0,334CE_{t-1} where CE_t=RD_t+0,004UR_t–0,105 and also for 1984Q1-1999Q1 as ΔRD_t=0,286ΔRD_{t-1} –0,008ΔUR_{t-1}–0,318CE_{t-1} and ΔUR_t=3,219ΔRD_{t-1}–0,844ΔUR_{t-1} –0,475CE_{t-1} where CE_t= RD_t + 0,018UR_t –0,245, *RD* denotes the relative dispersion, *UR* denotes the national unemployment rate and CE_t denotes the estimated cointegrating equation.

Gray (2004) draws three inferences concerning the nature of the British regional unemployment rates based on bivariate and multivariate cointegration. The author finds that decreasing the national rate of unemployment will reduce, but not eliminate, unemployment differentials. He infers that the equilibrating forces are insufficient to bind East Angolia to the rest of regional system in the long run. The author also finds that a multivariate approach to regional unemployment analysis provides a richer picture compared to a bivariate analysis. The author regresses the regional series against the corresponding national series $u_{Rt} = \alpha_R + \beta u_{Ntt} + \varepsilon_{Rt}$ where u represents unemployment rates; *R* and *N* are the region and the nation; ε_{Rt} represents the vactor of residuals; α_R is the intercept corresponding to the region *R*. The augmented Dickey-Fuller test involves the expression $\Delta x_t = \alpha_0 + (\rho - 1)x_{t-1} + \beta t + \sum^{p}\left(\alpha_j \Delta x_{t-j}\right) + \varepsilon_t$ where p is the order of the lag polynomial, $\varepsilon_t \sim d(0, \sigma_\varepsilon^2)$ and *t* is *a* time trend.

Filiztekin (2009) shows that an increase in the national rate of unemployment widens regional unemployment differences. The author finds a strong evidence for spatial correlation in unemployment rates and that labor supply plays an important role in shaping the distribution of local unemployment. He concludes that due to the transition to urbanization the unemployment problem would continue to be a major concern. To measure global correlation across all regions, the author uses Moran I statistics for the years 1980 and 2000: $I = \frac{\sum_i^N \sum_j^N w_{ij}(x_i - \bar{x})(x_j - \bar{x})}{\sum_i^N (x_i - \bar{x})^2}$ where xi and xj unemployment rates for regions i and j, $\bar{x}$ is the average unemployment rate and wij is the i, j element of of row standardized weight matrix W. For the analysis of aggregate unemployment rates, he uses the local indicators of spatial association (LISAs), local Moran is defined by $I_i = \frac{x_i - \bar{x}}{\sum_i^N (x_i - \bar{x})^2} \sum_{i \neq j}^{N} w_{ij}(x_j - \bar{x})$. The author uses several variables to explain the differences in regional unemployment by Ordinary Least Squares method and by Maximum Likelihood:

$$U_{jt} = \beta_0 + \beta_1 U_{jt} + \beta_2 PRIM_{jt} + \beta_3 SEC_{jt} + \beta_4 TERT_{jt} + \beta_5 AGR_{jt} + \beta_6 MAN_{jt} + \beta_7 DENS_{jt} + \beta_8 ERGR_{jt} + \beta_9 EMPGR_{jt} + \varepsilon_{jt}$$

where U_{jt} is the unemployment rate of jth province at time t minus the average unemployment rate in Turkey at t, ε is the random disturbance, PRIM is the the share of primary education, SEC is the sectoral share in total employment, DENS is the population density, AGR is the share of agricultural employment, MAN is the share of manufactoring employment in total employment, ERGR is demand less supply growth rate, EMPGR is employment growth in the previous five years.

Brunello, Lupi and Ordine (2001) find that the employment performance in the South of Italy worsens considerably in the presence of sustained labor force growth (as experienced in the South of Italy in the 1970s). Labor mobility from the South to North-Central areas declines sensibly with the reduction in earnings differentials and with the increase in social transfers per head; real wages in the South are not affected by local unemployment conditions but depend on the unemployment rate prevailing in the leading areas. The authors estimate $\Delta \ln N_{it} = \alpha_i + \sum_{j=0}^{1}\left(\beta_{ij} \Delta \ln {}_iN_{t-j}\right) + \varepsilon_{it}$ for each region where *i* is the region, *t* is time, N_{it} is regional employment in private sector, measured by standard labor units, and ${}_iN_t$ is aggregate employment in private sector, region *i* exluded, For each region *i*, vector autoregression model is estimated: $X_{it} = \mu_i + \sum_{j=1}^{k}\left(\Pi_{i,j} X_{i,t-j}\right) + \varepsilon_{i,t}$ where X_{it}={$\ln u_{it}$, $\ln \tau_{it}$, $\ln \zeta_{it}$, $\ln PM_t$}, *i* =1,…,19, u_{it} is regional unemployment rate, τ_{it} is tax wedge, ζ_{it} is government social transfers per head and PM_t is real price of imported energy and material, To investigate the possibility that the failure of regional wages to respond to regional local conditions in some areas of the country exacerbate unemployment differentials by eliminating an important adjustment mechanism, they estimate the first difference of logarithms

$$\Delta \ln w_{it} = \sum_i \alpha_i D_i + \beta t + \delta \Delta \ln u_{it} + \eta \Delta \ln PM_t$$

$$+ \gamma \ln w_{it-1} + \theta \ln u_{Nt-1} + \sigma \ln u_{t-1} + \varepsilon_{i,t}$$

where wit is the real gross wage in region i, $_uN_t$ is the unemployment rate prevailing in North-Center, T is a linear trend, D_i is a set of regional dummies, and ε_{it} is the error term, To estimate net immigration flows, the authors use error correction model $\Delta M_{it} = \sum_i \beta_i D_i + \alpha \Delta M_{it-1} + \gamma M_{it-1} + \beta t + \delta \ln \frac{W_{it-1}}{W_{Nt-1}} + \vartheta \ln u_{it-1} + \kappa \zeta_{it} + \varepsilon_{it}$ where M_{it} is the percentage of labor outflows with respect to the regional population in the previour year, and W_{it} and WN_t are the regional net wages and the average net wage prevailing in the North-Center.

3. Regional Unemployment Disparities

The annual regional unemployment rates of level 1 regions according to criterion of Nomenclature of Territorial Units for Statistics (NUTS 1) are retrieved from Turkish Statistics Agency (TUIK, http://www.tuik.gov.tr/PreTablo.do?alt_id=1007, 02.01.2017) for the years 2004-2015. Data covers 15+ age labour force status by non-institutional population. Aggregate unemployment rates of Turkey, twelve regions of Turkey and codes of the regions are given in Table 1.

Table 1. Aggregate Unemployment Rates and Codes of Regions

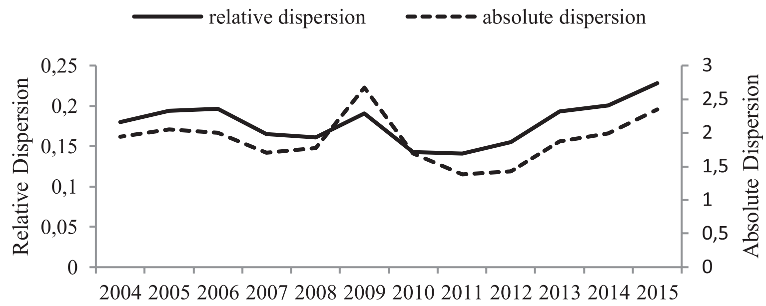
	TR1	TR2	TR3	TR4	TR5	TR6	TR7
Mean UR[1]	Istanbul	W, Marmara	Aegean	E, Marmara	W, Anatolia	Mediterranean	Central Anatolia
	12,1	7,5	10,3	10,1	10,8	12,6	10,4
	TR8	**TR9**	**TRA**	**TRB**	**TRC**	**TR**	
Mean UR	W, Black Sea	E, Black Sea	Northeast Anatolia	Middle East Anatolia	Southeast Anatolia	Turkey	
	7,0	6,1	6,0	12,2	14,3	10,6	

Martin (1997) and Dixon et al (2000) measure the disparity in regional unemployment as the difference between a region's share of unemployed and labor force and Pehkonen and Tervo (1998) measure it as standard deviations of absolute deviations $u_{it} - \bar{u}_t$ and relative unemployment rates$(\ln u_{it} - \ln \bar{u}_t)$. In the former case, dispersion relative to the national rate is defined as the sum (over regions) of absolute differences between a region's share of total unemployment (U_i/U) and its share in the total labor force (L_i/L): $\sum_i |(U_i / U) - (L_i / L)|$ where $U_i / U = (u_i / u)(L_i / L)$, $u_i = U_i / L$ and $u = U / L$, U_i is the number of the unemployed in region i, L is the size of the labor force, U is total national unemployment. Absolute dispersion is defined as the dispersion of regional unemployment rate differentials: $\sum_i |(L_i / L)(u_i - u)|$. Absolute dispersion divided by the national unemployment rate gives relative dispersion: $(1/u)\sum_i |(L_i / L)(u_i - u)|$. Applying these definitions to our regional data, we show in Figure 1 that relative and absolute dispersions have a similar behavior from 2004 to 2015, with absolute dispersion making a peak in 2009 recession and indicating another upcoming recession after 2005.

