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Article

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Okun's law under the demographic dynamics of the Turkish labor market

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ABSTRACT

This study examines the asymmetric relationships between demographic characteristics of labor market variables and Gross Domestic Product (GDP) in the Turkish economy. Both expansions and recessions are considered in a Markov Switching (MS) model, using quarterly data between 1989 and 2019. Okun's coefficients are estimated for the different age groups, genders and education levels. The results reveal that men are more likely to lose their jobs during recessions in Turkey whereas unemployment rates for 25-39 year-olds and those with at least university degrees are the least affected groups. There is also asymmetry within and between states across the demographic groups due to GDP phases. The study also investigates the gender dynamics of labor force participation rates (LFPR) as a fundamental determinant of unemployment rate. According to the MS models, LFPR responds significantly and positively to GDP expansions for men whereas it is significant and negative for women. That is, as economic activity begins to recover after a recession, Turkish women leave the labor force as secondary income earners.

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1. Introduction

Okun (1962) examines the relationship between Gross Domestic Product (GDP) and total unemployment rate for the United States of America (USA), but without acknowledging that demographic characteristics might affect this rule of thumb. In fact, Okun's coefficient may vary by age, gender or education levels. Thus, researchers have recently conducted many studies of the changing response of labor market variables to GDP developments in terms of specific demographic groups in the labor force. Other studies have focused on the asymmetrical responses of different groups. In this study, we try to determine the cyclical asymmetry of unemployment rates for age, gender and education level in the Turkish labor force using Markov Switching (MS) regime model. The study also investigates the gender dynamics of labor force participation rates (LFPR) as a fundamental determinant of unemployment. Understanding variations across these groups may be crucial for determining the overall dynamics of the Turkish labor market in

order to implement appropriate active labor market policies.

This study's main contribution is to shed light to asymmetric relationships between cyclical phases of Turkish GDP and unemployment data by age, gender and education level, using quarterly MS models for 1989–2019 period. We underline three main topics as a case study which is focusing on Turkey for the literature: demographic dynamics, size of the Okun's coefficient and the asymmetric relationship both within and between states. One of the other specific of the paper is the investigation of the impact of the recessions and expansions on the demographic of Turkish labor market variables. The analysis at the age, gender and education level allows us to draw some policy implications and identify the vulnerable groups, which are female, less educated and young. We conclude that the output-unemployment relationship is asymmetrical for demographically different unemployment rates. That is, Okun's coefficients are more sensitive to negative than positive output changes. More specifically, the coefficients are largest for the youngest cohort in absolute terms during recessions. While the estimated Okun's coefficients for females are biased due to low participation rates, men are more sensitive to GDP cycles. Our findings indicate that people with more than a high school education level are least affected by transitions between different phases of GDP. To summarize, the results show that men are more likely to lose their jobs during recessions in Turkey, while workers

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aged 25–39 years and those with university-level qualifications or higher are the least affected by transitions between different phases of GDP. There is also within and between states asymmetry for age, gender and education groups. The MS model results display that there is a statistically significant responses of LFPR for both genders. However, its direction changes with gender. During expansions, men's LFPR increases whereas women's decreases.

The evidence from Turkey is overall in line with the evidence from other countries. For the USA, many studies have shown deviations from full employment more strongly impact men, teenagers and lower educated people (Hyclak and Lynch, 1984; Ewing et al., 2002; Mincer, 1991). Bell and Blanchflower (2011) point out that the USA and United Kingdom (UK) unemployment rates of young people aged 16–24 have risen more severely during the recessions than other age groups. Bonaventura et al. (2018) analyse unemployment rate differences for male and female unemployment rates across the Italian regions. According to their estimation results, while in Northern regions, the change of female unemployment is more sensitive to the variation of GDP as compared to the male unemployment, the opposite occurs in the Southern regions, where the Okun coefficient is insignificant for women. Addabbo et al. (2015) investigate gender differences in the labor force participation decisions for Italy and Spain. Their results show a strong countercyclical added-worker effect for women, in contrast with a procyclical discouraged-worker effect for men. Though the added-worker effect prevails for women in Spain, in Italy the discouraged worker effect dominates. And married men show a low reaction to their partner's labor condition with respect to women in both countries. Belaire-Franch and Peiro (2015), in a very similar study to ours, apply a MS regime model to show that male unemployment is much more sensitive to business cycle fluctuations than female unemployment, and that this sensitivity is higher in the UK than in the USA. An important point is that employment stability rises with education level because better educated workers receive more on-the-job training and accumulate more human capital. Consequently, lower-educated workers tend to be the first to lose their jobs, as demonstrated by many studies for the USA (Mukoyama and Sahin, 2006; Elsby et al., 2010; Hoynes et al., 2012; Zhang et al., 2015; Cairo and Cajner, 2017).

Similar findings have been reported for OECD and Eurozone countries. Recessions have a greater effect on workers aged 15–24 or over 50 (Choudhry et al., 2012; Dietrich, 2012; Hutengs and Stadtmann, 2013; Dunsch, 2016; Dixon et al., 2017; Bruno et al., 2017; Zanin, 2014, 2018), those with less education (Pollmann-Schult, 2005; Snieska et al., 2015; Askenazy et al., 2015) and men (Verick, 2009; Hutengs and Stadtmann, 2014; Brincikova and Darro, 2015; Van Ours, 2015; Dunsch, 2017).

From their estimations of time-varying Okun's coefficients for South Korea for 1980–2014, Kim and Park (2019) conclude that the absolute value of the coefficient is higher for men and the 15–24 year age group than other subgroups. Based on the 1997 Asian crisis, they also report asymmetrical coefficients, being larger in recessions than expansions for all age cohorts and both genders.

LFPR is a fundamental determinant of unemployment, especially for developing countries, where female LFPR is generally lower for several reasons. First, women tend to be considered secondary income earners (added worker effect) who usually look for a job only if the household's main bread winner become unemployed. Second, structural change that has switched economic activity from agriculture to industry and services has reduced women's participation in the labor force (discouraged worker effect). Third, cultural factors and lower female education levels push them into low-skilled jobs. Overall, it can be difficult to distinguish whether higher female unemployment during recessions is due to the discouraged worker effect or the added worker effect. Thus,

most studies also investigate LFPR during downturns, especially for females.

Regarding the Turkish economy, various researchers have examined the demographic composition and educational differences in unemployment rates to underline the importance of subgroup dynamics (Erdem et al., 2012; Tansel et al., 2010). Several studies have provided Okun coefficients for Turkey, including age and gender subgroups (Verick, 2009; Dietrich, 2012; Zanin, 2014; Guclu, 2018). Erdoğan Coşar and Yavuz (2019) focuses on the total employment, unemployment and participation rates using MS framework together with the long and short run relationships are examined. Using Vector Autoregression (VAR) specification, Berument et al. (2006) analyse the effects of various macroeconomic policy shocks on unemployment rates for workers with different education levels, separately for men and women, for 1988–2003. They conclude that monetary policy does not affect unemployment rates in Turkey by educational level or gender whereas income and fiscal policies do.

