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Unemployment Rate Convergence in the Case of Turkey: A Regional Analysis within the Scope of Dollarization and Real Wage*

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ABSTRACT

The unemployment rate is a fundamental variable in the socioeconomic comparison between regions. Hence, it is included in the focus of regional economic policies. Regional policy sets are frequently used to eliminate regional unemployment differences. This situation raises discussions about the efficiency of the employment policies and questions whether regional unemployment rates tend to converge to national averages. Especially in economies with regional development differences and the labor market does not exhibit a homogeneous structure, the regional analysis of unemployment rates is becoming more critical. This paper analyses the convergence of unemployment rates with the panel data set, which includes 26 regions of Turkey and the period 2004-2020. It is investigated if regional macroeconomic interactions in Turkey make the labor market homogeneous. Besides, the effects of dollarization and real wage on the unemployment rate change are questioned. The study's findings indicate the presence of deterministic and stochastic β convergence. According to the unconditional and conditional β convergence analysis, the change in the unemployment rate depends on the initial value of the unemployment rate. The findings also show that if dollarization and real wage growth increase, unemployment rate growth also increases. σ convergence analysis also confirms the presence of unemployment rate convergence.

Keywords
Unemployment, Minimum Wage, Dollarization.

JEL Classification
E24, J64, F31

*The comments and opinions in the article belong to the author and are not related to the institution she works for. (Makalede yer verilen yorum ve görüşler yazara ait olup çalıştığı kurumla ilgisi bulunmamaktadır).

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1. Introduction

The convergence phenomenon is based on the idea in the economic growth literature that economies far from a stationary state are inclined to grow faster than economies close to a stationary state. This theoretical concept takes its origin from the basic assumptions of the Solow (1956) growth model. According to the traditional neoclassical assumptions, per capita income cannot be increased for a long time without technical progress, so economies go into a stationary state where per capita income is constant (Solow, 1956, 1957). In this approach, all economic units can use technology freely as a public good. Therefore, the technology, which is costly to produce, can be used by other economic units at costless or negligible cost. This assumption means economies converge to a similar income level in the long run (Archibugi & Michie, 1998). Thus, the growth rate negatively affects the initial per capita income. With the realization of convergence, the growth rate of relatively weak economies approaches the growth rate of more powerful economies. If the definition is to be generalized, the leader economic units capture by the economic units that come from behind. In this process, the growth trend of a fundamental variable becomes increasingly similar.

As well as programmatic developments, the diversification of data sets and the increase in their size, convergence analysis has expanded in empirical studies. As a result, convergence analysis has become applied in other fields such as economic growth, technology, productivity, labor market, and finance. In the context of the study, labor market is examined using the methodological framework of income convergence and the unemployment distribution is modelled. It aims to identify the regional unemployment rate trend and reveal the regional labor market properties. In addition, the labor market data set that gives information at the national level is questioned.

In the following chapters of this study, the theoretical framework and the literature are discussed first. In the subsequent sections, the empirical application's methodology is explained, and the data set and model are introduced. The empirical findings are introduced in the sixth chapter. The last chapter includes conclusions and evaluations with an approach concentrating on the significant findings of the analysis.

2. Theoretical Framework

Unemployment is the fundamental indicator in comparing socioeconomic development between regions. Friedman (1968) notes that there is a certain amount of unemployment at any point in time, which is consistent with the equilibrium in the structure of real wage rates. At the moment in question, real wage tend to rise at an average normal rate. This ratio can be maintained as long as variables such as capital formation and technological developments remain in their long-term dynamics. A lower unemployment rate indicates a surplus of labor demand. In this case, real wages have a tendency to increase. Similarly, a higher unemployment rate indicates a labor supply surplus. This case causes a tendency to decrease in real wages. Friedman (1968) defines the natural level of unemployment based on the Walrasian general equilibrium. This balance includes the real structural features of the labor and commodity markets, such as market disruptions, stochastic variability in demand and supply, open job positions, obtaining information cost, and labor mobility cost. Therefore, this view defines the natural unemployment rate as the equilibrium unemployment level and a function of real variables. Therefore, a natural unemployment rate will be in the case of full employment. According to this approach, changing wages and prices ensures a natural unemployment rate in the long term (Friedman, 1977).

The unemployment trends of the 1980s raise the question of whether cyclical fluctuations can permanently affect the unemployment rate (Gomes & Silva, 2009). The process, characterized by the labor market rigidity, causes the current unemployment rate to have permanent results and impacts the natural unemployment rate. In this case, the old natural unemployment rates cannot be returned, and business cycles lead to a new balance of unemployment rates. The increase in the current unemployment rate also increases the natural unemployment rate. This case is expressed as unemployment hysteria in the new Keynesian school. The current unemployment rate is highly dependent on the past unemployment rate. If the hysteria hypothesis is valid, the effect of shocks leading to a decrease in employment on unemployment is long-lasting, and unemployment may become permanent. Such a persistent state is not answered with the natural unemployment rate theory, which predicts that the natural unemployment rate will be valid in the long run through changing wages and prices (Blanchard & Summers, 1986). From the natural unemployment rate view, if the mobility of workers, work and wages ensure the adjustment mechanism and the labor market adapts to the long-term balance, temporary fluctuations occur in the relative unemployment. In these conditions, it is foreseen a convergence in unemployment rates (Blanchard & Katz, 1992).