The regions with higher GDP namely Istanbul, East Marmara, West Marmara, Agean, West Anatolia and Mediterranean show similar behavior and all reach their highest level of unemployment rate in 2009 over the 2004-2015 period. Mediterranean region is mostly affected by the crisis year. However, Istanbul tops all regions' unemployment rates after 2010. West Marmara, Turkey's industrial region, has the lowest unemployment rate with a 6,7 percentage points difference with Istanbul.

1 *Mean unemployment rate for each region in 2004-2015*

Figure 1. Absolute dispersion and relative dispersion



The graphs in Figure 2a indicates that the 2004-2006 economic expansion policy's impact is reflected in the unemployment rates of Istanbul, West Marmara and Mediterranean in 2005-2007 and in those of the other regions in 2004-2007. Among all regions Istanbul experienced the steepest shock with a 5,6 percentage point increase in the unemployment rate in the global economic crisis, followed by West Marmara with 3,9 and Mediterranean and Aegean both with 3,6 percentage point increase. In terms of recovery, the Mediterranean region has the steepest decrease with 6,9 percentage points in two years after the shock, followed by Istanbul, East Marmara, Aegean, West Anatolia and West Marmara with a decrease of 5,0, 4,6, 4,10, 3,80 and 3,70 points respectively. The unemployment rate of West Marmara remains below the national mean (aggregate unemployment rate) except in 2009 barely moving over the mean. The unemployment rates of Istanbul and Mediterranean remain above the mean except for the years 2007 and 2012 respectively. Unemployment rates in Aegean and East Marmara are above the mean in 2008 and below the mean in 2011. Unemployment rate in West Anatolia goes below the mean in 2010 and remains below the mean thereafter.

Figure 2b shows that the economic expansion policy during 2004-2006 did not lower the unemployment rates of NE Anatolia and SE Anatolia. Deviations are increasing partially in 2004-2007 in both regions. Southeast Anatolia is the only region not responding to both the 2004-2006 economic expansion and the 2008 economic crisis. As West Black Sea, East Black Sea and Northeast Anatolia unemployment rates remain below the mean, Southeast Anatolia remains over the national mean over the 2004-2015 period. Middle East Anatolia goes below the mean in 2011 and remains below the mean thereafter. Central Anatolia unemployment rate moves over the mean in 2005, remains over the mean up to 2011 and goes down below the mean in 2012.

Among regions with lower GDP (regions in Figure 2b) Southest Anatolia has the highest unemployment rates in and after 2011 due to political conflicts and low investments. The most comprehensive step in resolving the Kurdish conflict was taken in 2009 which reflects in unemployment rates with 5 percentage point decrease. This indicates the steepest decrease in a year over the last twelve years and also in out-migration rate with an 8,6 percentage points decrease compared to the 2007-2008 rate. The failure in the resolution process raises the unemployment rate to 16,5% and the out-migration rate to 9,8% in 2015.

Figure 2a. Deviations of unemployment rates in regions with higher GDP

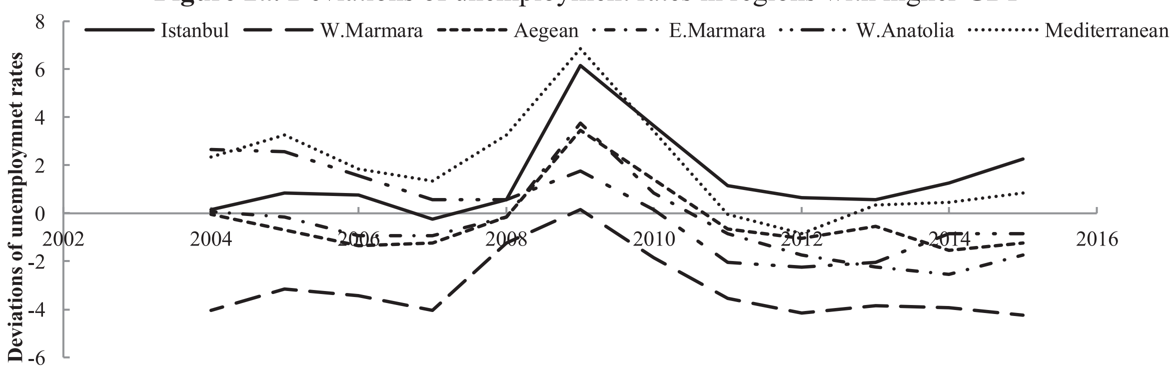
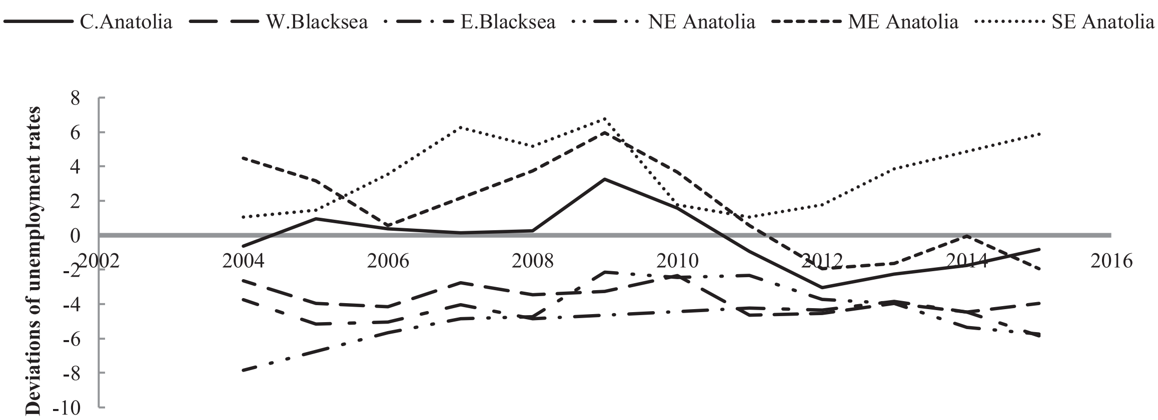


Figure 2b. Deviations of unemployment rates in regions with lower GDP



In the same year, the East Blacksea region has the lowest unemployment rate with 4,8%. While Middle East Anatolia and Central Anatolia have similar behavior to those in Figure 2a, West Blacksea and East Black Sea regions are almost uneffected by the 2008 global economic crisis and both have a stable behavior with only a 2% differential.

A visual inspection shows that unemployment rates of regions mostly persistent but does not converge to a common value, which is in line with Pehkonen and Tervo (1998) and Martin (1997). Regions with higher GDP are more affected from the global crisis compared to the regions with lower GDP. Over the 2004-2015 period, regions with higher GDP have more variations in deviations compared to the regions with lower GDP.

Table 2. Mean regional net migration and regional employment growth deviation

REGIONS	Mean UR[2] (rank)	Net in-migration(%)		Net migration % change[3]		Emp, growth % deviation[4]	GDP/ person deviation[5] (thousand $)	
		2009	2015	2009	2015		2009	2015
Istanbul	12,1(4)	0,207	0,198	0,021	0,022	0,70	6,205	7,845
W.Marmara	7,5(9)	0,051	0,059	0,007	0,009	-0,67	0,229	0,060
Aegean	10,3(7)	0,097	0,103	0,009	0,014	-0,04	-0,442	-0,474
E.Marmara	10,1(8)	0,103	0,111	0,023	0,032	0,37	1,424	2,590
W.Anatolia	10,8(5)	0,110	0,109	0,017	0,022	1,04	1,646	1,152
Mediterranean	12,6(2)	0,103	0,102	0,003	0,000	0,18	-1,501	-2,314
C.Anatolia	10,4(6)	0,055	0,049	-0,010	-0,011	1,13	-2,649	-3,221
W.Blacksea	7,0(10)	0,080	0,073	-0,006	-0,009	-0,56	-2,869	-3,666
E.Blacksea	6,1(11)	0,052	0,046	0,001	-0,007	-2,5	-2,763	-3,619
NE Anatolia	6,0(12)	0,033	0,035	-0,017	-0,020	-0,87	-4,375	-5,730
ME Anatolia	12,2(3)	0,046	0,047	-0,018	-0,021	0,83	-4,574	-6,026
SE Anatolia	14,3(1)	0,063	0,067	-0,028	-0,031	-0,61	-4,715	-5,860
Turkey	10,6							

2 *Mean unemployment rate for each region in 2004-2015*

3 *Net migration % change is calculated by dividing the difference between in-migration and out-migration by total regional migration*

4 *Deviation of mean regional employment growth from the mean national growth in 2004-2015*

5 *GDP per person deviation from the nation*

Regional mobility is conventionally viewed as facilitating regional unemployment. Inter-regional study of Gordon and Molho (1998) in UK shows that the tendency for net migration over 1960-1985 was from the high unemployment rate to low unemployment rate (McCormick, 1997). Net migration percent change in Table 2 indicates a tendency of mobility from regions with lower GDP to regions with higher GDP which is not in line with Gordon and Molho (1998) finding. East Blacksea and Northeast Anatolia regions over the 2008-2015 period have the lowest mean unemployment and in-migration rates except in 2009, 2012 and 2014. Table 2 shows that East Marmara, West Marmara and Istanbul have significant monthly wage increase from 2008 to 2012 and that net migration is leaning towards these growing regions. The same can be discussed for the same regions between deviation of value added per person and net migration. GDP per person from 2009 to 2015 rises only in Istanbul and East Marmara with 1640$ and 1166$ above the mean respectively.

