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# OLDER WORKERS AND UNEMPLOYMENT: THE CASE OF TURKIYE

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## ABSTRACT

*Türkiye is a rapidly ageing country as part of the global population trend. The structure of the labour force is changing in terms of age. This study examines the relationship between the labour force participation rate, interest rate and unemployment rate of older workers in Türkiye in the 2006Q1 - 2024Q1 period. According to the findings, there is a long-term relationship between the variables. Tthe effects of interest rates and labour force participation rates on the unemployment rate are not statistically significant. In the short run, the unemployment rate three periods ago significantly affects current unemployment levels. Based on these results and considering the findings of previous studies, flexible working models, employer incentives and lifelong learning programmes for older workers have an important place in combating the unemployment rate of older workers in Türkiye.*

***Keywords:*** *Ageing Workforce, Interest Rate, Labor Participation Rate, Older Workers, Unemployment.*

***Jel Codes:*** *J01, J14, J21.*

## 1. INTRODUCTION

Today, countries are in an economic struggle to increase their welfare, accelerate their financial and social progress and consequently raise the living standards of their citizens. If the factors that ensure economic development are considered equal, there are two ways to evaluate human resources to accelerate economic growth. The first is to increase the labour force and the other is to improve employee productivity (Zaim, 1997: 107). In addition, increasing the labour force is related to population politics. In this regard, countries can apply policies that increase or reduce the rate of population growth and improve the quality and quantity of the population (Oktay, 2014).

The world population has increased by 1 billion since 2007 and 2 billion since 1994, reaching 7.7 billion in mid-2019. The global population growth rate reached its highest, 2.1 per cent, between 1965 and 1970. Since then, the global population growth rate has slowed to less than 1.1 per cent annually in 2015-2020.

The global population is projected to reach 8.5 billion in 2030, 9.7 billion in 2050 and 10.9 billion in 2100. The following two foresight lie behind this expectation: women will have fewer than two live births on average during their lives and their life expectancy will increase. The number of children per

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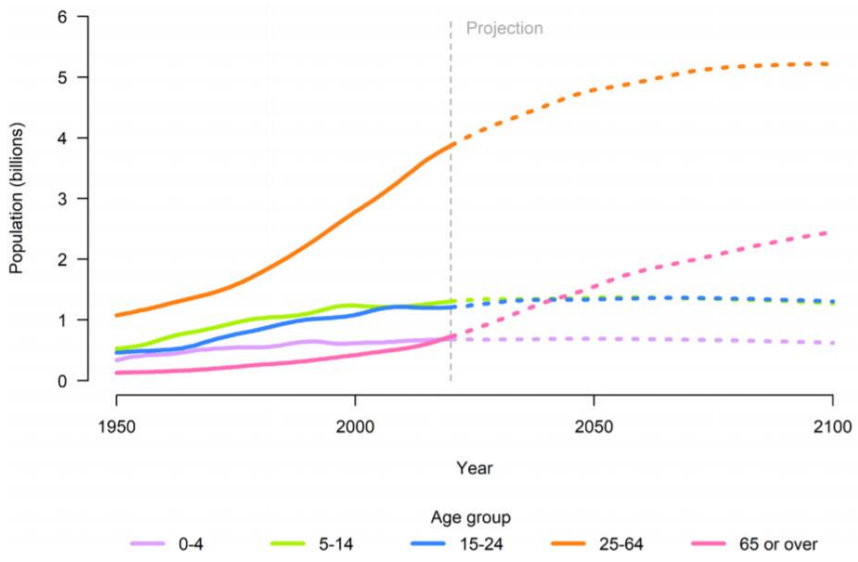
woman was 5 in the 1960s, while it decreased to less than 3 in 2000 and to 2 in 2050 (World Bank, 2019).

The extension of the expected lifetime indicates that the size of the world population will continue to increase over the next few decades. Toward the end of the 21st century, although it is accepted that the global population will continue to grow, it is also expected that the world population will stabilise or decrease for a while before 2100, with a probability of %27 (UN, 2019: 12).

Projections indicate that between 2019 and 2050, the global population will increase by 2 billion, with 1.05 billion (52 per cent) of this growth expected to occur in sub-Saharan Africa. Central and South Asia is projected to account for 25% of this increase, with an expected growth of 505 million. In the 2060s, Sub-Saharan Africa is projected to be the most populous of the eight geographical regions (UN, 2019: 12).