Thus, economic units return to their natural unemployment rate in course of time. In the exact opposite situation, the hysteria hypothesis is valid. According to the hypothesis, the shocks' effects on unemployment are permanent due to the labour market rigidities. Meanwhile, the unemployment rate has a non-stationary process. On the other hand, a third theory is also described by Phelps (1994). He suggests that most shocks are temporary and cause permanent effects at natural rates rarely. In this theory's background, the unemployment rate has a stationary process. However, this stationary process is located around a linear breaking trend. Unlike the traditional NAIRU framework, unemployment does not exhibit a significant persistence in this definition.

In theory, the regional convergence of unemployment finds answers on two main axes. Firstly, the unemployment rates of the regions do not converge because of the presence of regional compensatory mechanisms. Depending on socioeconomic limitations, regional labor markets may differ from each other. These restrictions reduce the mobility of the employment-related factors. Last of all, the unemployment rate in regions with weak labor demand exceeds the national average geographically. Although labor force mobility is possible geographically, socioeconomic and other geographical compensation mechanisms cause the labor force to remain in areas with weak labor demand and poor employment conditions. This situation ensures a ground for policies aiming to reduce regional unemployment disparities. In this approach, socioeconomic and geographical characteristics make the equilibrium unemployment rate unique to the region. The second axis is related to neoclassical foundations. In this approach, convergence along with factor and wage mobility takes place. In this case, the regions are in an equilibrium relationship (Marston, 1985). Therefore, the competitive unemployment rate between the regions converges. Unemployment differences between regions occur due to slow adaptation to labor market rigidities or asymmetric shocks that weaken labor demand in the short term (Blanchard & Katz, 1992). The disparity in unemployment between regions are eliminated with factor mobility in the long term (Rios, 2014). At this point, the government's employment policies do not work as they cannot reduce unemployment in any region for a long time (Marston, 1985).

The long-term balance of an economy depends on its structural features. Therefore, economies' structural features are also considered in the convergence analysis. In unconditional convergence, structural features also converge as an implicit assumption. In conditional convergence, which includes different structural features of economies, it is expected that structurally similar economies will have the same stationary state. Consequently, they will

converge on each other (Sala-i-Martin, 1996; Galor, 1996). In this context, wage is an essential theoretical variable related to employment analysis. Although it is formed according to the basic assumptions of different economics schools, wages have two main roles. Higher wages mean higher production costs depending on employment as the primary input to the production function. On the other hand, wages are also a source of total demand (Villanueva and Cárdenas, 2021). In the classical approach, unemployment occurs voluntarily since real wages are flexible. According to Keynes, labor demand determined by effective demand defines the level of employment. Unemployment occurs if the effective demand is lower than the necessary level for full employment. Contrary to the classical approach, falling wages do not eliminate unemployment due to inadequate effective demand (Serdaroglu, 1997). Meanwhile, the issue of the minimum wage effects on employment is discussed more widely spectrum. Since it has a social protection role and political basis, the minimum wage is an interdisciplinary issue. The minimum wage approaches of the economics schools have been shaped in the context of their basic assumptions. In the case of a competitive labor market, the minimum wage, which is set at a level higher than the equilibrium wage level, theoretically has an employment-reducing effect (Boeri, 2009). This approach points to potential job losses from the minimum wage. According to the neoclassical model, the minimum wage, set above the equilibrium wage, leads to an increase in the cost of production. This situation leads to an increase in production and the substitution of capital for labor. The labor demand decreases depending on the product price elasticity, the share of labor in production, the substitutability between labor and capital, and the difference between the minimum wage and the equilibrium wage (Neumark & Wascher, 2008). On the other hand, the monopsonist model accepts that the minimum wage set above the equilibrium wage level can theoretically increase employment (Stigler, 1946). Depending on the period, case and method, empirical studies prove that the minimum wage positively affects employment or increases unemployment (Bonin, et al., 2020; Cahuc & Zylberberg, 1999; Currie & Fallick, 1996; Deere et al., 1995; Kim & Taylor, 1995; Kim & Lim, 2018; Meer & West, 2016; Neumark & Wascher, 1992; Partridge & Partridge, 1998; Stewart, 2007).

Another structural variable used in the study to capture socioeconomic differences is dollarization. The phenomenon of dollarization refers to using foreign currency for any of the three essential functions of money: Unit of account, means of payment and store of value. The most relevant functions of money with dollarization are the unit of account and means of payment

functions (Calvo, 2002). The first function that soft money loses against hard money is the store of value role. It is aimed to hedge financial assets in economies with high inflation and unstable macroeconomic conditions through dollarization. It is a hedging reaction to the national currency in case of uncertainty and risk. In this sense, dollarization is also an indicator of macroeconomic instability. The behaviour of saving with a foreign currency also creates a risk that loans will also be issued with foreign currency in the banking system. Thus, negative results emerge in interest rates, investment, production, employment and wages (Dalgic, 2018).

3. Literature Review

In the case of Turkey, studies involving convergence analysis have generally approached the concept through income. These studies present different empirical evidence for convergence or divergence in the context of the analysed period and methodology (Elmalı et al., 2021; Erk et al. 2000; Filiztekin, 1998; Gezici & Hewings, 2004; Gömleksiz et al., 2017; Halaç & Kuştepeli, 2008; Karahasan, 2015; Kılıçaslan & Özatağan, 2007; Şanlı, 2022; Yıldırım & Öcal, 2006). However, there are very few studies analysing the regional unemployment convergence for Turkey. The fundamental cause is that the labor force data published at the regional level by the Turkish Statistical Institute date back to relatively recent (2004). This limitation regarding the data set also appears as a limitation of this study. Meanwhile, the issue of unemployment convergence in the international arena has often occurred in empirical studies, especially recently.