One percentage point increase in the deviation of mean regional employment growth increases the mean unemployment rate by 1,61% and 37,4% of the variations in the mean regional unemployment rates can be explained by the deviation of mean regional employment growth. One year after the 2008 world economic crisis, one percentage point increase in the deviation of regional employment growth decreases net migration by 0,28%, decreases net in-migration by 0,98%, and increases the deviation of regional unemployment rate by 8,5%. Point one percent increase in net migration in 2015 decreases mean regional unemployment rate by about 2,1%. Variations in mean regional unemployment rates cannot be explained by net migration percent change for a given year and 18,6% of the variations in mean regional unemployment rates can be explained by the 2015 regional net in-migration rates.

Time periods in Table 3 are taken to reflect to after the 2008 global economic crisis and based on availability of the data. A simple regression analysis shows that there is a weak negative correlation between 2008 monthly wages and mean unemployment rates. Only 0,47% and 0,2% of the variations in the mean regional unemployment rates can be explained by 2008 and 2012 regional monthly wages respectively. Only the first four regions increase their value added per person after the 2009 shock. East Marmara region provides the highest value added in 2011 and adds 677 dollars per person in two years. Over the 2009-2015 period, population density is rising 335 persons/km2 in Istanbul and 0-17 persons/km2 in the other regions.

Table 3. Value added per person, monthly wages and population density

Regions	Mean UR (rank)	VA/person deviation[6] (thousand $)		Monthly wage (thousand $)(rank)		Population density[7] (thousand persons/ km²)	
		2009	2011	2008	2012	2009	2015
Istanbul	12,1(4)	4,079	4,625	1,203(2)	1,330(1)	2,486	2,821
W.Marmara	7,5(9)	0,879	1,248	0,894(9)	1,026(4)	0,073	0,079
Aegean	10,3(7)	0,183	0,221	0,953(6)	0,956(7)	0,107	0,114
E.Marmara	10,1(8)	2,711	3,388	0,988(4)	1,226(2)	0,137	0,154
W.Anatolia	10,8(5)	0,643	0,445	1,246(1)	1,122(3)	0,095	0,106
Mediterranean	12,6(2)	-1,203	-1,491	0,946(7)	0,873(9)	0,105	0,113
C.Anatolia	10,4(6)	-2,026	-2,363	0,845(11)	0,946(8)	0,042	0,043
W.Blacksea	7,0(10)	-1,629	-1,947	1,102(3)	0,959(6)	0,061	0,061
E.Blacksea	6,1(11)	-1,953	-2,592	0,919(8)	0,788(12)	0,072	0,073
NE Anatolia	6,0(12)	-3,647	-4,293	0,978(5)	1,003(5)	0,031	0,031
ME Anatolia	12,2(3)	-3,746	-4,577	0,817(12)	0,828(11)	0,047	0,049
SE Anatolia	14,3(1)	-4,151	-4,603	0,852(10)	0,833(10)	0,099	0,112
Turkey	10,6			1,078	1,140	0,094	0,102

The regression line in Figure 3 indicates that regional unemployment rates remain remarkably stable over time. Correlation between 2008 and 2015 is 0,84 and coefficient of determination is 0,71. Jimeno and Bentolila (1998) have a similar analysis for the stability of the ranking of unemployment rates in Spain.

Figure 3. 2015 unemployment rates based on the 2008 unemployment rates

4. Model Estimation

In the analysis of the relationship between variables, time period is the main determinant of the results of a study. A short time period due to lack of data may not include structural breaks or temporary shocks. In this case, researchers will more likely deal with stationarity at level and settle with simple regression analysis or VAR model. The theory first requires to test the cross sectional dependence in panel

6 Deviation from the nation

7 Extracted from TUIK (2015) regional statistics based on the results of Address Based Population Registration System data. If there is no cross sectional dependence, one can proceed with the first generation unit root tests of stationarity for each variable. The relationship between nonstationary variables can be analyzed using a vector autoregressive (VAR) model which was used by Brunello, Lupi and Ordine (2001). If a variable is stationary at level (I(0)) and another variable becomes stationary after first differencing (I(1)), then an ARDL can be used. If a variable is stationary at I(1) and another variable becomes stationary after second differencing (I(2)), autoregressive (AR) models can be used. If all variables are stationary at level, a simple regression or a VAR model can be used. However, these variables must first be checked for seemingly unrelated effects, structural breaks and seasonality. To determine whether ordinary least squares (OLS) or seemingly unrelated regression (SUR) method is to be used, a system of equations for all regions can be constructed and Chi-square statistic can be used based on residual correlation matrix or residual covariance matrix. If all the variables are nonstationary at level and become stationary after first differencing, they are I(1). In addition, if they are cointegrated, a vector error correction model (VECM) can be used. If not, an unrestricted VAR model can be run. The same can be said for I(2),…,I(d). When the variables are nonstationary at level and they become stationary after first differencing which is a precondition for cointegration but they are not cointegrated, panel VAR model is run. In this case, the Hausmann test is used to determine whether fixed effect or random effect model is more aproppriate.

Regional deviations are the deviations from the national unemployment rate (nation): $d_{it} = u_{it} - u_t$

We regress the regional unemployment rates on the national unemployment rate:

$$d_{it} = \alpha_i + \beta_i u_t + \varepsilon_{it} \qquad (1)$$

where d_{it} is the unemployment rate in region i=1,…,N (cross section dimension), time t = 1,…,T (time series dimension), α_i is the intercept of region i, β_i is the rate of change in the regional unemployment rate with respect to the change in the national unemployment rate u_t and ε_{it} is the residual. In our study, i=1,…,12 and t=2004,…,2015, thus model (1) is neither short nor long, fixed balanced panel model.

Panel variables dit and ut must be tested for unit root first to avoid spurious results. We choose more powerful tests for our panel data such as Im, Pesaran & Shin (2003) W-statistics (IPS), Levin, Lin & Chu (2002) t statistic (LLC) and Fisher ADF and PP Chi-square (Maddala and Wu, 1999). In the presence of cross-sectional independence, IPS consider the mean of ADF statistics computed for each cross-section unit in the panel when the error term of the model is serially correlated possibly with different serial correlation patterns across cross-sectional units (i.e.$d_{it} = \sum_{j=1}^{p} \varphi_{ij} d_{it-j} + \varepsilon_{it}$) where *N* and *T* are sufficiently large. When there is no cross-sectional correlation in the errors, the IPS test is more powerful than the Fisher test (the IPS test has higher power when the two have the same size). Both tests are more powerful than the LLC test (Barberi, 2005). The test of cross sectional correlation is effective when *T* is large relative to N and has desirable asymptotic (in *T*) properties (Frees, 1995).

We first check whether there is a correlation in the residuals in model (1). Since *T* is small, we rely on the results for the asymptotically standard normal Pesaran Cross-Sectional Dependence (CD) test. As shown in Table 4, The Pesaran CD test barely do not reject the null hypothesis at five percent significance level which shows no correlation in residuals (i,e, corr(ε_{it}, ε_{jt})=0). The CD test is likely to have good properties for both *N* and *T* small.

Table 4. Residual Cross Section Dependence Test

H_0: No cross-section dependence (correlation) in residuals			
Test	Statistic	df	Prob.
Breusch-Pagan LM	97,59575	66	0,0070
Pesaran scaled LM	2,750057		0,0060
Pesaran CD	-1,958036		0,0502

Based on N equal to T or N/T converges to 1, there is no panel unit root test suggested in the literature. Breitung and Pesaran (2005) considers small N or small T as less than 10.

Now, we can proceed with the first generation panel unit root tests, All tests of panel unit root using Eviews 9 are employed in Tables 5 and 6. However, in this study we consider only four tests, namely, LLC, IPS, Fisher ADF and PP. Using an individual intercept and Schwarz Information Criteria (SIC) for automatic lag selection, we find that the panel data on the national unemployment rate is stationary at level, i.e. I(0) and regional unemployment rates is stationary at the first difference, i.e. I(1), based on the four statistics. Unit root test results for the nation and the regions are given in Table 5 and Table 6 respectively. In this case, an ARDL model can be run between dit and ut.

For deviations of all regions, the results of panel unit root test summary at level and first difference with individual intercept included in the model are given in Table 6.

Unit root (nonstationarity) for each region's deviation from the nation can be tested by the individual ADF test. In our case, all regions except three have unit roots at level with the intercept in the model. West Marmara, West Anatolia and Southeast Anatolia at 5% significance in the model with intercept are stationary. However, after first differencing each region's deviation with intercept in the model, W.Marmara, E.Marmara, Mediterranean, W.Blacksea, M.E. Anatolia and S.E. Anatolia become nonstationary, Istanbul, Aegean, West Anatolia, Central Anatolia, East Blacksea and N.E. Anatolia becomes stationary. Unit root test results (p-values) of all regions are given in Table 7. p-values must be less than 0,05 to reject nonstationarity of null hypothesis at level, first difference and second difference all with the intercept in the model. Only stationary regional unemployment deviations can be regressed on the national unemployment rate.