Sahin and Kizilirmak (2007) find that age, gender, education level and marital status all significantly affect the duration of workers drawing on unemployment insurance benefits in Turkey after controlling for the effects of types of workplace, job types and regions. Specifically, their estimation results indicate that older, married, male, educated and skilled workers have shorter job search durations. Bayrak and Tatli (2016) conclude that higher education schooling rates significantly and negatively effect the youth unemployment rates. Applying nonlinear dynamics and fractional integration methods to quarterly data for 1988–2013, Gil-Alana et al. (2019) find possible nonlinearities in female unemployment rates in Turkey. They also found greater persistence for the female and youth unemployment series. Regarding LFPR, Cengiz and Sahin (2014) estimate STAR models to investigate the relationship between LFPR and growth in Turkey for 2000–2011. They report an asymmetric and nonlinear relationship, such that LFPR falls during recessions but increases gradually during expansions. They also found that female LFPR falls following economic crises. Karaoglan and Okten (2015) find that there is added-worker effect for women in Turkey. That is women whose husbands involuntarily became unemployed are more likely to participate in the labor force. Besides, with a worsening of unemployment conditions, they find a slight discouraged-worker effect for women. Lastly, Signorelli et al. (2012) investigate the relationship between LFPR and financial crises for ten upper-middle-income economies, including Turkey. They conclude that financial crises significantly reduce female LFPR.

In the most similar study to ours, Guclu (2018) claims that, for Turkish economy, the sensitivity of economic growth to unemployment becomes larger as age increases; and higher for men. One of the profound differences between Guclu (2018) and our paper is that he estimates a linear model using annual data 2004–2014 whereas we employ a MS non-linear model using quarterly data for 1989–2019. To the best of our knowledge, our paper is the first to consider a non-linear model to search for asymmetries between unemployment rates\LFPR and growth in Turkey while taking into account gender, age and educational level differences.

This paper is organized as follows. Section 2 discusses the demographic characteristics of the Turkish labor market. Section 3 presents the data sources and explains the asymmetric effects of the phase of the business cycle on age, education and gender composition. Finally, section 4 concludes.

2. Turkish labor market by age, gender and education

The youth unemployment rate is substantially higher than the total unemployment rate in almost every country and Turkey is no

exception. Young people are twice as likely to be unemployed than the overall population where Turkey's youth unemployment increased from 18.4 percent in 2011 to 23.1 percent in 2018, and is probably higher if the unemployed definition is extended by discouraged workers or people under the category of "neither in employment nor in education or training" (NEET). There are also high levels of informal employment among youth. Regarding gender, female youth unemployment was 25.3 percent in 2018 but only 17.6 percent for men. More specifically, female non-agricultural youth unemployment was 30.0 percent in 2018. As Fig. 1 shows, Turkey's male and female youth unemployment rates were somewhat similar until 2008, after which the gap widened while Fig. 2 shows that female LFPR accelerated in parallel.

The main driver of Turkey's low female LFPR is the transition to a non-agricultural economy. Since many surplus female agricultural workers lack the required skills or educational qualifications for the other sectors, they either work in the informal sector or drop out of the labor force. After the 2008 global financial crisis, partly because of the added worker effect, female LFPR increased from 23.5 percent to 34.2 percent in 2018, although this is still lower than the OECD average. A recent study, Tunali et al. (2019) inspect female LFPR in Turkey using a synthetic cohort analysis and conclude that it has been on the rise lately not only due to increasing education levels but also Turkey has reached the turning point of the U-shaped pattern in female LFPR.

Turkey's unemployment rate varies widely for different education levels and university graduates have the highest LFPR. However, concerns remain as to the quality of education and whether rising education levels reduce skill mismatch in the economy. Few academic studies have investigated whether the increase in the number of universities has made economic growth more stable and created enough new jobs to reduce youth unemployment. In addition, Turkey's educated youth find the school-to-work transition a great challenge. As Fig. 3 shows, high school graduates have the highest unemployment rates while Fig. 4 shows that the 15–24 age cohort has the highest rate by age group. Erdem and Tugcu (2012) argues that the rise in higher education graduates are one of the factors which push up the unemployment rate in Turkey in the long-run.

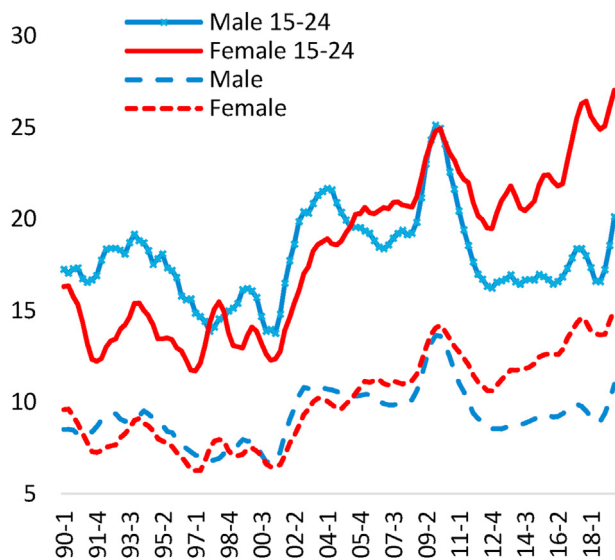


Fig. 1. Turkish Unemployment Rates by Gender (%). Note: Four quarter moving average transformation is applied to the series given at Figs. 1 and 2.

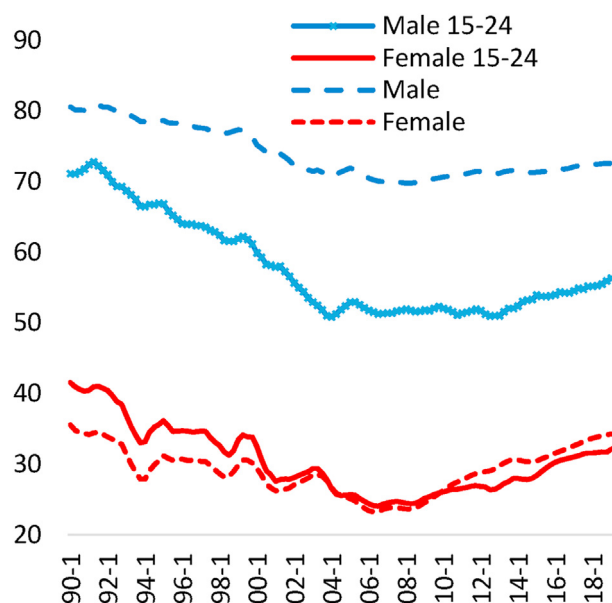


Fig. 2. Turkish Labor Force Participation Rates by Gender (%). Note: Four quarter moving average transformation is applied to the series given at Figs. 1 and 2.

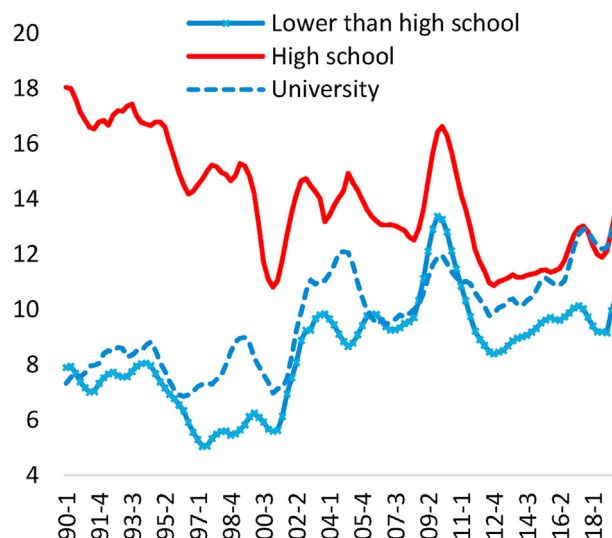


Fig. 3. Turkish Unemployment Rates by Education (%). Note: Four quarter moving average transformation is applied to the series given at Figs. 1 and 2.