Marston (1985) analysed unemployment rate convergence based on "Compensation Theory". The study includes 30 American metropolitan areas. According to the study's findings, assuming benefits are at the same level in the equilibrium for all individuals, the disparity between the unemployment rates of metropolitan areas converges with the mobility of factors within one year. It offers a compensation mechanism for favourable climate conditions, high wages and high unemployment insurance payments typical of the region. Therefore, these factors affect labor mobility, and unemployment differences converge to zero. They found that labor mobility provides a long-term balance in the labor market, and convergence has occurred. The study emphasises that temporary situations arising in growth cause temporary fluctuations in relative unemployment and wages.

Martin (1997), for the United Kingdom, showed that local unemployment rate shocks are not long-lasting. However, regional unemployment rates vary over the long term. Thus, there is a

stable equilibrium distribution around the national average unemployment rate. Costantini and Lupi (2006) investigated the convergence of the Italian labor market. The long-run characteristics of regional unemployment inequalities are examined with panel unit root and cointegration tests in the study. According to the findings, the stochastic convergence hypothesis is rejected, but a long-run equilibrium relationship between regional unemployment rates should not be ignored. Bayer and Juessen (2007), moreover, studied the persistence of regional unemployment rate differences in the case of West Germany for the period 1960-2002. The most apparent difference of the study is that relative unemployment rates are used directly instead of the absolute level of unemployment rates. The results reveal a moderate convergence rate. Again, the study shows that in the case of structural breakdowns are not kept in view, no evidence is found about stochastic convergence in relative unemployment rates. There is convergence in more robust panel-based methods. Considering the structural fracture caused by the second oil crisis, it is determined that the estimated convergence rate has increased significantly. Gomes and Silva (2009) analysed the unemployment rate dynamics for six Brazil regions and their national level. Structural unit root tests are used to determine which of the natural unemployment rate or convergence frameworks is valid. The findings indicate a hysteria effect for five regions, which indicates a high persistence in the regional unemployment rate. Meanwhile, stochastic convergence has been found in other metropolitan areas except a region characterised by the hysteria effect. In addition, the study concludes that stochastic convergence is associated with higher unemployment levels. Tyrowicz and Wojcik (2010) analysed the regional unemployment in Poland for the period 1999-2006. In the study, the existence of β and σ convergence is investigated using income convergence analysis methods. It has been determined that the unemployment rate distribution is stable over time. Accordingly, no support has been found to indicate the existence of conditional and unconditional β convergence. There is a high level of persistence in regions with very high and very low unemployment. It has been found that regions with moderate unemployment levels tend not to show persistence in regional unemployment differences. Güloğlu and Ispir (2011), for the period 1988-2008 and 9 sectors in Turkey, showed that the effects of temporary shocks on the unemployment rate persist for a long time but are not permanent. For this reason, it is emphasized that a particular type of natural unemployment can explain the unemployment rates of sectors. The study tests stationarity with a panel unit root test that allows breaking at different dates and numbers in each sector. Dikmen and Dursun (2018), on the other hand, examined unemployment hysteria

with the nonlinear panel unit root test suggested by Beyaert and Camacho (2008). They also investigated the existence of unemployment rates convergence for the period 1980-2015 in 12 Latin American countries. Two regimes of threshold autoregressive specification are used in the study. The findings show that unemployment hysteria is valid under the first regime, and convergence is valid under the second regime.

Estrada et al. (2013) analysed the macroeconomic convergence and the role played by the monetary union as a convergence factor for the Eurozone countries. According to the study's findings, there is a strong convergence in countries' unemployment rates in the first nine years of the Eurozone. However, between 1985 and 1998, unemployment rates in both the Eurozone and non-Eurozone countries converge. Both the long-term and short-term trends of unemployment rates have in common with the two group countries. According to the study results, the convergence process has been interrupted between the Eurozone countries because of the financial crisis and essentially reversed more than in other economies. Rios (2014) performed another study within the scope of Europe. In the study, unemployment rates are analysed by combining regional and national factors with spatial panel methods for the period 2000-2011 and the scope of 258 NUTS-2 regions of Europe. Empirical results show that regional unemployment rate differences are decreasing, and regional market balance factors drive the process of such regional convergence. Beyer and Stemmer (2016) also analysed the distribution and dynamics of European regional unemployment rates. The study finds a convergence between 1996 and 2007 and a divergence between 2007 and 2013. In addition, the study shows that convergence is caused only by country factors. On the contrary, divergence can be attributed to fluctuations specific to the country and the region. Baktemur and Özmen (2017) studied the unemployment convergence for EU countries. The study covers the 1995-2013 periods. Spatial effects are also included in the analysis. Although the findings support spatial effects, the study does not provide evidence for the unemployment convergence between countries. Kristic et al. (2019) analysed the unemployment rates in the Eurozone countries, taking into account structural breakdowns. Unemployment hysteria is detected in the study. Meanwhile, the study's findings support stochastic convergence in most Eurozone countries, but Eurozone membership does not guarantee stochastic convergence. Kónya (2020) examined the convergence of the unemployment rate for the former EU countries, the new EU countries, the Euro area countries and the non-Euro area countries. The analysis includes σ convergence, and β convergence. σ convergence has been detected for new EU countries and non-

Euro countries. When the internal structural break is allowed, each country group experiences σ convergence in the second half of the 1990s or the first half of the 2000s. The study's findings also provide support for stochastic convergence. Corakci et al. (2022) analysed the stochastic convergence of unemployment rates with the data set covering the 19 countries of the Euro area and the period 2000-2020. The analysis is carried out using a unit root test procedure, which allows for gradual structural breaks and asymmetric adjustment towards equilibrium. The results show that relative unemployment rates are stable compared to the Eurozone unemployment rate. Besides, evidence of stochastic convergence in unemployment rates has been obtained.