Table 5. Panel unit root test for the national unemployment rates u_t

Method	Hypothesis	Level-intercept		First difference-intercept	
		Statistic	p-value	Statistic	p-value
Levin, Lin & Chu t statistic	H_0:Unit root	-6,88382	0,0000	-7,97281	0,0000
Breitung t-stat	H_0:Unit root	-7,17185	0,0000	-7,18219	0,0000
Im, Pesaran & Shin W-statistics	H_0:Unit root	-2,75728	0,0029	-3,70670	0,0001
Fisher ADF Chi-square	H_0:Unit root	42,6284	0,0110	50,4211	0,0013
Fisher PP Chi-square	H_0:Unit root	26,9434	0,3071	59,7496	0,0001
Hadri z-stat	H_0:Stationarity	1,16376	0,1223	3,84344	0,0001
Heteroscedastic consistent z-stat	H_0:Stationarity	1,16376	0,1223	3,84344	0,0001

Table 6. Panel unit root test for deviations of regional unemployment rates d_{it}

Method	Hypothesis	Level-intercept		First difference-intercept	
		Statistic	p-value	Statistic	p-value
Levin, Lin & Chu t statistic	H_0:Unit root	-4,08498	0,0000	-6,87544	0,0000
Breitung t-stat	H_0:Unit root	-1,47936	0,0695	-2,36355	0,0091
Im, Pesaran & Shin W-statistics	H_0:Unit root	-1,86111	0,0314	-3,63702	0,0001
Fisher ADF Chi-square	H_0:Unit root	35,6031	0,0599	57,7229	0,0001
Fisher PP Chi-square	H_0:Unit root	31,8629	0,1304	94,8638	0,0000
Hadri z-stat	H_0:Stationarity	3,80555	0,0001	2,40727	0,0080
Heteroscedastic consistent z-stat	H_0:Stationarity	2,89571	0,0019	4,15606	0,0000

Table 7. Individual ADF unit root test results for regional unemployment deviations

Cross Section	**Level-intercept**[8]	**First difference-intercept**	**Second difference-intercept**
Turkey	0,1693	0,1223	0,0397**
Istanbul	0,3693	0,0997***	0,0259**
W.Marmara	0,0129**		
Aegean	0,2709	0,1793	0,0428**
E.Marmara	0,6290	0,0372**	
W.Anatolia	0,0333**		
Mediterranean	0,8527	0,0113**	
Central Anatolia	0,4449	0,1164	0,1528
W.Blacksea	0,0567***	0,0152**	
E.Blacksea	0,0797***	0,0809***	0,0424**
NE Anatolia	0,1946	0,1623	0,0984***
ME Anatolia	0,9834	0,0200**	
SE Anatolia	0,0427**	0,0312**	

The ARDL model: Long run model is $\Delta d_{it} = \alpha_i + \beta_i u_t + \varepsilon_{it}$ and short run model is

$$\Delta d_{it} = c_{i0} + c_{i1}\varepsilon_{i,t-1} + \sum_{j=1}^{p} c_{i,1+j}\Delta d_{i,t-j} +$$
$$c_{i,p+2}\Delta u_t + \sum_{j=1}^{p} c_{i,2+p+j}\Delta u_{t-j} + r_{it} \quad (2)$$

where p is the order of lags, i is the region, t denotes periods, Δu_{it} is the first difference of u_{it}, r_{it} is the error term and

$$\varepsilon_{i,t-1} = d_{i,t-1} - \hat{\beta}_i u_{t-1} - \hat{\alpha}_i \quad (3)$$

is the cointegrating equation. The coefficients are estimated with a max of fixed two lags and the results are given in Table 8.

Table 8. Panel PMG/ARDL model estimation results

Dependent Variable: Δd_{it}				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
Ut	0,644021	0,077968	8,260087	0,0000
Short Run Equation				
C_1	-0,421125	0,089142	-4,724185	0,0000
Δdit(-1)	0,018093	0,113654	0,159194	0,8739
ΔUt	-0,236609	0,127536	-1,855228	0,0671
ΔUt(-1)	-0,192211	0,082385	-2,333077	0,0221
C_0	-3,100581	0,833735	-3,718904	0,0004
Mean dependent var	-0,047500	S.D. dependent var		1,154892
S.E. of regression	0,758634	Akaike info criterion		2,011228
Sum squared resid	47,76860	Schwarz criterion		3,269274
Log likelihood	-83,80841	Hannan-Quinn criterian		2,522427

* *Note: p-values and any subsequent tests do not account for model*

8 *significant at 5%*

Long run equation in Table 8 indicates that the nation is statistically significant and long run coefficient is 0,644. This means that one percent increase in the nation will decrease the regional unemployment by 0,64 percent. All regions adjust back to equilibrium at a speed of 42% annually. Short run equations in Table 9 show that long run coefficients are negative and significant, which means that there is a long run causality from the nation to all regions except West Blacksea region. This region deviates from the equilibrium at 21% annually. Istanbul moves towards to long run equilibrium at a speed of 27,7% annually. Aegean region has the highest speed of adjustment to long run equilibrium with 90,9%. This implies that deviations dissipate completely in four years. East Marmara has the lowest speed of adjustment to long run equilibrium with 13,4%, which means 13,4% of disequilibrium is corrected each year by changes in the unemployment rate.

Table 9. Cross Section Short Run Coefficients

	Variable	Coefficient	Std, Error	t-Statistic	Prob,
TR1	COINTEQ01	-0,277150	0,060928	-4,548818	0,0199
	D(DIT(-1))	0,058844	0,117251	0,501867	0,6503
	D(UT)	0,279849	0,053591	5,221907	0,0137
	D(UT(-1))	-0,024277	0,065275	-0,371914	0,7347
	C	-1,302230	1,827780	-0,712465	0,5276
TR2	COINTEQ01	-0,875016	0,141007	-6,205458	0,0084
	D(DIT(-1))	-0,718735	0,082490	-8,713041	0,0032
	D(UT)	0,003947	0,032766	0,120471	0,9117
	D(UT(-1))	-0,597407	0,043752	-13,65447	0,0008
	C	-8,607134	12,99047	-0,662573	0,5550
TR3	COINTEQ01	-0,418613	0,014130	-29,62501	0,0001
	D(DIT(-1))	0,321696	0,037736	8,524858	0,0034
	D(UT)	-0,086793	0,006456	-13,44287	0,0009
	D(UT(-1))	-0,236277	0,006374	-37,06738	0,0000
	C	-3,005022	0,706218	-4,255091	0,0238
TR4	COINTEQ01	-0,908636	0,012618	-72,00977	0,0000
	D(DIT(-1))	0,352515	0,015719	22,42612	0,0002
	D(UT)	-0,217639	0,001995	-109,1048	0,0000
	D(UT(-1))	-0,442644	0,001987	-222,7357	0,0000
	C	-6,800321	0,351446	-19,34953	0,0003
TR5	COINTEQ01	-0,133720	0,014703	-9,094914	0,0028
	D(DIT(-1))	0,164139	0,085237	1,925680	0,1498
	D(UT)	-0,374521	0,016002	-23,40520	0,0002
	D(UT(-1))	0,052851	0,029742	1,776975	0,1736
	C	-1,190581	0,731467	-1,627661	0,2021
TR6	COINTEQ01	-0,440574	0,062682	-7,028724	0,0059
	D(DIT(-1))	-0,183294	0,060929	-3,008320	0,0573
	D(UT)	0,338986	0,028394	11,93856	0,0013
	D(UT(-1))	1,42E-05	0,019075	0,000745	0,9995
	C	-2,370781	1,644103	-1,441991	0,2450

TR7	COINTEQ01	-0,415193	0,047459	-8,748496	0,0031
	D(DIT(-1))	0,377891	0,046227	8,174706	0,0038
	D(UT)	-0,074086	0,012804	-5,786272	0,0103
	D(UT(-1))	0,086018	0,016450	5,229167	0,0136
	C	-3,016502	2,470055	-1,221229	0,3092
TR8	COINTEQ01	0,210062	0,051994	4,040101	0,0273
	D(DIT(-1))	-0,570002	0,055782	-10,21836	0,0020
	D(UT)	-0,914961	0,024289	-37,67030	0,0000
	D(UT(-1))	0,036944	0,062811	0,588178	0,5978
	C	2,182479	5,864855	0,372128	0,7345
TR9	COINTEQ01	-0,177633	0,015363	-11,56211	0,0014
	D(DIT(-1))	-0,018922	0,092775	-0,203956	0,8514
	D(UT)	-1,012728	0,020282	-49,93213	0,0000
	D(UT(-1))	-0,256921	0,101637	-2,527833	0,0856
	C	-2,113868	2,024475	-1,044156	0,3731
TRA	COINTEQ01	-0,563563	0,008562	-65,81952	0,0000
	D(DIT(-1))	0,002938	0,026713	0,109986	0,9194
	D(UT)	-0,749442	0,013248	-56,57196	0,0000
	D(UT(-1))	-0,423639	0,030835	-13,73868	0,0008
	C	-6,157967	1,120901	-5,493767	0,0119
TRB	COINTEQ01	-0,502169	0,147344	-3,408134	0,0422
	D(DIT(-1))	-0,197370	0,111175	-1,775308	0,1739
	D(UT)	-0,015443	0,101451	-0,152217	0,8887
	D(UT(-1))	0,166168	0,080814	2,056175	0,1320
	C	-3,165894	4,351841	-0,727484	0,5196
TRC	COINTEQ01	-0,551300	0,112973	-4,879922	0,0165
	D(DIT(-1))	0,627415	0,090215	6,954632	0,0061
	D(UT)	-0,016472	0,070639	-0,233189	0,8306
	D(UT(-1))	-0,667367	0,073580	-9,069947	0,0028
	C	-1,659155	1,705576	-0,972783	0,4024