3. Markov Switching model estimations for Okun's relationship by age, gender and education

3.1. Data

Seasonally-adjusted quarterly labor market variables were taken from TurkStat's Household Labor Force Survey (HLFS) while GDP data came from TurkStat. Both the HLFS and the GDP data methodology have changed several times. HLFS data were reported semi-annually between 1988 and 1999, quarterly for 2000–2004 and monthly since then. We employed seasonal factors to fill the gap for the semi-annual data. For the GDP data, TurkStat has used

ESA 2010 methodology since 2016 with a base year of 2009. The growth rates of previously announced series were used to merge the data. The variables used in the analyses cover 1989Q1 to 2019Q2.

The transition from agriculture to industry and services in Turkey has created a structural change in both urbanization and labor market variables, which blur economic inferences. To get robust results, we therefore use agriculture-excluded variables in our analyses, specifically agriculture-excluded GDP and unemployment rate series by gender (total, male, female), education (“lower than high school”, “high school and equivalents”, “university or higher”) and age cohorts (15–24, 25–39 and 40+). However, agriculture-excluded LFPR and GDP cycles are examined by gender; other LFPR classifications, age and education, reflect the total economy.

Before obtaining the cyclical components of the variables, seasonal adjustment and detrending filters are applied. Seasonal adjustment is performed following Tramo/Seats methodology while the trend components of the variables are eliminated using the Hodrick-Prescott (1997) (HP) filter. This is applied to the logarithm of GDP with a smoothing parameter equal to 1600 but to the seasonally adjusted level of unemployment rate and LFPR with the same smoothing parameter. Cyclical components are defined as the difference between the seasonally-adjusted variables and the HP trends of the series.

The stationarity of the cyclical components of the variables is tested by the Augmented Dickey Fuller (ADF) unit root test.

Table 1
Interpretation of coefficients.

	Expansion in GDP gdp_t^{c+}	Recession in GDP gdp_t^{c-}
State 0: Expansion Unemployment rate below trend	β_0^+	β_0^-
State 1: Recession Unemployment rate above trend	β_1^+	β_1^-

Although the details are not reported here, all the cyclical components of the variables are $I(0)$ at 1 and 5 percent significance levels. We therefore use the levels of the cyclical components in the analyses. Since we investigate asymmetric behaviour along the business cycle, the sample should be as long as possible. Therefore, while examining the relationship between unemployment rate and growth, we take 1989–2019 as the sample period as this was the largest sample for which we could extend the data backwards.

3.2. Models for unemployment rate and GDP cycles

The MS model following Holmes and Silverstone (2006) that includes both the expansionary and recessionary phases of GDP and demographically categorized unemployment rates includes a random variable S_t , which takes values of 0 and 1 to show the state of the economy at time t , where 0 and 1 denote above and below trend unemployment rate, respectively. The model is:

$$E(unemp(di)_t^c | S_t) = [(1 - S_t)\mu_0 + S_t\mu_1] + (1 - S_t)\beta_0^+ gdp_t^{c+} + (1 - S_t)\beta_0^- gdp_t^{c-} + S_t\beta_1^+ gdp_t^{c+} + S_t\beta_1^- gdp_t^{c-} + (1 - S_t) \sum_{i=1}^l \delta_i unemp(di)_{t-i}^c + S_t \sum_{i=1}^l \alpha_i unemp(di)_{t-i}^c + \varepsilon_t \tag{1}$$

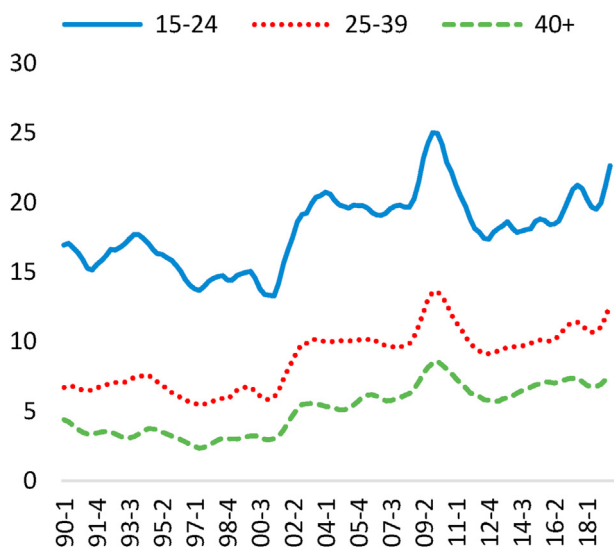


Fig. 4. Turkish Unemployment Rates by Age (%). Seasonally Adjusted, Agriculture Sector Included
Note: Four quarter moving average transformation is applied to the series given at Figs. 1 and 2.

where $unemp(di)_t^c$ denotes the cyclical component of unemployment rates of gender (total, male and female), age groups (15–24, 25–39 and 40+) or education levels (“lower than high school”, “high school and its equivalents” and “university or higher”), μ indicates the state-dependent constant term, and gdp_t^{c+} and gdp_t^{c-} represent the expansionary and recessionary phases of the cyclical component of logarithmic transformed GDP, respectively. In the equation, the error term, ε_t , is assumed to follow $\varepsilon_t \sim i.i.d.N.(0, \sigma_\varepsilon^2)$ and the unobserved indicator variable S_t evolves according to the following first-order MS process:

$$P(S_t = 0 | S_{t-1} = 0) = p$$

$$P(S_t = 1 | S_{t-1} = 0) = 1 - p$$

$$P(S_t = 1 | S_{t-1} = 1) = q$$

$$P(S_t = 0 | S_{t-1} = 1) = 1 - q$$

$0 < p, q < 1$, where p and q are the fixed transition probabilities of

Table 2
MS model estimation results by gender.

Dependent variable: Cycle of Unemployment Rate ($unemp_t^c$)				
State 0 = Expansion (Unemployment Rate Below Trend)				
Explanatory Variable	Coefficient	Total	Male	Female
		Estimate & St. Error	Estimate & St. Error	Estimate & St. Error
Constant	μ_0	0.002** (0.001)	-0.001 (0.001)	-0.001 (0.001)
gdp_t^{c+}	β_0^+	-0.051** (0.023)	0.003 (0.027)	-0.019 (0.039)
gdp_t^{c-}	β_0^-	-0.095*** (0.024)	-0.002 (0.034)	-0.090* (0.053)
$dep. var. \hat{c}_{t-1}$	δ_0	0.89*** (0.08)	0.74*** (0.073)	0.881*** (0.073)
State 1 = Recession (Unemployment Rate Above Trend)				
Explanatory Variable	Coefficient	Total	Male	Female
		Estimate & St. Error	Estimate & St. Error	Estimate & St. Error
Constant	μ_1	-0.005*** (0.002)	0.001 (0.001)	0.003 (0.004)
gdp_t^{c+}	β_1^+	-0.108** (0.052)	-0.310*** (0.078)	-0.317** (0.128)
gdp_t^{c-}	β_1^-	-0.127** (0.048)	-0.209*** (0.057)	-0.150 (0.190)
$dep. var. \hat{c}_{t-1}$	α_1	0.64*** (0.12)	0.579*** (0.124)	-0.246** (0.126)

Dummy variables are included in the regression. The residual diagnostics related with autocorrelation and normality are passed. *, ** and *** denote statistical significance at 10, 5 and 1 percent, respectively. Number of observations are 122.