4. Methodology

Convergence analysis allows us to investigate whether the initial conditions affect the long-term results of the variable. There are two basic frameworks in the literature on convergence analysis: β convergence and σ convergence. β convergence shows that economies with relatively poor initial conditions tend to develop faster than economies with better initial conditions (Sala-i-Martin, 1996). β convergence occurs when the relative unemployment rates are stationary. The constant term stationarity is characterized by deterministic convergence in the relative unemployment rate series. On the other hand, the trend stationarity is characterized by stochastic convergence (Kristic et al., 2019). $\overline{u_{it}}$ is relative unemployment rate of the *i*-th region at the *t*-th period is defined by;

$$\overline{u_{it}} = \ln(\frac{u_{it}}{\overline{u_t}}) \qquad i = 1,2,...,26 \ and \ t = 2004,...,2020 \tag{1}$$

u_{it} shows unemployment rate for *i*-th region at the *t*-th period. $\overline{u_t}$ is the adjusted average unemployment rate. This variable is obtained by weighing the unemployment rate for each year with the regional unemployed persons numbers. In order to avoid a possible bias, *i*-th region's unemployment rate is excluded from the average unemployment rate $\overline{u_t}$. The existence of the convergence for the relative unemployment rate is tested by Pesaran (2003) CADF unit root test[1].

Another perspective, β convergence is divided into unconditional (absolute) and conditional β convergence. Convergence occurs if there is a negative relationship between the

[1] For detailed equations, see: Pesaran, 2003.

variable's initial level and growth rate. In unconditional β convergence, it is assumed that the structural features of different economies are the same. They have the same production function and stable state equilibrium. In conditional β convergence, different structural features of economies are included in the model (Galor, 1996; Sala-i-Martin, 1996; Purwono et al., 2021). Unconditional (absolute) β convergence is analyzed by following Sala-i-Martin (1996). This method is defined by Equations 2 and 3.

$$\gamma_{i,t,t+T} \equiv \log(y_{i,t+T} / y_{i,t}) / T \tag{2}$$

$$\gamma_{i,t,t+T} = \alpha - \beta.\log(y_{i,t}) + \varepsilon_{i,t} \tag{3}$$

$\gamma_{i,t,t+T}$ shows the economy i's GDP growth rate between t and $t+T$. $\log(y_{i,t})$ is the logarithm of GDP per capita of at time t for economy i. The variable of GDP per capita included in the equation is adapted as the unemployment rate in the study. Meanwhile, conditional β convergence is also analyzed with this methodology. In order to reflect the structural differences of the regions, control variables are added to the model. These variables are also calculated using Equation 2.

The development of the dispersion or variation of the variable is analysed in σ convergence. σ convergence occurs when the standard deviation decreases over time. In this case, the economy converges to the average level of economies in terms of the relevant variable (Purwono et al., 2021). β convergence is a necessary condition for σ convergence to occur. However, the presence of β convergence does not mean that there is also σ convergence. The decrease of the distribution's standard deviation reflects σ convergence, and its increase reflects σ divergence (Sala-i-Martin, 1996). σ convergence is defined by;

$$\sigma_{t+T} < \sigma_t \qquad t = 2004,...,2020 \tag{4}$$

σ_t is the standard deviation of relative unemployment rate, $\ln(\frac{u_{it}}{u_t})$, at the t-th period. It is estimated by calculating the standard deviation of the cross-section distribution for the relative unemployment rate.

5. Data Set and Model

The study analyses Turkey's regions according to the nomenclature of regional units for statistics-2 (NUTS-2) for 2004-2020. The variables used in the analysis are presented in Table 1.

Table 1

Data Set Description (2004-2020)

Variable	Description	Data sources	Value
U	Regional unemployed persons numbers	TURKSTAT	Level
u_{it}	Regional unemployment rate	TURKSTAT	% Rate
$\overline{u_t}$	Adjusted mean unemployment rate	Author's calculation	% Rate
$\overline{\overline{u_{it}}}$	The logarithm of the relative unemployment rate	Author's calculation	% Rate
$fcr_{i,t}$	Dollarization- The share of foreign currency deposits of domestic residents in total deposits	Turkey Banking Regulation and Supervison of Agency	% Rate
$P_{i,t}$	CPI- Consumer Price Index	TURKSTAT	Level
$w_{i,t}$	Nominal wages (Daily-Average)	Turkey Social Security Institution	Level
$wr_{i,t}$	Reel wages (Daily-Average)	Author's calculation	Level
$u^g_{i,t}$	Unemployment rate growth-The average change in the unemployment rate for the year t compared to 2020	Author's calculation	Logarithmic Level
$fcr^g_{i,t}$	Dollarization growth rate -The average change in the Dollarization rate for the year t compared to 2020	Author's calculation	Logarithmic Level
$wr^g_{i,t}$	Reel wage growth rate -The average change in the reel wage for the year t compared to 2020	Author's calculation	Logarithmic Level