Does each region individually have long run causality with the nation over the 2004-2015 period? As shown in Table 7, Istanbul, Aegean, East Blacksea and Turkey all are $I(2)$. Table 10 indicates that $c_i(1)$ is the error correction coefficient and $\hat{\beta}$ is the estimated coefficient of the national unemployment. There is no significant autocorrelation in the residuals because Durbin-Watson (DW) values are mostly about 2. Istanbul and Aegean are cointegrated with the nation, but East Blacksea is not. Hence, we run ECM for the first two relations and unrestricted VAR for the last one. Johansen cointegration test with lag one gives one cointegrating equation (CE) for Istanbul and Turkey. Running ECM, the CE (one lag residual) is $\varepsilon_{1,t-1} = d_{1,t-1} + 0{,}603u_{t-1} - 7{,}944$ from (3) hence cointegration equation is $d_{1,t-1} = -0{,}603u_{t-1} + 7{,}944$ and estimating system equations, we get $\Delta d_{1t} = 0{,}201 - 0{,}258\varepsilon_{1,t-1} - 0{,}149\Delta d_{1,t-1} + 0{,}283\Delta u_{t-1}$ from (2). There is no long run causality from the nation to Istanbul and Aegean region because p value is greater than 0,05 for both and the coefficient of the cointegration equation is positive for Aegean region. One percent increase in the national unemployment rate decreases the deviation of regional unemployment rate by 0,60%. Unrestricted

VAR gives $d_{9t} = 2{,}205d_{9,t-1} - 0{,}526d_{9,t-2} + 2{,}354d_{9,t-3} + 1{,}531u_{t-1} + 0{,}263u_{t-2} + 2{,}581u_{t-3} - 33{,}202$. The coefficients are insignificant at 5%. One percent increase the previous year in the deviation of the unemployment rate of East Blacksea increases that by 2,21% this year.

As shown in Table 7, East Marmara, West Blacksea, Mediterranean, Middle East Anatolia and Southeast Anatolia are I(1) and Turkey is I(2). Therefore, we run AR models for each region in relation with the nation. The estimation results are shown in Table 11. One percent increase in the nation increases the unemployment in East Marmara, Mediterranean, Middle East Anatolia and Southeast Anatolia by 0,43%, 0,50%, 0,20 and 0,38% respectively, but decreases the unemployment in West Blacksea by 0,64%.

Table 10. The error correction coefficients and cointegration coefficients with related statistics

Regions	Integration order	$\hat{\alpha}$	$\hat{\beta}$	$c_i(1)$	p	DW	R^2
Istanbul	2	-7,944	0,603	-0,258	0,581	2,233	0,235
Aegean	2	-18,121	1,723	0,021	0,843	1,903	0,089

Table 11. Unrestricted VAR and AR models with related statistics

Dependent variable: d_{it}						
Regions	Integration order	Method	*p*-value	DW	Adj.R^2	F-statistics
W.Marmara	0*		>0,05	2,087	0,303	0,437
d_{2t} = -1,39044156865*$d_{2,t-1}$ – 1,71659608344*$d_{2,t-2}$ + 0,839607243887*$d_{2,t-3}$ + 0,904392107231*u_{t-1} – 0,949978570517*u_{t-2} + 0,824831290374*u_{t-3} – 17,8475511196						
	U does not Granger cause W.Marmara and W.Marmara does not Granger cause U					
E.Marmara	1*		<0,05	1,826	0,613	0,027
d_{4t} = -5,18916490391 + 0,439246762758*u_t + [AR(1)=0,698962265175,AR(2)=-0,80827351403,UNCOND]						
W.Anatolia	0*		>0,05	3,219	0,723	0,194
d_{5t} = - 0,0716133003251*$d_{5,t-1}$ + 1,55520928495*$d_{5,t-2}$ - 1,1631712136* $d_{5,t-3}$ – 0,255916038682*u_{t-1} + 0,580716901813*u_{t-2} – 0,511153955243*u_{t-3} + 1,89972584323						
	U does not Granger cause W.Anatolia and W.Anatolia does not Granger cause U					
Mediterranean	1*		>0,05	1,867	0,519	0,031
d_{6t} = -3,40922401976 + 0,498424739662*u_t + [AR(1)=0,467451448592,UNCOND]						
C.Anatolia	1**		>0,05	2,492	0,640	2,104
d_{7t} = 0,260306* $d_{7,t-1}$ + 0,425123* $d_{7,t-2}$ - 0,231196* $d_{7,t-3}$ + 0,178213* u_{t-1} – 0,018246* u_{t-2} -0,345520* u_{t-3}+ C(7)						
U does not Granger cause C.Anatolia and C.Anatolia does not Granger cause U						
W.Blacksea	1*		<0,05	2,016	0,561	0,022
d_{8t} = 2,75826805948 – 0,605708833459*u_t + [AR(1)=-0,406763738033,UNCOND]						
E.Blacksea	2*		>0,05	3,004	0,609	0,265
d_{9t} = 2,20461754145* $d_{9,t-1}$ – 0,525853392763*$d_{9,t-1}$ + 2,35443005021*$d_{9,t-3}$ + 1,53079139755*u_{t-1} + 0,262775511936*u_{t-2} + 2,58082165306*u_{t-3}– 33,2024310747						
NE Anatolia	1**		>0,05	2,167	0,803	0,013
d_{10t} = 0,62177075991*$d_{10,t-1}$ – 0,0362545500801*$d_{10,t-2}$ + 0,227487337647*u_{t-1} + 0,57539258247*u_{t-2} - 10,2319334224						
ME Anatolia	1*		>0,05	1,753	0,191	0,213
d_{11t} = -0,685317012264 + 0,206551451468*u_t + [AR(1)=0,692334087998,UNCOND]						
SE Anatolia	1*		>0,05	1,952	0,550	0,044
d_{12t} = -0,40381089885 + 0,376189165154*u_t + [AR(1)=1,00560367581,AR(2)=-0,784588520664,UNCOND]						

**Only intercept included, **No intercept and no trend included*

Now, we analyze the effects of the market variables over the regional unemployment deviations after the 2008 crisis over the 2009-2015 period. For i=1,2,3,…,12 and t=2009-2015, the number of panels is 12 and the number of time periods is 7, so N >T. Hence, we can apply the LLC test for unit root test, but since the LLC test is weak we also include the IPS, the Fischer ADF and PP tests. In Table 12, the Pesaran CD test do not reject the null hypothesis at five percent significance level which shows no correlation in residuals.

Panel unit root test results in Table 13 indicates that based on the four tests, all variables d, L and M are I(1) with individual intercept and no trend included in the equation.

Pedroni (2004) Residual Cointegration Test of regional unemployment, labor participation and net migration shows that there is no cointegration. But Kao (1999) and Johansen (1991, 1995) cointegration tests show the opposite. The result are shown in Tables 14-16. In addition, pairwise cointegration testing shows that regional unemployment is cointegrated with labor participation, but not with net migration. In this case, we run unrestricted VAR instead of VECM.