Table 3
Parameter asymmetry tests by gender.

Null and alternative hypotheses	Type of asymmetry	Wald F-stat values		
		Total	Male	Female
$H_0^1 : \beta_0^+ = \beta_0^-$	within	0.13	1.25	1.15
$H_A^1 : \beta_0^+ \neq \beta_0^-$				
$H_0^2 : \beta_1^+ = \beta_1^-$	within	1.61	0.81	0.45
$H_A^2 : \beta_1^+ \neq \beta_1^-$				
$H_0^3 : \beta_0^+ = \beta_1^+$	between	5.50**	15.43***	4.56**
$H_A^3 : \beta_0^+ \neq \beta_1^+$				
$H_0^4 : \beta_0^- = \beta_1^-$	between	14.00***	10.13***	0.19
$H_A^4 : \beta_0^- \neq \beta_1^-$				

(*), (**) and (***) denote statistical significance at 10, 5 and 1 percent, respectively.

being in state 0 or 1.¹

The states are defined according to unemployment rate. The coefficients β_0^+ , β_0^- , β_1^+ and β_1^- , which represent the elasticity of unemployment rates to GDP phases in different states, are expected to take negative values (Table 1). In the regression, unemployment rate is the dependent variable and the states denote the expansions (unemployment rate below trend) and recessions (unemployment rate above trend) of the unemployment cycle. In the table, β_0^+ and β_1^+ represent the response of unemployment to the expansionary phase of GDP while β_0^- and β_1^- denote the response of

unemployment to the recessionary phase of GDP, respectively.

Table 2 summarizes the MS model estimation results for different gender unemployment rates. In general, the coefficients are statistically significant and have the expected negative sign, indicating an inverse relationship between economic growth and unemployment. For the total population, when unemployment rate is below trend, one unit increase in GDP expansion cause 0.051 unit decrease and one unit increase in GDP recession (a deeper recession) cause 0.095 unit increase in unemployment rate cycle. Similarly, when unemployment rate is above trend, one unit increase in GDP expansion cause 0.108 unit decrease and one unit increase in GDP recession (a deeper recession) cause 0.127 unit increase in unemployment rate cycle. Again for the total population, a comparison of coefficients reveals that unemployment responds more strongly to recessions than expansions in GDP while the estimation results indicate between-state asymmetry. Comparing the elasticities, β_1^+ and β_1^- are higher than the other coefficients in absolute terms. That is, both male and female unemployment rates are more responsive to GDP expansion and recession phases in state 1. In

¹ Transition probabilities are calculated using time varying transition model and mean model. These models assume that intercept terms and the coefficients given at Table 1 are statistically different from zero. For the details of the model see Holmes and Silverstone (2006). We choose this model based on its economic meaning but not solely on its statistical significance. But for robustness issue, we test all the transition probability models given in Holmes and Silverstone (2006). Test results also lead to the use of time varying transition and mean model.

Table 4
MS model estimation results at age cohorts by gender.

Dependent Variable: Cycle of Unemployment Rate According to Age Cohorts and Gender							
State 0 = Expansion (Unemployment Rate Below Trend)							
Explanatory Variable	Coefficient	15–24		25–39		40+	
		Estimate & St. Error		Estimate & St. Error		Estimate & St. Error	
		Male	Female	Male	Female	Male	Female
Constant	μ_0	-0.003** (0.001)	-0.015** (0.006)	-0.006*** (0.001)	-0.003** (0.001)	-0.003** (0.001)	-0.002*** (0.001)
gdp_t^{c+}	β_0^+	-0.160** (0.061)	-0.427 (0.288)	-0.207*** (0.061)	-0.208*** (0.043)	-0.060 (0.039)	0.013 (0.009)
gdp_t^{c-}	β_0^-	-0.295*** (0.086)	-0.261** (0.100)	-0.128** (0.062)	-0.639*** (0.096)	-0.125*** (0.032)	-0.034** (0.015)
$dep. var. \zeta_{t-1}^c$	δ_0	0.444*** (0.096)	0.056 (0.340)	0.239* (0.135)	0.010 (0.094)	0.472*** (0.082)	0.886*** (0.038)
State 1 = Recession (Unemployment Rate Above Trend)							
Variable	Coefficient	15–24		25–39		40+	
		Estimate & St. Error		Estimate & St. Error		Estimate & St. Error	
		Male	Female	Male	Female	Male	Female
Constant	μ_1	0.010*** (0.003)	0.004* (0.003)	0.003*** (0.001)	0.002 (0.002)	0.004*** (0.001)	0.004*** (0.001)
gdp_t^{c+}	β_1^+	-0.724** (0.265)	-0.174** (0.085)	-0.207*** (0.043)	0.065 (0.075)	-0.060* (0.034)	-0.038** (0.016)
gdp_t^{c-}	β_1^-	-1.059*** (0.217)	-0.631*** (0.178)	-0.397*** (0.046)	-0.102** (0.066)	-0.212*** (0.044)	-0.001 (0.051)
$dep. var. \zeta_{t-1}^c$	α_1	-0.252 (0.266)	0.258 (0.174)	0.254** (0.106)	1.001*** (0.156)	0.291* (0.168)	0.685*** (0.119)

Dummy variables are included in the regression. The residual diagnostics related with autocorrelation and normality are passed. *, ** and *** denote statistical significance at 10, 5 and 1 percent, respectively. Number of observations are 122.

addition, the higher β_1^- coefficient value in absolute terms for males indicates that males in Turkey are more likely than females to lose their jobs during recessions. Although estimation sample used in this paper doesn't cover the late Covid-19 period, estimation results are consistent with the unemployment outlook after the epidemic. Comparison of the third quarter of the year 2020 unemployment rate to the end year value of 2019 reveals that the rise in male's unemployment rate is much higher than the rise in female's unemployment rate.

Table 3 presents the Wald coefficient equality tests to analyse

state-dependent asymmetry. The first two hypotheses predict that there is no asymmetry between the expansionary and recessionary phases of GDP in states 0 and 1, respectively. The null hypothesis of the first two hypothesis (i.e. that there is within state asymmetry) could not be rejected for either gender. In other words, the expansionary and recessionary phases of GDP have the same effects on unemployment in both state 0 and in state 1. Regarding the third and fourth hypotheses, there was evidence of asymmetry between the states for total and male unemployment. That is, the effect of expansionary phase in state 0 is statistically different from the

Table 5
Parameter asymmetry tests for age cohorts by gender.