The panel data set consists of 26 regions and 17 years. The data on unemployment were compiled from the Household Labor Force Survey of the Turkish Statistical Institute (TURKSTAT). Meanwhile, the average unemployment rate data refers to the average values of unemployment rates weighted by the unemployed number for each year. In order to avoid a possible bias, following Kristic et al. (2019), *i*-th region at the *t*-th period is excluded from the average unemployment rate ($\overline{u_t}$) for the calculations of $\overline{\overline{u_{it}}}$. The last variable derived for the analysis is the relative unemployment rate ($\overline{\overline{u_{it}}}$). This variable shows the relative unemployment rate obtained from dividing the unemployment rate of *i*-th region by the adjusted average

unemployment rate calculated for other regions except for *i*-th region. Deterministic/stochastic β and σ convergence analyses were performed on the final variable ($\overline{u_{it}}$).

Meanwhile, unconditional and conditional β convergence were also analysed. In this contex, $u^{g}_{i,t}$, $\ln(u)_{i,t}$, $fcr^{g}_{i,t}$ and $wr^{g}_{i,t}$ variables were used for two different models, including conditional and unconditional β convergence. The dollarization ($fcr_{i,t}$) and real wage ($wr^{g}_{i,t}$) were added to the conditional model in order to reflect the difference in the socioeconomic indicators of the regions in the model. $fcr_{i,t}$ variable shows the ratio of foreign currency deposits within the total deposits of domestic residents. This variable has been used as a proxy for dollarization. Finally, $wr_{i,t}$ variable represents daily average reel wages. This variable was calculated using the average wages ($w_{i,t}$) and CPI ($P_{i,t}$). The average wages include the official gross wage notified to the Social Security Institution. Therefore, the data reflect the impact of minimum wage increases on labor costs (wage, tax and social security deductions). However, the increase in average wages remains below the minimum wage increase. The proportion of insured persons notified to the Social Security Institution (SSI) at the minimum wage level is 42%. This segment's wages rise in parallel with the minimum wage increase. The insured rate, which is declared above the minimum wage level, is 58%. Wage increases in this segment differ from the increase in the minimum wage (SSI Statistical Yearbook, 2020).

Firstly, unconditional β convergence is defined by;

$$i=1,\ldots 26 \text{ and } t=2004,...2020$$

$$u^{g}_{i,t,t+T} = f\left\{\ln(u)_{i,t}\right\} \tag{5}$$

$$u^{g}_{i,t,t+T} = \alpha + \beta \ln(u)_{i,t} + \varepsilon_{i,t} \tag{6}$$

$$u^{g}_{i,t,t+T} = \log(u_{i,t+T} / u_{i,t}) / T \tag{7}$$

Secondly, conditional β convergence was analyzed. In order to reflect the structural differences of the regions, $wr^{g}_{i,t}$ and $fcr^{g}_{i,t}$ are added to the model as a control variables. Conditional β convergence is defined by;

$$u^{g}_{i,t,t+T} = f\left\{\ln(u)_{i,t},\ fcr^{g}_{i,t}, wr^{g}_{i,t}\right\} \tag{8}$$

$$u^{g}_{i,t,t+T} = \alpha + \beta_1 \ln(u)_{i,t} + \beta_2 fcr^{g}_{i,t,t+T} + \beta_3 wr^{g}_{i,t,t+T} + \varepsilon_{i,t} \tag{9}$$

$$fcr^{g}_{i,t,t+T} = \ln(fcr_{i,t+T} / fcr_{i,t}) / T \tag{10}$$

$$wr^{g}_{i,t,t+T} = \ln(wr_{i,t+T} / wr_{i,t}) / T \tag{11}$$

In the case of convergence, it is expected that $\frac{\partial u^g}{\partial \ln(u)_t} = \beta < 0$ and $\frac{\partial u^g}{\partial \ln(u)_t} = \beta_1 < 0$ in the Equations 6 and 9. On the other hand, it is expected to be $\frac{\partial u^g}{\partial fcr^g} = \beta_2 > 0$. Finally, it may be $\frac{\partial u^g}{\partial wr^g} = \beta_3 > 0$ or $\frac{\partial u^g}{\partial wr^g} = \beta_3 < 0$ within the framework of the basic assumptions on which different economics schools are based.

6. Empirical Findings

Descriptive data regarding the unemployment rate and the relative unemployment rate, which are the main variables of the analysis, are presented in Table 2. The region that has improved the relative unemployment rate the most is the Malatya-Elazig-Bingöl-Tunceli region from 2004 to 2020 (-0.9 points). In 2004, the beginning of the analysis period, this region had the highest unemployment rate (19.2%).