The global population is growing, fertility levels are low, and people live longer. As a result, the population is ageing in almost all countries and regions. Graph 1 shows that in 2018, for the first time in human history, the number of people aged 65 and over exceeded the number of children under the age of 5. Projections indicate that between 2019 and 2050, the population of individuals aged 65 and over will increase at a rate that is twice that of the under-five population, which is expected to remain relatively stable. Consequently, by 2050, the global demographic balance is projected to shift such that the number of elderly individuals will exceed that of children under the age of five. Moreover, it is projected that by 2050, the global population of individuals aged 65 and over will exceed that of the 15-24 age group, reaching 1.5 billion.

**Graph 1. Population Estimation by Age Groups 1950-2100**

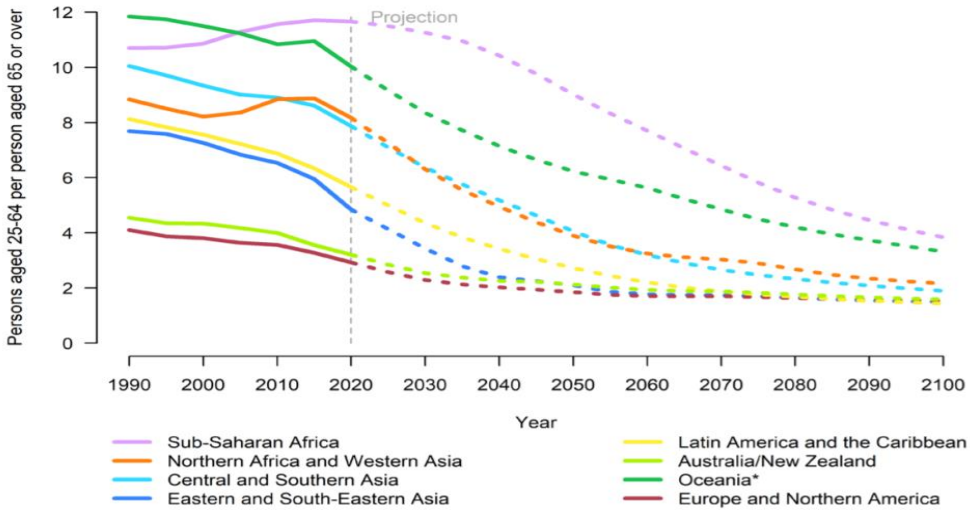



It is estimated that 201 countries or regions with a current population of at least 90,000 will see an increase in the proportion of people 65 and older between 2019 and 2050. Furthermore, currently,

about %9 of people at the global level are 65 years or older. It is estimated that the proportion of older people globally could reach about 12 per cent by 2030, %16 by 2050 and about %23 by 2100. Europe and North America have the oldest population at 18 percent in 2019. Estimates show that by 2050, one in every four people in Europe and North America will be 65 or older (UN, 2019).

The ageing of the population has a significant impact on the potential support rate. The potential support ratio is statistically inverse to the elderly dependency rate. It refers to the number of people aged 15 to 64 years per 65 and older people instead of those over 65 years of age per person in the group of 15 to 64 years (Ünal, 2015). As demonstrated in Graph 2, in 2019, the population ratio was 11.7 people in Sub-Saharan Africa, 10.2 in Oceania, 8.3 in North and West Asia, 8.0 in Central and South Asia, Latin America and the Caribbean, 5.8 in East and South East Asia, 3.3 in Australia and New Zealand, and 3.0 in Europe and North America. Japan currently exhibits the lowest potential support rate, standing at 1.8.

**Graph 2. Potential Support Ratio 1990-2100**




The ageing population also increases the importance of employment for the 55-64 age group in the working-age population. The employment rate of this group in the world, among OECD countries, while Türkiye takes the last place in the ranking with %34.3, Iceland has the highest rate with more than 80% employment rate. The OECD average rate is %61.8, approximately twice that of Türkiye. Another critical data is the labour force participation rate. While Türkiye has the last place with %37.8, which is far below the OECD average, Iceland has the highest labour force participation rate with approximately %85 (OECD Database, E.Y. 2020).