Null and alternative hypotheses	Gender	Type of asymmetry	Wald F-stat values		
			15–24	25–39	40+
$H_0^1 : \beta_0^+ = \beta_0^-$	Male	within	1.66	1.29	1.09
$H_A^1 : \beta_0^+ \neq \beta_0^-$	Female		0.25	17.59***	6.75**
$H_0^2 : \beta_1^+ = \beta_1^-$	Male	within	1.70	9.14***	8.95***
$H_A^2 : \beta_1^+ \neq \beta_1^-$	Female		4.20**	2.11	0.42
$H_0^3 : \beta_0^+ = \beta_1^+$	Male	between	4.18**	0.02	0.13
$H_A^3 : \beta_0^+ \neq \beta_1^+$	Female		1.05	9.49***	8.27***
$H_0^4 : \beta_0^- = \beta_1^-$	Male	between	10.79***	13.57***	2.38
$H_A^4 : \beta_0^- \neq \beta_1^-$	Female		4.25**	19.04***	0.43

*, ** and *** denote statistical significance at 10, 5 and 1 percent, respectively.

Table 6
MS model estimation results at education levels by gender.

Dependent Variable: Cycle of Unemployment Rate According to Gender and Education Level								
State 0 = Expansion (Unemployment Rate Below Trend)								
Explanatory Variable	Coefficient	Lower than high school		High school		University or higher		
		Estimate & St. Error		Estimate & St. Error		Estimate & St. Error		
		Male	Female	Male	Female	Male	Female	
Constant	μ_0	-0.003** (0.001)	-0.003* (0.002)	-0.006*** (0.001)	-0.008*** (0.002)	-0.002** (0.001)	-0.007*** (0.002)	
gdp_t^{c+}	β_0^+	-0.033 (0.050)	-0.008 (0.046)	-0.205*** (0.063)	-0.331*** (0.055)	-0.029 (0.024)	-0.155** (0.060)	
gdp_t^{c-}	β_0^-	-0.311*** (0.068)	-0.125** (0.058)	-0.228** (0.084)	-0.123 (0.107)	-0.110*** (0.035)	-0.358** (0.159)	
$dep. var. \dot{c}_{t-1}$	δ_0	0.527*** (0.083)	0.533*** (0.107)	0.290* (0.165)	-	0.632*** (0.081)	0.165 (0.132)	
State 1 = Recession (Unemployment Rate Above Trend)								
Variable	Coefficient	Lower than high school		High school		University or higher		
		Estimate & St. Error		Estimate & St. Error		Estimate & St. Error		
		Male	Female	Male	Female	Male	Female	
Constant	μ_1	0.014*** (0.004)	0.005** (0.002)	0.001 (0.000)	0.012*** (0.002)	0.008*** (0.002)	0.010*** (0.002)	
gdp_t^{c+}	β_1^+	-0.151** (0.075)	-0.131** (0.054)	-0.129*** (0.034)	-0.340*** (0.057)	0.023 (0.137)	-0.199** (0.079)	
gdp_t^{c-}	β_1^-	-0.637** (0.316)	-0.607*** (0.106)	-0.395*** (0.046)	-0.279** (0.112)	-0.265** (0.106)	0.078 (0.145)	
$dep. var. \dot{c}_{t-1}$	α_1	0.522 (0.492)	0.254 (0.192)	0.396*** (0.069)	-	0.984*** (0.272)	0.348*** (0.112)	

Dummy variables are included in the regression. The residual diagnostics related with autocorrelation and normality are passed. *, ** and *** denote statistical significance at 10, 5 and 1 percent, respectively. Number of observations are 122.

effect of the expansionary phase in state 1. The same is true for the recessionary phase. In contrast, female unemployment does not respond differently to the recessionary phase in states 0 and 1.

Table 4 presents Okun’s law estimation results for the three different age cohorts by gender. According to estimation results, male unemployment rate reacts to both GDP expansions and recessions with the expected negative sign both in state 0 and 1. The only exception belongs to the expansionary phase of GDP in state 0 for the 40+ aged men. Besides, it is more responsive to GDP recession periods than GDP expansions for all three age groups. Age cohort 15–24 is the most responsive age group to GDP recessions and expansions, followed by 25–39 and 40+ age cohorts, respectively.

Female unemployment rate results is not as explicit as men’s unemployment rate results. In state 0, female unemployment rate responds to GDP expansions only at 25–39 age cohort. As a reverse of this, 25–39 is the only age cohort that doesn’t respond to expansion in state 1. Considering that the age of 25–39 is a high fertility period for women, a plausible explanation for this may be that women chose to stay out of the workforce in good times to look after their families. 40+ age cohort is the least responsive age cohort for female unemployment. But there isn’t any clear-cut distinction between the 15–24 and 25–39 age cohorts in terms of their response to GDP cycles.

When the results are evaluated according to gender differences it is observed that, response of male unemployment rate to economic fluctuations is slightly higher in absolute terms than the female unemployment rate in state 1. For state 0, there isn’t such a significant difference. That is when unemployment rate is above its trend, men are more likely to find a job (lose their jobs) with an expansion (recession) in GDP compared to female.

Table 5 shows that there isn’t any within state asymmetry at all three age groups at state 0 but there is within state asymmetry for 25–39 and 40+ age cohorts at state 1 for male unemployment rate.

However, for women, there are more signs of within state asymmetry in state 1. Response of male unemployment rate to GDP expansions differ significantly according to the state only at the 15–24 age cohort. But, response of male unemployment rate to GDP recessions differ between states 0 and 1 for both 15–24 and 25–39 age cohorts. That is, male unemployment rate responds more severely to GDP recessions in state 1 than the ones in state 0. While, we observe statistically different response to GDP expansions in different states for 25–39 and 40+ age cohorts for female unemployment. A similar difference occurs for GDP recessions between the two states for 15–24 and 25–39 age cohorts. Female unemployment rate for 15–24 age cohort responds more severely to GDP recessions in state 1 than state 0. Whereas the reverse is valid for the 25–39 age group.

Similar to the previous findings, male unemployment rate reacts to GDP recessions more severely than expansions no matter what the education level is (See Table 6). In state 0, male unemployment rate responds to recessions at all education levels but it responds to expansions only at “high school” education group. But in state 1, it responds to both phases at “lower than high school” and “high school” education groups. At “university or higher” group, male unemployment rate respond only to recessions in both states. In sum, male unemployment rate seems to react GDP recessions more severely than expansions in both states and “lower than high school group” seems to be the most affected group from GDP fluctuations.

The findings for female unemployment rate draws a blurred picture. In state 0, female unemployment rate for “lower than high school” group responds only to recessions; for “high school” group for expansions and for “university or higher” group to both expansions and recessions. But when unemployment rate is above its trend, that is state 1, being “university or higher” group as an exception, female unemployment rate responds to both phases of GDP. Similar to male, female unemployment rate belonging to the

Table 7
Parameter asymmetry tests for education levels by gender.