Table 12. Residual Cross Section Dependence Test

Null hypothesis: No cross-section dependence (correlation) in residuals			
Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	74.46597	66	0.2221
Pesaran scaled LM	0.736868		0.4612
Pesaran CD	-1.149306		0.2504

Table 13. Panel unit root test summary of d, M and L

Series: Regional unemployment rate				
Method	Statistic	Prob.**	Cross-section	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-2,54489	0,0055	12	60
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-0,19958	0,4209	12	60
ADF - Fisher Chi-square	27,3958	0,2863	12	60
PP - Fisher Chi-square	47,7592	0,0027	12	72
Series: Net migration rate M				
Method	Statistic	Prob.**	Cross-section	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-1,55518	0,0600	12	60
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0,38977	0,6516	12	60
ADF - Fisher Chi-square	27,5113	0,2812	12	60
PP - Fisher Chi-square	33,2734	0,0984	12	72
Series: Labor participation L				
Method	Statistic	Prob.**	Cross-section	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-6,67726	0,0000	12	60
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1,19152	0,1167	12	60
ADF - Fisher Chi-square	36,0210	0,0546	12	60
PP - Fisher Chi-square	35,4373	0,0622	12	72

Table 14. Pedroni Residual Cointegration Test of d, L and M

H_0: No cointegration				
Alternative hypothesis: common AR coefs. (within-dimension)				
	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-0,695435	0,7566	-0,490941	0,6883
Panel rho-Statistic	2,045308	0,9796	1,663113	0,9519
Panel PP-Statistic	1,353102	0,9120	-0,088688	0,4647
Panel ADF-Statistic	2,225558	0,9870	1,946111	0,9742
Alternative hypothesis: individual AR coefs. (between-dimension)				
	Statistic	Prob.		
Group rho-Statistic	3,251453	0,9994		
Group PP-Statistic	-0,352991	0,3620		
Group ADF-Statistic	3,248563	0,9994		

Table 15. Kao Residual Cointegration Test of d, Land M

H_0: No cointegration		
	t-Statistic	Prob.
ADF	-2,310851	0,0104
Residual variance	1,017651	
HAC variance	1,145202	

Table 16. Johansen Cointegration Test of d, Land M

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0,05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0,605247	48,54128	29,79707	0,0001
At most 1	0,060809	3,925561	15,49471	0,9094
At most 2	0,018865	0,914191	3,841466	0,3390
Trace test indicates 1 cointegrating eqn(s) at the 0,05 level				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0,605247	44,61572	21,13162	0,0000
At most 1	0,060809	3,011371	14,26460	0,9460
At most 2	0,018865	0,914191	3,841466	0,3390
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0,05 level				

** denotes rejection of the hypothesis at the 0,05 level, **MacKinnon-Haug-Michelis (1999) p-values*

Since the variables are integrated of the same order but not cointegrated, Granger causality test can be run. To determine Granger causality between the stationary variables, we select optimal lag two by running an unrestricted VAR model. The results in Table 17 indicate that there is no Granger causality (G-causality) from labor participation and net migration to regional unemployment. This means that labor participation and net migration are not significant to predict the unemployment.

Before we estimate an unrestricted VAR model, we check whether there is a relationship between errors or not. A system of 12 regression equations

$$\Delta d_{it}=c_i+c_{1+i}\Delta L_{it}+c_{2+i}\Delta M_{it} \quad (4)$$

over the 2009-2015 period is estimated in order to analyze the relationship between the variables after the 2009 shock due to the 2008 global economic crisis. The OLS estimation results in Table 18 indicate that the coefficients of West Marmara, Aegean, Mediterranean and Central Anatolia are significant. Mostly coefficients are insignificant due to small sample size. Estimation results indicate that one percent increase in the deviation of labor participation in West Marmara region decreases the unemployment rate deviation in that region by 0,58 percent and one percent increase in the net migration rate increases the unemployment rate deviation by 53%. The both are economically sound. Labor participation decreases unemployment and more in migration to the region will increase the unmployment in that region. One percent increase in the deviation of labor participation in Aegean region increases the unemployment deviation in that region by 0,28 percent. Even though this result oppose the previous one, it is also economically sound. The participants in that region are selective to accept the jobs available for them, perhaps due to low wages or dislike. One percent increase in the deviation of labor participation in Mediterranean region decreases the unemployment deviation in that region by 0,63 percent and one percent increase in the net migration rate increases the unemployment deviation by 153 percent. This result indicates that the labor participants in Mediterranean region are more selective in accepting the jobs offered to them compared to Aegean region and in migration is more effective on the unemployment in Mediterranean region compared to West Marmara region. This means that a person migrating to West Marmara can find a job three times faster in time compared to one migrating to Mediterranean. One percent increase in the net migration rate in Central Anatolia region decreases the unemployment deviation by 129 percent. This result is also economically sound. It indicates that in migration to Central Anatolia region is more due to unemployment and the participants are not as much selective as those in Eagean and Mediterranean regions.

Table 17. VAR Granger causality test results

Null hypothesis: No Granger Causality			
Dependent variable: D(d_{it})			
Excluded	Chi-sq	df	Prob.
D(L_{it})	0.216307	2	0.8975
D(M_{it})	2.165358	2	0.3387
All	2.350074	4	0.6717
Dependent variable: D(L_{it})			
Excluded	Chi-sq	df	Prob.
D(d_{it})	0.761604	2	0.6833
D(M_{it})	4.599445	2	0.1003
All	4.782488	4	0.3104
Dependent variable: D(M_{it})			
Excluded	Chi-sq	df	Prob.
D(d_{it})	1.131929	2	0.5678
D(L_{it})	0.064426	2	0.9683
All	1.519681	4	0.8231

Table 18. OLS estimation results

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.237756	0.432794	-0.549351	0.5862
C(2)	0.285591	0.509825	0.560174	0.5788
C(3)	-1.368690	14.70760	-0.093060	0.9264
C(4)	-0.357873	0.077154	-4.638433	0.0000
C(5)	-0.576109	0.117584	-4.899569	0.0000
C(6)	53.12465	10.92053	4.864659	0.0000
C(7)	-0.227082	0.144113	-1.575721	0.1238
C(8)	0.279145	0.114687	2.433968	0.0200
C(9)	-10.60803	16.90538	-0.627494	0.5343
C(10)	-0.387058	0.279973	-1.382483	0.1753
C(11)	0.219960	0.311262	0.706671	0.4843
C(12)	46.86025	85.20847	0.549948	0.5858
C(13)	0.118525	0.217698	0.544445	0.5895
C(14)	0.368813	0.235196	1.568110	0.1256
C(15)	-3.302436	37.80811	-0.087347	0.9309
C(16)	-0.831155	0.206137	-4.032057	0.0003
C(17)	-0.626309	0.176889	-3.540686	0.0011
C(18)	152.7934	40.96166	3.730156	0.0007
C(19)	-0.004618	0.231448	-0.019953	0.9842
C(20)	-0.106187	0.149214	-0.711641	0.4813
C(21)	-129.0742	43.19361	-2.988270	0.0050
C(22)	-0.047519	0.430510	-0.110379	0.9127
C(23)	-0.485117	0.243704	-1.990596	0.0542
C(24)	-47.09157	35.93696	-1.310394	0.1984
C(25)	-0.169060	0.927281	-0.182318	0.8564
C(26)	-0.356793	0.340964	-1.046425	0.3023
C(27)	16.88217	68.39286	0.246841	0.8064
C(28)	0.394807	0.731161	0.539973	0.5925
C(29)	0.376026	0.670123	0.561130	0.5782
C(30)	458.1994	310.7800	1.474353	0.1491
C(31)	-0.726788	0.627416	-1.158382	0.2543
C(32)	-0.145644	0.588538	-0.247468	0.8060
C(33)	-56.78344	68.45540	-0.829495	0.4123
C(34)	0.303985	0.712760	0.426490	0.6723
C(35)	0.276524	0.385010	0.718224	0.4773
C(36)	-118.6582	83.18402	-1.426454	0.1624
Determinant residual covariance		0.000000		
Equation: D(D1)=C(1)+C(2)*D(L1)+C(3)*D(M1)				

Observations: 6			
R-squared	0.273108	Mean dependent var	-0.033333
Adjusted R-squared	-0.211486	S.D. dependent var	0.508593
S.E. of regression	0.559796	Sum squared resid	0.940113
Durbin-Watson stat	0.947007		
Equation: D(D2)=C(4)+C(5)*D(L2)+C(6)*D(M2)			
Observations: 6			
R-squared	0.906865	Mean dependent var	-0.116667
Adjusted R-squared	0.844774	S.D. dependent var	0.376386
S.E. of regression	0.148291	Sum squared resid	0.065971
Durbin-Watson stat	2.205015		
Equation: D(D3)=C(7)+C(8)*D(L3)+C(9)*D(M3)			
Observations: 6			
R-squared	0.737804	Mean dependent var	-0.166667
Adjusted R-squared	0.563007	S.D. dependent var	0.516398
S.E. of regression	0.341367	Sum squared resid	0.349594
Durbin-Watson stat	1.929478		
Equation: D(D4)=C(10)+C(11)*D(L4)+C(12)*D(M4)			
Observations: 6			
R-squared	0.333681	Mean dependent var	-0.300000
Adjusted R-squared	-0.110531	S.D. dependent var	0.593296
S.E. of regression	0.625225	Sum squared resid	1.172721
Durbin-Watson stat	1.985522		
Equation: D(D5)=C(13)+C(14)*D(L5)+C(15)*D(M5)			
Observations: 6			
R-squared	0.458835	Mean dependent var	0.183333
Adjusted R-squared	0.098059	S.D. dependent var	0.541910
S.E. of regression	0.514655	Sum squared resid	0.794610
Durbin-Watson stat	1.610236		
Equation: D(D6)=C(16)+C(17)*D(L6)+C(18)*D(M6)			
Observations: 6			
R-squared	0.879924	Mean dependent var	-0.383333
Adjusted R-squared	0.799873	S.D. dependent var	0.818332
S.E. of regression	0.366085	Sum squared resid	0.402055
Durbin-Watson stat	3.457376		
Equation: D(D7)=C(19)+C(20)*D(L7)+C(21)*D(M7)			
Observations: 6			
R-squared	0.754690	Mean dependent var	-0.066667
Adjusted R-squared	0.591150	S.D. dependent var	0.771146
S.E. of regression	0.493082	Sum squared resid	0.729388