The number of people working in the labour market expresses the labour supply quantitatively, while their level of skills indicates the quality aspect. In this sense, the structure and quantity of the population directly affect the labour supply. Increasing the population can be considered a measure to increase the labour supply. In this regard, increasing the population has been encouraged in our country,

especially during the Republic period. According to The Turkish Criminal Code of 1926, illegal abortion and abortion are considered a crime and in 1936, with the amendments in the applicable law article, spaying and dissemination of contraceptive information were prohibited. Incentives continued until the 1960s and population policy was also included in the First Five-Year Development Plan (1963-1967) and a new population policy was introduced. The latest population policy includes more than one measure to reduce birth control and, thus, the population growth rate (DPT, 1963: 73).

It has been mentioned that the amount of the general population is the critical determinant and source of labour supply. All these resources cannot be used as a labour supply for various reasons. Because people under 15 and over 64 are considered to be a population that is not working. This way, these age groups are removed from the general population and the working-age population is obtained. Thus, the age group of 15-64 can be expressed as a working-age population. Also, not every person in this age group can qualify as a workforce member. The working-age population consists of people currently in the workforce, the ones willing to work, those who do not work, those who cannot work, or those who are not willing to work. In this context, the part of the working and willing population of the working age is defined as the labour force (Murat, 2007-73: 44).

The demographic characteristics of a country's population and related projections are also the main determinants of many policies, such as economics, health and social security. Therefore, developing policies by examining the changing population structure and determining its current and future needs is important. As it is seen in Table 1, the working-age population in Türkiye is getting older. It is necessary to decide in advance on the problems caused by this ageing and take precautions.

**Table 1. Age Distribution of Population in Working Age in Türkiye**

| Age/Year | 2000 | 2013 | 2023 | 2050 |
|---|---|---|---|---|
| 15-19 | 15,5 | 8,5 | 7,4 | 5,7 |
| 20-24 | 14,7 | 8,1 | 7,7 | 6 |
| 25-29 | 13,4 | 8,2 | 7,8 | 6,1 |
| 30-34 | 12,1 | 8,5 | 7,4 | 6,3 |
| 35-39 | 10,9 | 7,6 | 7,4 | 6,4 |
| 40-44 | 9,6 | 7 | 7,7 | 6,6 |
| 45-49 | 8 | 6,2 | 6,8 | 6,6 |
| 50-54 | 6,2 | 5,5 | 6,2 | 7 |
| 55-59 | 5 | 4,6 | 5,4 | 6,5 |
| 60-64 | 4 | 3,6 | 4,7 | 6,3 |

**Source:** TURKSTAT population projection has been created by calculating 2000-2025 and 2013-2075 data.

The ageing of the population is one of the most important issues that is prominently affecting the change in population structure worldwide. Developments in health services, improved living conditions and some sociocultural changes have led to decreased birth and death rates while expected lifetime prolonging and, thus, ageing of the population. The ageing of the 15-64 age group, which is the most critical age group for economies and corresponds to the active working population, poses significant problems. Labour supply is one of the critical factors directly affecting economic growth. In this context, changes in the age group that compose the labour supply directly impact a country's future economic growth potential (Kuzgun, 2002: 38).

Population ageing occurs with a decrease in death and birth rates. The number of births per woman, which was 6.7 in the years 1950-1955, falls below 2 as of 2015 and it is predicted that it will remain below 2 until 2100. In this regard, there is a dramatic decrease in the number of births per woman. According to data from the Türkiye Statistical Institute in 2018, the average age of mothers is 28.9 and each woman has 1.99 children.

As with the expected life expectancy at birth in Türkiye, there has been a significant decrease in birth rates. The life expectancy of women in 1950-1955 was 44 and men in 38 and when it comes to 2020, these expectancies are 81 and 75, respectively. There has also been a regular increase in future forecasts (UN, 2019).

In this context, it is possible to say that Türkiye is an ageing country with a one-child family structure and this ageing will bring along new problems. To prepare today's youths for tomorrow's conditions, plans to make tomorrow's conditions suitable for the elderly should be one of the social policy issues for the state. It is not yet known what it means to be elderly in a digitised world. But today's youths will be the elderlies of the digital world.