Null and alternative hypotheses	Gender	Type of asymmetry	Wald F-stat values		
			Lower than high school	High school	University or higher
$H_0^1 : \beta_0^+ = \beta_0^-$	Male	within	9.83***	0.07	3.20*
$H_A^1 : \beta_0^+ \neq \beta_0^-$					
$H_0^1 : \beta_0^+ = \beta_0^-$	Female		2.69	2.90*	1.31
$H_A^1 : \beta_0^+ \neq \beta_0^-$					
$H_0^2 : \beta_1^+ = \beta_1^-$	Male	within	1.07	19.01***	2.78
$H_A^2 : \beta_1^+ \neq \beta_1^-$					
$H_0^2 : \beta_1^+ = \beta_1^-$	Female		15.41***	0.19	2.49
$H_A^2 : \beta_1^+ \neq \beta_1^-$					
$H_0^3 : \beta_0^+ = \beta_1^+$	Male	between	0.18	1.25	0.15
$H_A^3 : \beta_0^+ \neq \beta_1^+$					
$H_0^3 : \beta_0^+ = \beta_1^+$	Female		2.53	0.02	0.28
$H_A^3 : \beta_0^+ \neq \beta_1^+$					
$H_0^4 : \beta_0^- = \beta_1^-$	Male	between	1.04	3.31*	2.15
$H_A^4 : \beta_0^- \neq \beta_1^-$					
$H_0^4 : \beta_0^- = \beta_1^-$	Female		16.46***	1.46	3.26*
$H_A^4 : \beta_0^- \neq \beta_1^-$					

*, ** and *** denote statistical significance at 10, 5 and 1 percent, respectively.

“lower than high school” seems mostly affected from recessions. But for higher education levels it is not possible to make a generalization. In state 1, expansions of GDP also seems to affect female unemployment rate in a positive way by creating new jobs for whom with a relatively higher education level.

For both genders, when unemployment rate is above its trend, “lower than high school” group is the most adversely affected group from recessions. People in this group are more likely to lose their jobs during recessions. And among the highly educated group, GDP expansions seems to favour women compared to men in both states. However, in the “high school” group, economic fluctuations affect male and female unemployment rates similarly.

According to Table 7, there is within state asymmetries in state 0 and state 1 for the lowest and highest education groups and “high school” group, respectively. Regarding female unemployment rate, there is within state asymmetries in states 1 and 0 for “lower than high school” and “high school” groups, respectively. There isn’t any difference between expansion phases across states for both genders. And finally we observe some between state asymmetries at different education groups for both genders. In other words, GDP

recessions affect most severely unemployment rates in state 1 than state 0.

3.3. Models for labor force participation rate and GDP cycles

To complement the analyses presented above, we also investigate the relationship between LFPR and GDP business cycle within the MS model framework.

According to Fig. 5 and the cross-correlation analysis, LFPR moved countercyclically until 2001. That is, LFPR increases (decreases) as GDP decelerates (accelerates). After 2001, however, LFPR moves pro-cyclically, both overall and for males specifically, indicating that LFPR rises in parallel with faster economic growth. Female LFPR, on other hand, always moves countercyclically. Since female LFPR is very low in Turkey and females are mainly the household’s secondary income earners, their participation rate increases during recessions and decreases during expansions. Similarly, the relationship between unemployment and participation rates, both overall and for males specifically, reverses after 2001. That is, LFPR is positively correlated with unemployment before

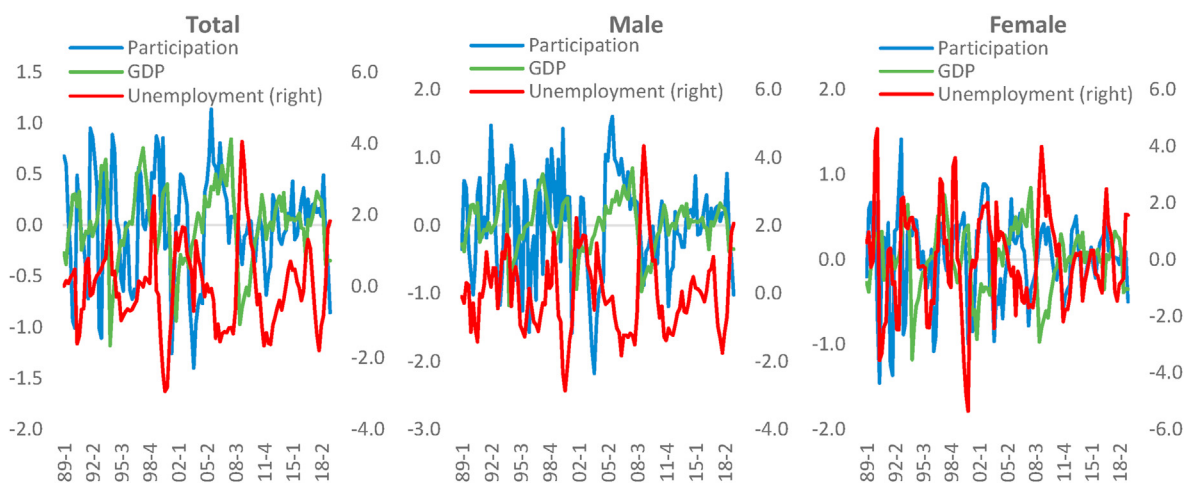


Fig. 5. Cycles of unemployment rate, labor force participation rate and GDP

2001 but negatively after that. Female LFPR, however, remains positively correlated with unemployment throughout the sample period. Although graphical analyses and cross-correlations give an indication about changes in the relationships between the variables, it is important to keep in mind that these analyses, especially cross-correlations, do not indicate causality.

To provide quantitative evidence of changing relationships between the series, we apply the Chow structural breakpoint test. As Table 8 confirms, there is a structural change in the relationships between the variables around 2001. We therefore estimate the MS models for LFPR for 2001Q1-2019Q2.

Table 9 shows that the relationship between LFPR and business cycle phases varies by gender. The model employed and coefficients are similar to the ones given in equation (1) and Table 1, respectively. The states are determined according to LFPR. As previous studies have shown for Turkey, male LFPR is procyclical whereas female LFPR is countercyclical due to the added worker effect (Baslevant and Onaran, 2003; Ilkkaracan and Degirmenci, 2014).

According to the estimation results given in Table 9, male LFPR responds significantly to GDP phases in both states. For both men and the whole sample, high LFPR is accompanied by high GDP

growth and low unemployment rate. Male LFPR responds more to GDP recessions in state 1 than state 0. That is, when unemployment rate is above its trend but LFPR is below its trend (i.e. state 1), a recession induces more men to participate in the labor force than when conditions are similar in state 0. In contrast, Tables 9 and 10 show that male LFPR responds similarly to GDP expansions in both states.

For women, high LFPR is associated with low GDP growth and high unemployment rate. Female LFPR responds negatively to both GDP business cycle phases in state 0. When LFPR is above its trend, female LFPR decreases (increases) as GDP accelerates (decelerates). That is, as economic activity starts to recover after a recession, women leave the labor force. In state 1, when LFPR is below its trend, female LFPR increases as GDP growth speeds up. These results are similar to those reported by Cengiz and Sahin (2014).

Table 10 shows that male LFPR exhibits both within and between state asymmetries. That is, male LFPR responds differently depending on state and the GDP phase. Conversely, female LFPR exhibits only between state asymmetry. In other words, female LFPR responds to GDP recessions depending on the state. As the economy recovers from a crisis, women who entered the labor force

Table 8
Chow breakpoint test results.