Table 2

Descriptive Statistic (2004 and 2020)

Turkey's Regions (NUTS-2)	**Unemployment Rate (u_{it})**			**Relative Unemployment Rate ($e^{\overline{u_{it}}}$)**		
	2004 %	**2020 %**	**Change**	**2004 %**	**2020 %**	**Change**
Malatya, Elazığ, Bingöl, Tunceli	19.2	10.6	-8.6	1.6	0.7	-0.9
Kastamonu, Çankırı, Sinop	10.7	6.6	-4.1	0.9	0.4	-0.4
Hatay, Kahramanmaraş, Osmaniye	17.4	15.2	-2.2	1.5	1.0	-0.4
Zonguldak, Karabük, Bartın	12.2	9.3	-2.9	1.0	0.6	-0.4
Gaziantep, Adıyaman, Kilis	15.1	13.0	-2.1	1.3	0.9	-0.4
Adana, Mersin	14.9	13.4	-1.5	1.2	0.9	-0.3
Ankara	15.3	14.8	-0.5	1.3	1.0	-0.3
Kocaeli, Sakarya, Düzce, Bolu, Yalova	12.7	12.2	-0.5	1.0	0.8	-0.2
Konya, Karaman	8.9	8.0	-0.9	0.7	0.5	-0.2

Turkey's Regions (NUTS-2)	Unemployment Rate (u_{it})			Relative Unemployment Rate ($e^{\overline{u_{it}}}$)		
	2004 %	2020 %	Change	2004 %	2020 %	Change
İzmir	15.7	17.1	1.4	1.3	1.2	-0.1
Bursa, Eskişehir, Bilecik	9.3	9.6	0.3	0.8	0.6	-0.1
Manisa, Afyonkarahisar, Kütahya, Uşak	7.6	8.3	0.7	0.6	0.6	-0.1
İstanbul	12.4	14.7	2.3	1.0	1.0	0.0
Kırıkkale, Aksaray, Niğde, Nevşehir, Kırşehir	10.2	12.0	1.8	0.8	0.8	0.0
Balıkesir, Çanakkale	6.5	7.8	1.3	0.5	0.5	0.0
Aydın, Denizli, Muğla	7.7	9.6	1.9	0.6	0.6	0.0
Trabzon, Ordu, Giresun, Rize, Artvin, Gümüşhane	6.9	8.8	1.9	0.6	0.6	0.0
Samsun, Tokat, Çorum, Amasya	6.2	8.3	2.1	0.5	0.6	0.1
Kayseri, Sivas, Yozgat	9.9	12.8	2.9	0.8	0.9	0.1
Tekirdağ, Edirne, Kırklareli	6.6	9.0	2.4	0.5	0.6	0.1
Antalya, Isparta, Burdur	7.0	12.2	5.2	0.6	0.8	0.3
Erzurum, Erzincan, Bayburt	3.6	10.1	6.5	0.3	0.7	0.4
Şanlıurfa, Diyarbakır	11.8	20.1	8.3	1.0	1.4	0.4
Ağrı, Kars, Iğdır, Ardahan	1.8	11.4	9.6	0.1	0.8	0.6
Van, Muş, Bitlis, Hakkâri	10.6	23.6	13.0	0.9	1.7	0.8
Mardin, Batman, Şırnak, Siirt	6.1	33.5	27.4	0.5	2.4	1.9

Note: Author's calculation.

The relative situation has deteriorated the most in the Mardin-Batman-Sirnak-Siirt region (1.9 points). Similarly, this region had the lowest unemployment rate (6.1%) at the beginning of the analysis period. Therefore, Table 2 provides a priori information about the existence of convergence. The summary statistics for the variables are presented in Table 3.

Table 3

Summary Statistics

Variable	Unit	Observation	Mean	Standard Deviation	Minimum	Maximum
U	Number of person	442	115,928	133,468	5,000	1,010,000
u_{it}	%	442	10.48	4.48	1.80	33.50
$\overline{u_t}$	%	442	12.21	1.46	9.69	15.35
$\overline{u_{it}}$	Rate	442	-0.23	0.40	-1.91	0.89
$fcr_{i,t}$	%	364	31.99	10.31	12.27	66.41
$wr_{i,t}$	TL	442	24.19	3.55	18.02	40.03
$u^g_{i,t}$	Rate	442	0.03	0.04	- 0.10	0.26
$\ln(u)_{it}$	%	442	2.27	0.41	0.59	3.51

$fcr^{g}_{i,t}$	Rate	364	0.08	0.04	- 0.02	0.25
$wr^{g}_{i,t}$	Rate	442	0.02	0.03	- 0.13	0.17

Note: Author's calculation.

Table 3 shows that the unemployment rate varies from 1.8% to 33.5%, depending on the region and time. Relating to the region's population, the number of unemployed is 133 thousand to 1.01 million. This case indicates that the regions exhibit a heterogeneous structure in terms of unemployment. As a dollarization indicator, the foreign currency deposits' share of domestic residents in total deposits ($fcr_{i,t}$) is between 12.27% and 66.41%. On the other hand, the regional daily reel wage ($wr_{i,t}$) is between 18.02 TL and 40.03 TL. In terms of these indicators, the regions also exhibit a heterogeneous structure.

For the purpose of deciding the β convergence, the stationarity of relative unemployment rates was investigated by the unit root test. In order to diagnose the unit root test specification, the cross-section dependence is tested firstly with Pesaran (2004)[2] CD test. According to Pesaran (2004) CD test result, the null hypothesis " there is no cross-section dependence" is rejected. Table 4 shows the results.