Türkiye still needs to be considered as a country that has completed its demographic transition. However, the population projections show that the share of the older workers' labour force will gradually increase. Changing the workforce structure requires reviewing existing methods for combating unemployment. Therefore, macro and micro factors affecting older workers' employment or unemployment must be identified. This study aims to examine the macroeconomics factor of this subject.

In Türkiye, active and passive employment policies are implemented for various disadvantaged groups such as women, children, refugees and persons with disabilities. However, public or private employment policies still need to be implemented for older workers. In order to prevent Türkiye's unemployment problem in the coming years, a proactive approach should be adopted to identify possible problems and social policies should be produced for this age group. Our research will pioneer future studies in this sense with problem detection and solution suggestions.

## 2. RELATED LITERATURE OVERVIEW

The effects or reasons for this rate have been an important research topic for researchers over the years since the unemployment rate is related to almost all macroeconomic variables and it is a variable that can be used to express the economic structure of countries. In this section, summaries of the articles that help to generate the theoretical background of the study are presented. Within the scope of the literature, many articles have examined the unemployment rate for almost all countries.

**Table 2. Summary of Results Reached by Related Earlier Studies on the Unemployment Rate for Türkiye**

| Authors | Date | Countries | Variables | Method | Findings |
|---|---|---|---|---|---|
| Doğrul and Soytaş (2010) | 2005:01 2009:08 | Türkiye | OP, IR, UR | Toda Yomamoto | IR has positive effect on UR |
| Doğan (2012) | 2000: Q1 2010: Q1 | Türkiye | IR, ER, LR, IFR, EG, EXG | VAR | IR has negative effect on UR |
| Ağazade (2014)* | 2005: 01 2013: 09 | Türkiye | LR, UN | Linear and Nonlinear Co-integration Analysis | ∄ relation between LR and UR |
| Tansel et.al. (2016) | 1988: Q3 2013: Q4 | Türkiye | UR, LR | VECM | ∄ long-run relation between LR and UR |
| Yüksel and Adalı (2017) | 2003: Q1 2016: Q4 | Türkiye | IR, UR, EG, CD, ER | MARS | IR has a positive effect on UR |
| Akcan and Ener (2018) | 2000: Q1 2015: Q3 | Türkiye | IR, CV, EG, EX, IM, MS, ER, IFR, UN | VAR | ∃ relationship between IR and UN, but it is not stable and can vary from one period to another. |
| Sivri (2019) | 2005: 01 2013: 09 | Türkiye | UN, LR | VAR | ∄ relation between LR and UR |
| Çalış (2022) | 2006:Q1 – 2022:Q1 | Türkiye | CPI, IPI, REE, PPE, IR, UN | ARDL Toda-Yamamato | ∃ bidirectional causality relationship between the unemployment rate and the interest rate |

| | | | | | |
|---|---|---|---|---|---|
| Merdan (2023) | 1990 - 2022 | Türkiye | ER, EG, UN | Johansen Co-integration and Granger Causality | ∃ short-run positive relation between EG and ER |
| Kadiroğlu (2023) | 1998 – 2020 | Türkiye | PD, IR, UN | ARDL - ECM | PD and IR has adverse effect on UN |
| Dündar (2024) | 1988-2022 | Türkiye | LR, ER, UR (55-64 age group) | VECM | ∃ the older labor force participation rate supports the existence of a relationship between older employment rates and unemployment rates in the short and long term |

**Note:** Unemployment Rate: UR, Employment rate: ER, Interest Rate: IR, Labor Participation Rate: LR, OP: Oil Price Rate, VAR: Vector Autoregressive Model, , Inflation Rate: IFR, Economic Growth: EG, VECM: Vector Error Correction Model Export Growth: EXG, CPI: Consumer price index MARS: Multivariate Adaptive Regression Splines, CV: Credit Volume, EX: Export, IM: Import, ER: Exchange Rate, PD: Public debt, MD: Money Supply, IPI: Industrial production index, REE: Real effective exchange rate, PPE: Primary public expenditure, CBRT: Central Bank of Republic Türkiye,*: study has divided the participation and unemployment rates into general, female, male and urban, ∄:does not exist, ∃: exist

Doğrul and Soytaş (2010) have found that the unemployment rate is positively affected by the interest rate. A similar result was obtained by Yüksel and Adalı (2017). Both studies show that unemployment is significantly affected by interest rates. Doğan (2012) stated that this relationship is in the opposite direction; that is, an increase in interest rates decreases the unemployment rate. Akcan and Ener (2018), on the other hand, stated that the effect of interest rates on unemployment is unstable and variable across periods. Çalış (2022) states that there is a bidirectional causality between the interest rate and the unemployment rate, while Kadiroğlu (2023) states that interest rates have a negative effect on unemployment, that is, a decrease in interest rates can reduce unemployment.