H_0 : No breaks at specified breakpoints			
Breakpoint Date	F-statistic	Log Likelihood Ratio	Wald Statistic
2000Q3	1.40	7.41	7.01
2000Q4	2.04*	10.66*	10.22*
2001Q1	2.04*	10.65*	10.21*
2001Q2	2.17*	11.30**	10.87**
2001Q3	0.95	5.09	4.77
2001Q4	1.00	5.34	5.00

(*) and (**) denote statistical significance at 10 and 5 percent, respectively. Chow breakpoint test results are obtained from the regression where cycle of total LFPR is the dependent variable and cycle of GDP and its two lags are the independent variables.

Table 9
MS model estimation results for LFPR and growth by gender.

Dependent Variable: Cycle of LFPR by Gender				
State 0 = Labor Force Participation Rate Above Trend				
Explanatory Variable	Coefficient	Total Estimate & St. Error	Male Estimate & St. Error	Female Estimate & St. Error
constant	μ_0	0.001* (0.000)	0.002** (0.001)	0.0005* (0.0003)
gdp_t^{c+}	β_0^+	0.010 (0.013)	0.071*** (0.023)	-0.017* (0.010)
gdp_t^{c-}	β_0^-	0.026 (0.021)	0.057** (0.024)	-0.028* (0.014)
$dep. var. \varphi_{t-1}^c$	δ_0	0.465*** (0.131)	0.000 (0.169)	0.686*** (0.075)
State 1 = Labor Force Participation Rate Below Trend				
Variable	Coefficient	Total Estimate & St error	Male Estimate & St error	Female Estimate & St error
constant	μ_1	-0.003** (0.002)	-0.0012 (0.0008)	-0.005*** (0.001)
gdp_t^{c+}	β_1^+	0.118** (0.055)	0.075* (0.044)	0.087* (0.047)
gdp_t^{c-}	β_1^-	0.183** (0.080)	0.210*** (0.046)	-0.011 (0.042)
$dep. var. \varphi_{t-1}^c$	α_1	0.507** (0.191)	0.789*** (0.089)	0.675** (0.257)

Dummy variables are included in the regression. The residual diagnostics related with autocorrelation and normality are passed. *, ** and *** denote statistical significance at 10, 5 and 1 percent, respectively. Number of observations are 74.

Table 10
Parameter asymmetry tests by gender (LFPR and growth).

Null and alternative hypotheses	Type of asymmetry	Wald F-stat values		
		Total	Male	Female
$H_0^1: \beta_0^+ = \beta_0^-$	within	0.49	0.20	0.40
$H_A^1: \beta_0^+ \neq \beta_0^-$				
$H_0^2: \beta_1^+ = \beta_1^-$	within	0.45	4.34**	2.06
$H_A^2: \beta_1^+ \neq \beta_1^-$				
$H_0^3: \beta_0^+ = \beta_1^+$	between	3.53*	0.01	4.29**
$H_A^3: \beta_0^+ \neq \beta_1^+$				
$H_0^4: \beta_0^- = \beta_1^-$	between	3.65*	8.65***	0.17
$H_A^4: \beta_0^- \neq \beta_1^-$				

*, ** and *** denote statistical significance at 10, 5 and 1 percent, respectively.

to compensate for household income loss, leave the workforce. Additionally, it is also true that economic expansions also make jobs more abundant, which in turn enables workers to find jobs more easily, which might increase women's participation in the labor force. Future studies could investigate whether those women that leave the labor force during recovery periods are less educated and whether women entering the labor force during expansionary phases are disproportionately more highly educated and living in urban areas.

4. Conclusion

In this study, we employ a MS model for the Turkish economy to analyse the relationship between GDP growth and unemployment, and GDP growth and LFPR for three different demographic groups during 1989–2019. We conclude that the absolute values of Okun's coefficients for age, gender and education level are higher during recessions, and that these relationships exhibit both within and between-state asymmetries. More specifically, the youth cohort, aged 15–24 years, is more sensitive to economic shocks than the other age cohorts. Regarding gender, the low LFPR of women in Turkey limits the interpretation of the model results. For men, however, the estimations show that they are more likely than women to lose their jobs when the economy starts to slow down. Regarding education level, people with less than a high school education are the most vulnerable to GDP phase changes. Finally, male LFPR responds positively to GDP phases whereas female LFPR responds negatively.

Based on the findings of this paper regarding the relationships between GDP and labor force variables in age, gender and education detail, policies to implement during recessions might be to offer firms effective incentives, such as tax reductions or subsidies; or to encourage reduced working hours instead of firing employees for the younger workers. Another important policy tool is Active Labor Market Policies (APL), implemented by the Turkish Employment Agency (ISKUR). Since 2008, ISKUR has introduced job and vocation counselling, on-the-job training programs and increased coverage of the unemployed and the number of participants in active labor market programs (Goksen et al., 2015). ISKUR also provides incentives to firms to employ young people and women. Additionally, unemployment insurance and unemployment pay for up to 240 days are given to those registering with ISKUR. We would therefore recommend policies to increase ISKUR's effectiveness.

Additionally, to increase aggregate demand, the government could implement fiscal or monetary policies during recessions to decrease unemployment, whereas an additional tool could be childcare improvements which could help women to participate into labour market. The models for LFPR indicate that, when both LFPR and unemployment are high, female LFPR decreases as GDP

accelerates; that is, women tend to leave the labor force during an economic recovery, having taken up work during the recessions to support the family. The main reason why Turkish women remain marginally attached to the work force might be inadequate child-care provision. Finally, skill mismatch problem is another factor for especially the vulnerable group's employment opportunities, however, the issue is beyond the scope of this paper.

Further research might investigate the persistence of disparities in unemployment within Turkish regions. Estimations to show whether Okun's coefficients differ between more and less developed regions, and whether this regional categorization exhibits asymmetry would be a valuable subject to investigate. Also, whether those women that leave the labor force during recovery periods are less educated and whether women entering the labor force during expansionary phases are disproportionately more highly educated and living in urban areas might be interesting questions to study.