Table 4

Cross-Section Dependence Test

Variable	**CD-Test**	**Probability Value**	**Correlation**	**Absolute Correlation**
$\overline{u_{it}}$	3.020	0.003	0.041	0.309

Note: Under the null hypothesis “there is no cross-section dependence” CD ~ N (0.1)

In the second stage, the stationarity of the relative unemployment series was diagnosed by Pesaran (2003) CADF unit root test, which is robust to cross-section dependence. The stationarity has been tested as a constant and trend. The constant term stationarity determines the deterministic β convergence. The stochastic β convergence is determined by the trend stationarity (Carlino & Mills, 1993).

[2] For detailed equations, see: Pesaran, 2004.

Table 5

β Convergence (Unit Root Test Results)

Convergence	t-bar	cv10	cv5	cv1	Z[t-bar]	Prob
Deterministic β Convergence	-2.835	-2.070	-2.150	-2.320	-5.476	0.000
Stochastic β Convergence	-3.263	-2.580	-2.670	-2.830	-4.912	0.000

Note: H_0: There is a unit root-the series is not stationary. The lag structure was determined by AIC, and the lag length (lag) was taken as 1.

Table 2 shows that the H_0 hypothesis is rejected in the alternatives of constant terms and trend at the level. Therefore, the series does not contain a unit root. The fact that relative unemployment rate between regions follows a stationary process. It provides evidence for deterministic and stochastic β convergence and shows that relative unemployment shocks lead to temporary deviations in any convergence process.

The findings of the model developed to analyse the unconditional and conditional β convergence of the unemployment rate are presented in Table 6. The table shows Prais-Winsten regression's results with heteroskedastic panels corrected standard errors[3]. It was assumed that the cross sections (IBBS-2 regions) were correlated, and the error structure was heteroskedastic for the two models. In addition, it specified that, within panels, there is first-order autocorrelation and that the coefficient of the AR(1) process is specific to each panel. The technique used in regression (Prais-Winsten) provides robust standard errors in cases of heteroscedasticity, autocorrelation and cross sectional dependence. Therefore, the diagnostic tests have not been performed.

[3] For detailed equations, see: Greene, 2018; Hoechle, 2007.

Table 6

β Convergence (Prais-Winsten Regression)

Dependent Variable u^g	**Model-1 Unconditional Convergence**	**Model-2 Conditional Convergence**
$\ln(u)_t$	-0.0946***	-0.0833***
	(0.0057)	(0.0063)
fcr^g	-	0.0948**
		(0.0472)
wr^g	-	0.2570***
		(0.0611)
Constant	0.2364***	0.2004***
	(0.0136)	(0.0151)
Number of observation	442	442
Number of groups	26	26
R^2	0.45	0.46
Mean VIF	1.00	1.08
Wald chi2	277.70	229.54
Wald chi2 prob.	[0.000]	[0.000]
CADF test for residual	-3.074***	-2.837***
CADF test prob.	[0.000]	[0.004]

Note: *** p<0.01 ** p<0.05 * p<0.1; The lag length (lag) was taken as 1.

The parameter $\ln(u)_t$ shows the coefficient of convergence. The sign of this parameter is negative in the unconditional and conditional model and is statistically significant at the 1% significance level. These findings show the existence of unemployment rate convergence. That is, the change in the unemployment rate depends on the initial value of the unemployment rate. The regions with a higher unemployment rate tend to show slower unemployment rate growth (or faster unemployment rate reduction) compared to those with a lower unemployment rate. Meanwhile, the signs of the fcr^g and wr^g parameters were positive in the conditional model. These findings show that dollarization and real wage growth will negatively affect unemployment. Therefore, if dollarization and real wage growth increase, unemployment rate growth also increases.

The existence of β convergence reveals a tendency to σ convergence. The existence of σ convergence is determined by the standard deviation of the cross-section distribution. If the standard deviation decreases over time, there is σ convergence. The standard deviation development of the relative unemployment rates is presented in Table 7.

Table 7

σ Convergence

Year	**Mean** $\overline{u_{it}}$	**Standart Deviation** $\sigma_{\overline{u_{it}}}$	**Standart Deviation (First Difference of** $\overline{u_{it}}$ **)** $\sigma_{\overline{du_{it}}}$	**Frequency**
2004	-0.28	0.53	-	26
2005	-0.25	0.44	0.24	26
2006	-0.20	0.38	0.20	26
2007	-0.15	0.39	0.17	26
2008	-0.13	0.35	0.17	26
2009	-0.19	0.35	0.16	26
2010	-0.16	0.29	0.19	26
2011	-0.18	0.33	0.18	26
2012	-0.23	0.35	0.17	26
2013	-0.25	0.38	0.24	26
2014	-0.30	0.46	0.19	26
2015	-0.32	0.46	0.15	26
2016	-0.30	0.46	0.15	26
2017	-0.30	0.46	0.17	26
2018	-0.26	0.44	0.19	26
2019	-0.19	0.37	0.13	26
2020	-0.21	0.38	0.10	26

Note: Author's calculation.

Table 7 shows that the standard deviation ($\sigma_{\overline{u_{it}}}$) calculated for the relative unemployment rate has decreased. A decrease in the standard deviation indicates convergence, and an increase indicates divergence. The standard deviation was 0.53 in 2004 and 0.38 in 2020. According to these findings, the unemployment rate between the regions has converged during the analysis period. The standard deviation tendency of the relative unemployment rate captures convergence or divergence in unemployment's structural and cyclical components. Meanwhile, the standard deviation of the first difference of the relative unemployment rate series shows its cyclical component. Thus, the development of cyclical synchronization between regions can be monitored (Estrada et al., 2013). The variable $\sigma_{\overline{du_{it}}}$ in Table 7 refers to the cyclical component, and this indicator again provides evidence for σ convergence. Figure 1 shows the standard deviation of the relative unemployment rate for cross-section units.