Ağazade (2014) and Tansel et al. (2016) did not find a long-run relationship between the labour force participation rate and unemployment rate, while Sivri (2019) stated that the two are not correlated. Dündar (2024) found that the labour force participation rate is associated with unemployment and employment, especially for the 55-64 age group. This finding suggests that conducting age-specific analyses may yield more precise results.

**Table 3. Summary of Results Obtained from Earlier Related Studies on the Unemployment Rate in Countries**

| Authors | Date | Countries | Variables | Method | Findings |
|---|---|---|---|---|---|
| Emerson (2011) | 1948:01 - 2010:12 | USA | LR, UN | VEC | ∃ long-run relation between LR and UR |
| Putriani (2013) | 1980: Q1 - 2012: Q1 | USA | UN, IR, OP, IN | ECM | ∃ relationship between IR and UN |
| Ahmad (2013) | 1991:01 - 2010:12 | Pakistan | UN, IR, OP | Toda-Yamamoto | ∄ relation between IR and UR |
| Bahadorkhah and Aminifard (2014) | 1973 - 2012 | Iran | UN, IR, OP | ARDL | IR→UN |
| Sumera and AJmad (2016) | 1974 - 2013 | Pakistan | UN, IR, ER, IFR, ED, PG, IM, MS, PS, DC | ARDL | ∄ relation between IR and UR |
| Apargis and Arısoy (2017) | 1976 - 2014 | USA | LR, UN | Panel Data Analysis | ∃ relationship between IR and UN |
| Karlsson et.al. (2018) | 1997: 01 - 2015: 12 | Norway | UN, IR, OP | Toda Yamamoto | IR→UN<br>UN→ IR<br>But this causality changes periodically, as periodically |
| Agboola (2019) | 2000: Q1 - 2016: Q4 | Nigeria | UN, IR, EG | Toda Yamamoto | IR→UN |
| Sköld (2020) | 2008: 01 - 2020: 02 | Sweden, Norway, Denmark, Finland | UN, IR, OP | Toda-Yamamoto and ARDL | IR→UN except Denmark |
| Panigrahi et.al. (2020) | 1995 - 2018 | ASEAN Countries | UN, IR, IFR, EG | Granger Causality, Fmols and Dols | ∄ relation between IR and UR |
| Majima and Musa (2021) | 1991 - 2019 | Nigeria | UN, IR, OP | Toda Yomamoto | UN→ IR |

| | | | | | |
|---|---|---|---|---|---|
| Capistrano (2023) | 2000 – 2020 | Philippines | UN, GDP, LR, NNI, PG, IR | Simple linear regression | LR, PG and IR linear relationships with Un, while GDP growth rate did not. |
| Yilanci and Ozgur (2024) | June 1999 – Jaunary 2023 | South Korea | UN, LR | Johansen-Type Cointegration Analysis | The present study investigates the long-term relationship between the unemployment rate and the labour force participation rate in South Korea. |
| Alam et al. (2024) | 1990 – 2018 | Gulf Cooperation Council countries | GDP, UN, LR | Panel dynamic ordinary least squares (DOLS) and Fully Modified Ordinary Least Squares (FMOLS) | It is evident that in the long term, the unemployment rate exerts a statistically significant negative effect on economic growth in the GCC nations. Concurrently, the labour force participation rate exerts a significant influence on economic expansion over the long term. |
| Yildirim (2024) | 1991 - 2022 | Belgium | UN, LR (15-24 age group) | ARDL co-integration analyses | ∄ relation between LR and UN |
| Zaheer Khan et al. (2024) | 1990-2021 | Pakistan | LR, UN | Johansen's cointegration and Gregory and Hansen's cointegration tests | ∄ relation between LR and UN |