References

- Addabbo, T., Rodríguez-Modroño, P., Gálvez Muñoz, L., 2015. Gender differences in labor force participation rates in Spain and Italy under the great recession. *Rev. Econ. Mund.* 2015 (41).
- Askenazy, P., Erhel, C., Chevalier, M., 2015. Okun's laws differentiated by education. CEPREMAP Working Papers 1514.
- Baslevnt, C., Onaran, O., 2003. Are married women in Turkey more likely to become added or discouraged workers? *Labor* 17, 439–458.
- Bayrak, R., Tatli, H., 2016. Short and long term analysis of some factors effecting youth unemployment in Turkey. *Theoretical and Applied Economics* 23 (3), 229–242.
- Belaire-Franch, J., Peiro, A., 2015. Asymmetry in the relationship between unemployment and the business cycle. *Empir. Econ.* 48 (2), 683–697.
- Bell, D., Blanchflower, D., 2011. Young people and the great recession. *Oxf. Rev. Econ. Pol.* 27 (2), 241–267.
- Berument, M., Dogan, N., Tansel, A., 2006. Economic performance and unemployment: evidence from an emerging economy. *Int. J. Manpow.* 27 (7), 604–623.
- Bonaventura, L., Cellini, R., Sambataro, M., 2018. Gender Differences in Okun's Law across the Italian Regions. MPRA Paper. No. 87557. <https://mpra.ub.uni-muenchen.de/87557/>.
- Brincikova, Z., Darmo, L., 2015. The impact of economic growth on gender specific unemployment in the EU. *Ann. Alexandru Ioan Cuza Univ. - Econ.* 62 (3), 383–390.
- Bruno, G., Tanveer, C., Marelli, E., Signorelli, M., 2017. The short-and long-run impacts of financial crises on youth unemployment in OECD countries. *Appl. Econ.* 49 (34), 3372–3394.
- Cairo, I., Cajner, T., 2017. Human capital and unemployment dynamics: why more educated workers enjoy greater employment stability. *Econ. J.* 128 (609), 652–682.
- Cengiz, S., Sahin, A., 2014. Modelling nonlinear behavior of labor force participation rate by STAR: an application for Turkey. *Int. J. Econ. Sci. Appl. Res.* 7 (1), 113–127.
- Choudhry, M.T., Marelli, E., Signorelli, M., 2012. Youth unemployment rate and impact of financial crises. *Int. J. Manpow.* 33 (1), 76–95.
- Dietrich, H., 2012. Youth Unemployment in Europe Theoretical Considerations and Empirical Findings. Friedrich Ebert Foundation, International Policy Analysis, Berlin, Germany.
- Dixon, R., Lim, G.C., Van Ours, J., 2017. Revisiting the Okun relationship. *Appl. Econ.* 49 (28), 2749–2765.
- Dunsch, S., 2016. Okun's law and youth unemployment in Germany and Poland. *Int.*

- J. Manag. Econ. 49 (1), 34–57.
- Dunsch, S., 2017. Age and gender specific unemployment and Okun's law in CEE countries. *E. Eur. Econ.* 55 (4), 377–393.
- Elsby, M., Hobijn, B., Sahin, A., 2010. The Labor Market in the Great Recession. National Bureau of Economic Research. Technical report.
- Erdem, E., Tugcu, T., 2012. Higher Education and Unemployment: a cointegration and causality analysis of the case of Turkey. *Eur. J. Educ.* 47 (2), 299–309.
- Erdogan-Coşar, E., Yavuz, A., 2019. Is there asymmetry between GDP and labor market variables in Turkey under Okun's law? *Central Bank of Turkey Working Paper* 19 (27).
- Ewing, T., Levernier, W., Malik, F., 2002. The differential effects of output shocks on unemployment rates by race and gender. *South. Econ. J.* 68 (3), 584–599.
- Gil-Alana, L., Ozdemir, Z., Tansel, A., 2019. Long memory in Turkish unemployment rates. *Emerg. Mark. Finance Trade* 55 (1), 201–217.
- Goksen, F., Yukseker, D., Kuz, S., Oker, I., 2015. Policy Performance and Evaluation: Turkey. University of Brighton Style Working Papers. <http://www.styleresearch.eu/publications/working-papers>.
- Guclu, M., 2018. The effect of unemployment by age cohorts and gender on economic growth in Turkey. *Ege Akademik Bakis Dergisi* 18 (3), 399–407.
- Hodrick, R.J., Prescott, E.C., 1997. Postwar U.S. business cycles: an empirical investigation. *J. Money Credit Bank.* 29, 1–16.
- Holmes, M.J., Silverstone, B., 2006. Okun's law, asymmetries and jobless recoveries in the United States: a Markov-switching approach. *Econ. Lett.* 92, 293–299.
- Hoynes, H., Douglas, M., Jessamyn, S., 2012. Who suffers during recessions? *J. Econ. Perspect.* 26 (3), 27–48.
- Hutengs, O., Stadtmann, G., 2013. Age effects in Okun's law within the Eurozone. *Appl. Econ. Lett.* 20 (9), 821–825.
- Hutengs, O., Stadtmann, G., 2014. Youth and gender specific unemployment and Okun's law in Scandinavian countries. *Comp. Econ. Stud.* 56 (4), 567–580.
- Hyclak, T., Lynch, G.J., 1984. Cyclical and noncyclical unemployment differences among demographic groups. *Growth Change* 15 (1), 9–17.
- Ilkcaracan, I., Degirmenci, S., 2014. Economic Crises and the Added Worker Effect in the Turkish Labor Market: Gender Perspectives and Gender Impacts of the Global Economic Crisis. Routledge, pp. 209–254.
- Karaoglan, D., Okten, C., 2015. Labor force participation of married women in Turkey: a study of the added-worker effect and the discouraged-worker effect. *Emerg. Mark. Finance Trade* 51 (1), 274–290.
- Kim, M., Park, S., 2019. Do gender and age impact the time-varying Okun's law? Evidence from South Korea. *Pac. Econ. Rev.* 24 (5), 672–685. <https://doi.org/10.1111/1468-0106.12288>.
- Mincer, J., 1991. Education and Unemployment? NBER Working Paper, p. 3838.
- Mukoyama, T., Sahin, A., 2006. Costs of business cycles for unskilled workers. *J. Monetary Econ.* 53, 2179–2193.
- Okun, A., 1962. Potential GNP: its measurement and significance. In: *Proceedings of the Business and Economics Statistics Section. American Statistical Association*, pp. 98–104.
- Pollmann-Schult, M., 2005. Crowding-out of unskilled workers in the business cycle: evidence from West Germany. *Eur. Socio Rev.* 21 (5), 467–480.
- Sahin, H., Kizilirmak, A., 2007. Determinants of duration of unemployment insurance benefits in Turkey. *Appl. Econ. Lett.* 14 (8), 611–615.
- Signorelli, M., Choudhry, M., Marelli, E., 2012. The impact of financial crises on the female labor. *Eur. J. Dev. Res.* 24 (3), 413–433.
- Snieska, V., Valodkiene, G., Daunoriene, A., Draksaitė, A., 2015. Education and unemployment in European Union economic cycles. *Procedia – Social and Behavioral Sciences* 213, 211–216.
- Tansel, A., Tasci, M., 2010. Hazard analysis of unemployment duration by gender in a developing country: the case of Turkey. *Labor* 24 (4), 501–530.
- Tunali, I., Kirdar, M.G., Dayioglu, M., 2019. Female Labor Force Participation in Turkey: A Synthetic Cohort (Panel) Analysis, 1988–2013. IZA Discussion Paper No. 12844. Available at: SSRN: <https://ssrn.com/abstract=3513686>.
- Van Ours, J., 2015. The Great Recession was not so great. *Labor Economics* 34, 1–12.
- Verick, S., 2009. Who is hardest hit during a financial crisis?. In: *The Vulnerability of Young Men and Women to Unemployment in an Economic Downturn. IZA Discussion Paper*, vol. 4359. Institute for the Study of Labor.
- Zanin, L., 2014. On Okun's law in OECD countries: an analysis by age cohorts. *Econ. Lett.* 125 (2), 243–248.
- Zanin, L., 2018. The pyramid of Okun's coefficient for Italy. *Empirica* 45, 17–28.
- Zhang, M., Peppas, S., Peppas, S., Yu, T., 2015. The great recession: a statistical analysis of its effects on unemployment. *International Journal of Business and Economics Perspectives* 10 (1), 44–55.