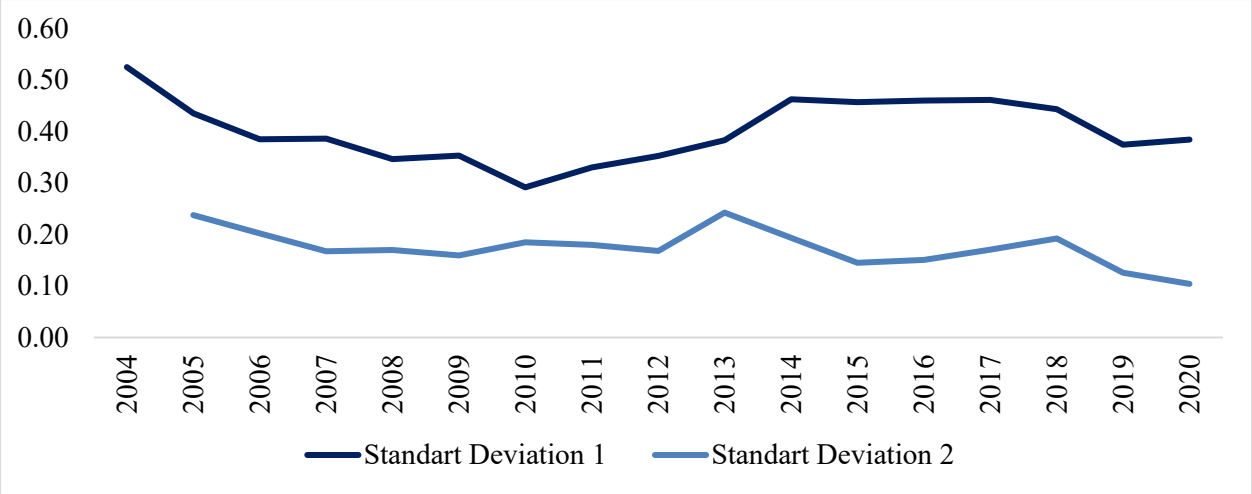

Figure 1. σ Convergence

In Figure 1, the first series (standard deviation 1) shows the standard deviation calculated for the relative unemployment rate ($\sigma_{\overline{u_{it}}}$). Although not continuously, this series tended to decline in 2004-2011. Therefore, σ convergence took place during this period. However, since 2011, this situation has been reversed, and the standard deviation has increased dramatically. Therefore, there is a divergence in this period. Similarly, the first series captures the convergence or divergence in relative unemployment's structural and cyclical components. The second series (standard deviation 2) shows the standard deviation ($\sigma_{\overline{du_{it}}}$) of the first difference in relative unemployment, the cyclic component. The convergence tendency increases when the cyclical component is taken into account.

7. Conclusion

In the economics literature, empirical studies on convergence mainly focus on per capita income and growth. Programmatic developments, the diversification of data sets and the increase in their size have expanded the use of convergence in empirical studies. The labor market is also one of the fields convergence analysis is applied. The study aims to investigate whether the unemployment rate tends to converge in NUTS-2 regions of Turkey.

The study's results indicate that the relative unemployment between the regions follows a stationary process. The finding points to the deterministic and stochastic β convergence. This situation shows that regions react symmetrically to common shocks, and shocks to the relative unemployment rate also tend to be temporary. Unconditional and conditional β convergence were

also analysed at the next stage. The findings again point to the unemployment rate convergence. The change in the unemployment rate depends on the initial value of the unemployment rate. That is, regions with a higher unemployment rate tend to show slower unemployment rate growth compared to those with a lower unemployment rate. In order to reflect the structural differences of the regions, dollarization and reel wages are added to the conditional model. In this context, findings show that dollarization and real wage growth will negatively affect unemployment rate. Therefore, if dollarization and real wage growth increase, unemployment rate growth also increases. Meanwhile, the findings show that the standard deviation calculated for the relative unemployment rate decreases over time. Therefore, σ convergence occurs during the analysis period. Although not continuous, σ convergence emerged in the period 2004-2011. Since 2011, the situation has reversed, and divergence has been observed in 2011-2020. When σ convergence is decomposed into its structural and cyclic components, it is observed that the cyclic component's convergence tendency increases.

If the convergence hypothesis is valid, the disparities in the unemployment rate between regions can be described with the labor market rigidity in the short run and weak adaptation process to asymmetric shocks in labor market. The findings of the study supporting unemployment convergence provide a basis for policies that eliminate rigidity and accelerate the adaptation process. Thus, the efficiency of employment incentives and supports for developing priority regions to reduce regional unemployment differences is an important research topic and waits for its researchers. On the other hand, the study's findings on real wages and dollarization show that these variables negatively affect the unemployment rate. These findings indicate that minimum wage policies in which the public has a role, should be determined by taking into account labor market indicators such as productivity, labor supply and demand. However, the ensuring self-sufficiency function and social protection role of the minimum wage is a different research topic. Besides, considering that dollarization is a hedging reaction to the national currency in case of uncertainty and risk, ensuring macroeconomic stability is an important policy area. These issues are also waiting for their researchers.

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