Durbin-Watson stat	1.830889			
Equation: D(D8)=C(22)+C(23)*D(L8)+C(24)*D(M8)				
Observations: 6				
R-squared	0.749728	Mean dependent var		0.500000
Adjusted R-squared	0.582880	S.D. dependent var		1.306905
S.E. of regression	0.844062	Sum squared resid		2.137321
Durbin-Watson stat	1.068734			
Equation: D(D9)=C(25)+C(26)*D(L9)+C(27)*D(M9)				
Observations: 6				
R-squared	0.271946	Mean dependent var		0.416667
Adjusted R-squared	-0.213424	S.D. dependent var		1.654590
S.E. of regression	1.822622	Sum squared resid		9.965850
Durbin-Watson stat	1.156985			
Equation: D(D10)=C(28)+C(29)*D(L10)+C(30)*D(M10)				
Observations: 6				
R-squared	0.420432	Mean dependent var		0.016667
Adjusted R-squared	0.034053	S.D. dependent var		1.575331
S.E. of regression	1.548276	Sum squared resid		7.191473
Durbin-Watson stat	0.974036			
Equation: D(D11)=C(31)+C(32)*D(L11)+C(33)*D(M11)				
Observations: 6				
R-squared	0.218597	Mean dependent var		-0.700000
Adjusted R-squared	-0.302339	S.D. dependent var		1.341641
S.E. of regression	1.531081	Sum squared resid		7.032630
Durbin-Watson stat	2.071212			
Equation: D(D12)=C(34)+C(35)*D(L12)+C(36)*D(M12)				
Observations: 6				
R-squared	0.404650	Mean dependent var		0.466667
Adjusted R-squared	0.007749	S.D. dependent var		1.695484
S.E. of regression	1.688902	Sum squared resid		8.557170
Durbin-Watson stat	2.601716			

Correlograms show that there is no autocorrelation in the residuals. Residual correlation matrix and residual covariance matrix are calculated to test the following hypothesis.

H_0: OLS method is appropriate (there is no relationship between models' errors).

H_1: SUR method is appropriate (there is a relationship between models' errors).

The Breusch and Pagan (1980) chi-square test value $T\sum_{i=1}^{N}\sum_{j=1}^{i-1} r_{ij}^{2}$ =7(12,80) = 89,60 is greater than Chi-square table value for (*p;df*)=(0,05;66)=85,97 where r is the residual correlation, $df=N(N-1)/2$ and N is the number of equations. Therefore, we reject the null hypothesis which means there is a relation between the error terms of the models. Consequently, these models should be estimated by the SUR method. However, we could not run the SUR model using Eviews 9. This may be due to variables being closely related.

We run the panel VAR model (4) with optimal lag two (pooled OLS) and check whether the coefficients are BLUE (best linear unbiased estimator). For this to happen, residuals must have no autocorrelations and be normally distributed and homoscedastic.

VAR Residual Portmanteau Tests for Autocorrelations accepts null hypothesis of no residual autocorrelations up to lag h. VAR residual normality test using Cholesky (Lutkepohl) orthogonalization with the null hypothesis of multivariate normal residuals does not reject the normality for the first two components of kurtosis and skewness. However, it rejects the normality jointly. This result is due to short sample, with 48 observations included. VAR Residual Heteroskedasticity Tests reject the null hypothesis of no cross terms (only levels and squares) which means homoscedasticity under joint test and for two components out of six under individual F and chi-square tests. These results indicate that the estimated coefficients are not BLUE. VAR Granger Causality/Block Exogeneity Wald Tests with the null hypothesis of zero lagged coefficients show that the lagged coefficients of labor participation and net migration jointly do not G-cause regional unemployment. This means that past values of labor participation and net migration are not significant to predict the future values of the unemployment.

Due to weakness of Pooled OLS in terms of serial correlation, we estimate FE and RE model to determine whether coefficients of labor participation and net migration rate are significant to explain the regional unemployment. Hausman test is used based on H0: Random Effects (RE) model and H1: Fixed Effect (FE) model to determine which one is more appropriate. Table 19 indicates rejection of the null hypothesis and that FE is more appropriate.

In Table 20, the Pesaran CD test do not reject the null hypothesis of no correlation in residuals at five percent significance level.

Cross section FE model is defined as

$$\Delta d_{it} = c_{i0} + \sum_{j=1}^{p} \left(c_{i,j} \Delta d_{i,t-j} + c_{i,l+j} \Delta L_{i,t-j} + c_{i,2+j} \Delta M_{i,t-j} \right) + r_{it} \quad (5)$$

where p is the order of the lags, i is the region, t denotes periods, r_{it} is the error term, d, L are deviations of regional unemployment, labor participation from the national rate respectively and M is net migration rate. As stationary variables included in the model, FE panel VAR model estimation results are shown in Table 21. Estimation results indicate no significant coefficients to explain the regional unemployment rate.

Table 19. The Hausman test results

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	13.780126	6	0.0322

Table 20. Residual Cross Section Dependence Test

Null hypothesis: No cross-section dependence (correlation) in residuals			
Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	82.38048	66	0.0839
Pesaran scaled LM	1.425738		0.1539
Bias-corrected scaled LM	-0.574262		0.5658
Pesaran CD	-0.711998		0.4765

Table 21. Fixed effects model estimation results

Δd_{it} = C(1)*Δd_{it}(-1) + C(2)*Δd_{it}(-2) + C(3)*Δl_{it}(-1) + C(4)*Δl_{it}(-2) + C(5)*ΔM_{it}(-1) + C(6)*ΔM_{it}(-2) + C(7)				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.039147	0.151889	0.257734	0.7984
C(2)	-0.036945	0.128522	-0.287462	0.7757
C(3)	-0.132677	0.083501	-1.588925	0.1226
C(4)	-0.123047	0.097910	-1.256732	0.2185
C(5)	22.99212	12.49846	1.839597	0.0757
C(6)	-3.493433	11.82474	-0.295434	0.7697
C(7)	-0.185648	0.113671	-1.633201	0.1129
	Effects Specification			
Cross-section fixed (dummy variables)				
R-squared	0,483142	Adjusted R-squared		0,190256
F-statistic	1,649592	Durbin-Watson stat		2,598887
Prob(F-statistic)	0,112352			

Finally, we follow Jimeno and Bentolila (1998) and Brunello et al (2001) to estimate the responses of variables to each other. We run an unrestricted VAR model with unemployment and labor participation in deviations from the mean and net migration rate. One standard deviation shock given to error term of each variable can effect future values of the dependent variable. Figure 4 shows no significant response of labor participation and net migration to regional unemployment after 2009. However, there is an indication of a moderately negative response of regional unemployment to labor participation and a moderately positive response of labor participation to net migration after ten years.

Figure 4. Response of the variables after 2008

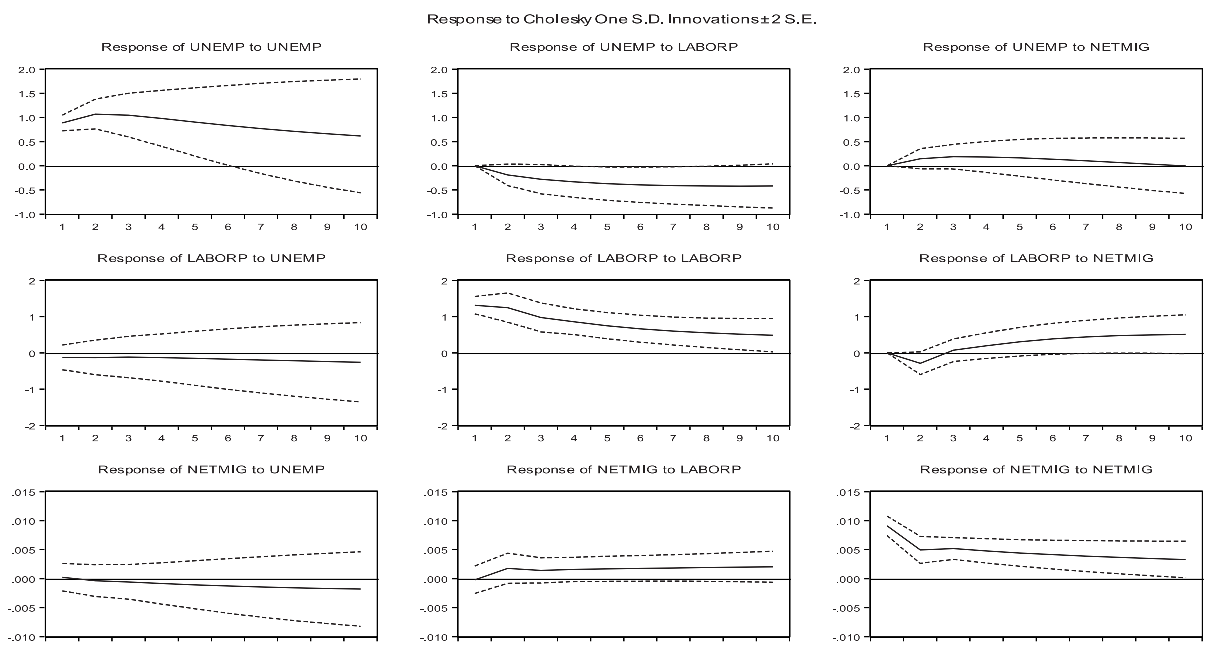


Table 22. Short Run Model: First Order Transition Probability Matrix

	A	B	C	D	E
A	0,38(3)	0,63(5)	0	0	0
B	0,14(4)	0,55(16)	0,31(9)	0	0
C	0,02(1)	0,13(6)	0,77(36)	0,09(4)	0
D	0	0	0,10(4)	0,83(35)	0,07(3)
E	0	0	0	0,33(2)	0,67(4)

5. Markov Chain Estimations

Acar et. al. (2016) using a Markov chain computed short run transition probabilities of individuals moving across three different labor market states which are employment, unemployment and inactivity. First order time independent Markov models are not widely used to estimate transition probabilities of unemployment rates. Pehkonen and Tervo (1998) have estimated the probabilities of municipalities' unemployment rates in short run and long run using the period between two crisis 1975 and 1993 in Finland. Results have shown that persistence of transitions were more clear in the short run than in the long run. In our study, we have classified regional unemployment rates in five categories with equal class width and formed a first order time independent Markov chain model by coding states of unemployment rates with E, D, C, B, A from the lowest state to the highest state. We have estimated the probabilities of one year transitions from one state to another in regional unemployment rates over the 2004-2015 period using 5x5 transition frequency matrix so that the sum of the probabilities in each row equals to one.

Table 21 includes 132 transitions (12 regions times 11 transitions) which are given in paranthesis and annual transition probabilities. The relative frequency of the transitions from state i to state j is the estimator of transition probabilities. The first row has three transitions from the highest (unemployment rate between 14,60% and 17,54%) to the highest category and five transitions from the highest to the second highest category (unemployment rate between 11,65% and 14,59%). Of these, 37,5% remained in the same state. Zero probabilities below and above the diagonal indicates that there is no transition from the lowest to the highest, second highest and third highest and vice versa. Further, there is no transition from the second lowest state to the highest and to the second highest and vice versa. The overall probability of persistence is 64%. The highest persistence rate is 83% which is observed in the second lowest row category. A visiual check on the panel data easily shows that among all 132 transitions there is only one two-state transition due to 2008 global economic crisis, which is in Istanbul province. The others remain within one transition. The unemployment rates in eight out of 12 regions have increased to the next state over the 2008-2009 period. The probability of persistence in a region varies from 25% to 100% with Middle East Anatolia being the least persistent and West Black Sea being the most persistent region. Both regions remains in the second lowest category permanently over the 2004-2015 period. Among all transitions the lowest persistence is observed in 2008-2009 with 41,7% of transitions remaining in the same state and the highest persistence is observed in 2005-2006 with 91,7% of transitions remaining in the same state. 2004-2006 economic expansion policy has lowered unemployment rates in 2004-2005 in East Black Sea and Middle East Anatolia only, with all other regions remaining in the same state.

The most significant change in the long run from 2004 to 2015 is observed in Middle East Anatolia region where unemployment rate is dropping two categories, from the highest category to midcategory. As half of the regions remain in the same category, Istanbul and Southest Anatolia move one category up to the second highest and the highest, respectively. The overall probability of persistence drops to 48%. The highest persistence rate is 100% which is observed in the lowest row category. Even though our data is insufficient, long run model in Table 22 shows persistence in unemployment rates in the period 2004-2015. This implies that shock in 2009 was transitory. As the diagonal probability declines for midcategory and one below, it increases for the lowest category.

Table 23. Long Run Model: 12 Year Transition Probability Matrix

	A	**B**	**C**	**D**	**E**
A	0	0	1	0	0
B	0,333	0	0,667	0	0
C	0,25	0	0,75	0	0
D	0	0	0	0,667	0,333
E	0	0	0	0	1

Table 23 shows that Istanbul province unemployment rate has more tendency to decline to mid-category than to increase to the highest category from the second highest category. West Marmara unemployment rate has a tendency to increase to midcategory from the second lowest category. Aegean unemployment rate predictions would have same probabilities as the nation, which has a tendency to increase to the second highest category from the midcategory. Mediterranean remaining in the midcategory over the last five years and West Blacksea remaining in the second lowest category over the last 12 years are expected to remain in the same category in the long run. The limit matrices of the other regions are given under stationarity in Table 23. Regions with lower GDP have more variations in probabilies to move to a lower or to a higher category compared to the regions with higher GDP. As expected unemployment rate in West Marmara, Aegean, West Anatolia, Central Anatolia and the nation slightly increase, it slightly declines in Istanbul and East Marmara. A significant increase is expected in Northeast Anatolia, East Blacksea and Middleeast Anatolia and a significant decline is expected in Southeast Anatolia in the long run.

Table 24. Estimation and Expectation of Unemployment Rates in 2016 and Stationarity

REGIONS	**2016**	**STATIONARITY**	$E(\hat{Q}_{16})$	$E(\hat{Q})$	**SY**[9]
Istanbul	0 0,67 0,33 0 0	0,07 0,43 0,50 0 0	12,1	11,9	2023
West Marmara	0 0 0,13 0,88 0	0 0 0,27 0,73 0	7,7	8,0	2029
Aegean	0 0,11 0,89 0 0	0 0,18 0,82 0 0	10,5	10,7	2024
East Marmara	0 0,13 0,75 0,13 0	0 0,09 0,73 0,18 0	10,3	9,9	2023
West Anatolia	0 0,25 0,50 0,25 0	0 0,27 0,53 0,20 0	10,2	10,4	2024
Mediterranean	0 0 1 0 0	0 0 1 0 0	10,2	10,2	2016
Central Anatolia	0 0,14 0,71 0,14 0	0 0,18 0,64 0,18 0	10,1	10,2	2021
West Blacksea	0 0 0 1 0	0 0 0 1 0	7,2	7,2	2016
East Blacksea	0 0 0 0,50 0,50	0 0 0 0,69 0,31	5,7	6,3	2023
Northeast Anatolia	0 0 0 0,25 0,75	0 0 0 0,64 0,36	5,0	6,2	2037
Middle East Anatolia	0 0,20 0,80 0 0	0,07 0,27 0,67 0 0	10,8	11,5	2028
Southeast Anatolia	0,75 0,25 0 0 0	0,53 0,47 0 0 0	15,3	14,7	2029
Turkey	0 0,11 0,89 0 0	0 0,18 0,82 0 0	10,5	10,7	2024

9 *Stationarity year*

6. Conclusion

We have shown that regions with higher GDP show similar behavior and all reach their highest level of unemployment rate in 2009 over the 2004-2015 period. Relative and absolute dispersions indicated a rise in unemployment and consequently another upcoming recession. As of November 2016 national unemployment rate is 12,1% and climbing up towards a new top. We have shown that the 2009 shock was transitory in Turkish economy. Regional unemployment deviations have a moderate adjustment rate to equilibrium with the national unemployment rate as the explanatory variable. Regional unemployment deviations get back to equilibrium in about seven years.

We have regressed the regional unemployment rates on national unemployment rate. Panel analysis showed that regional unemployment rates converges to equilibrium slowly and there is a long run causality from the nation to each region except West Blacksea region. However, individual analysis showed the opposite by indicating no long run causality.

We have found that the response of labor participation and net migration to unemployment were not significantly different from zero whereas the response of regional unemployment to labor participation was moderately negative and that of labor participation to net migration was moderately positive after ten years.

An estimation for 2008 and 2015 showed that regional unemployment rates were remarkably stable. However, we cannot link 2015 shock (presumably) to 2008 shock directly because 2015 crisis is mainly based on a failed military coup, election of Trump and Syria war.

Short run Markov chain model showed that regional unemployment rates were persistent during 2004-2006 economic expansion which did not lower unemployment rates in regions with higher GDP. The highest persistence was observed in four fifth of the regions remaining between 5,66% and 8,60% unemployment rates. The 2008-2009 world economic crisis affected Istanbul province most by taking unemployment rate two categories up. In this period, as eight regions moved up to next category, three regions remained uneffected. Overall probability of persistence is greater in the short run Markov chain compared to the long run Markov chain. We have also shown that the regions with higher GDP are expected to be more persistent in the long run compared to regions with lower GDP. Mediterranean and West Black Sea are the most persistent or stable in their category and about half percent decline is expected in Southeast Anatolia in the long run. However, Southest Anatolia, the region with the highest unemployment rate and high out migration rate, should be analyzed in more detail and with more care due to political conflict in this region.

The findings of the study suggest some policy implications. A seven year period per shock was observed in the last two decades. The results support the equilibrium of the unemployment in the long run. We can deduce that a possible shock this year or next will more likely bounce back to around equilibrium in the centennial of the Republic of Turkey. Over-hiring workers may destabilize the regional unemployment, the wages and production. Therefore, the government should not carry out a macroeconomic policy to stabilize aggregate unemployment rate.

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