**Note:** Unemployment Rate: UR, Interest Rate: IR, Labor Participation Rate: LR, Inflation Rate: IFR, Economic Growth: EG, Export Growth: EXG, CV: Credit Volume, EX: Export, IM: Import, ER: Exchange Rate, MD: Money Demand, NNI: Net National İncome, PG: Population Growth, ED: External Debt, PS: Political Stability, DC: Domestic Credit to Private Sector, IN: Industrial Index, ECM: Error Correction Model, VAR: Vector Autoregressive Model, MARS: Multivariate Adaptive Regression Splines→ : $one$ −way causality

Studies on countries or groups of countries other than Türkiye can reach a general conclusion about the relationship between unemployment, labour force participation rates and interest rates. Putriani (2013) and Apergis and Arısoy (2017) find a long-run relationship between interest rates and unemployment. Ahmad (2013), on the other hand, found that there is no relationship between these two variables in the context of Pakistan. Karlsson et al. (2018) find that interest rates affect unemployment in Norway, but this causality changes over time. Agboola (2019) and Sköld (2020) stated that interest rates influence unemployment, but this relationship may vary across countries. While Panigrahi et al. (2020) stated that there is no relationship between interest rate and unemployment in ASEAN countries, Alam et al. (2024) emphasised that there is an indirect effect of interest rate in Gulf countries and the negative impact of unemployment on economic growth.

Emerson (2011) reveals that a long-run relationship exists between the labour force participation rate and the unemployment rate in the USA.. Similarly, Yilanci and Ozgur (2024) found a long-run relationship between these two variables in South Korea. Capistrano (2023) stated that the labour force participation rate is directly related to unemployment in the context of the Philippines. On the other

hand, Yildirim (2024) states that there is no relationship between the labour force participation rate and unemployment in Belgium, while Zaheer Khan et al. (2024) found a similar result in Pakistan.

In the literature, studies on the determinants of the unemployment rate have generally focused on the overall unemployment rate and detailed analyses specific to age groups have not been sufficiently included. Studies in the Turkish context have also examined the effect of interest rate and labour force participation rate on unemployment but have not addressed these relationships for a specific age group such as the 55-64 age group. This study fills this gap and provides a more targeted analysis in the context of an ageing labour force. Moreover, applying the ARDL model to this age group provides a methodological contribution to the literature by demonstrating the potential of the method in age-specific analyses. In this context, this study fills an important gap in the literature by providing both an age-specific analysis and a framework to better understand the economic dynamics of the ageing population in the Turkish context.

## 3. DATA AND METHODOLOGY

Prior to the investigation of the existence of a cointegration relationship between the variables under consideration, the degree of integration of the series must be ascertained. In this study, the degree of integration of the variables is determined by employing the Augmented Dickey-Fuller (ADF) unit root test. The null hypothesis of this test posits the existence of a unit root, thereby implying non-stationary series, while the alternative hypothesis suggests the absence of a unit root, i.e. stationarity of the series.The results of the ADF tests are presented in Table 2.

After testing the unit root analysis, I performed the ARDL Bounds test. ARDL bounds test is a statistical approach used to assess the existence of a long-term relationship between variables in a time series context. The modelling approach of ARDL was first pioneered by Pesaran and Shin (1999); later, in 2001, Pesaran, Shin and Smith further extended this technique. This method is characterized by its flexibility in handling variables that can be integrated to different degrees, in particular, I(0) or I(1), without necessarily being of the same order (Natsiopoulos and Tzeremes, 2022; Salmasi and Heidari, 2012). This feature makes the ARDL bounds test particularly advantageous when dealing with small sample sizes, as it provides reliable results even when the number of observations is limited (Saleem and Ahmed, 2023).

In the study, the quarterly unemployment rate (UNR) and labour participation rate (LPR) series for the period 2006: Q1-2024: Q1 are obtained from Databank, interest rate (IR) is obtained from IMF and all econometric analyses have been performed with the help of STATA/MP 18.0. In addition, all the series used in the study are seasonally adjusted series.

Regarding the relationship between the unemployment rate (UN), labour force participation rate (LR) and interest rate (IR), we specify the following equation:

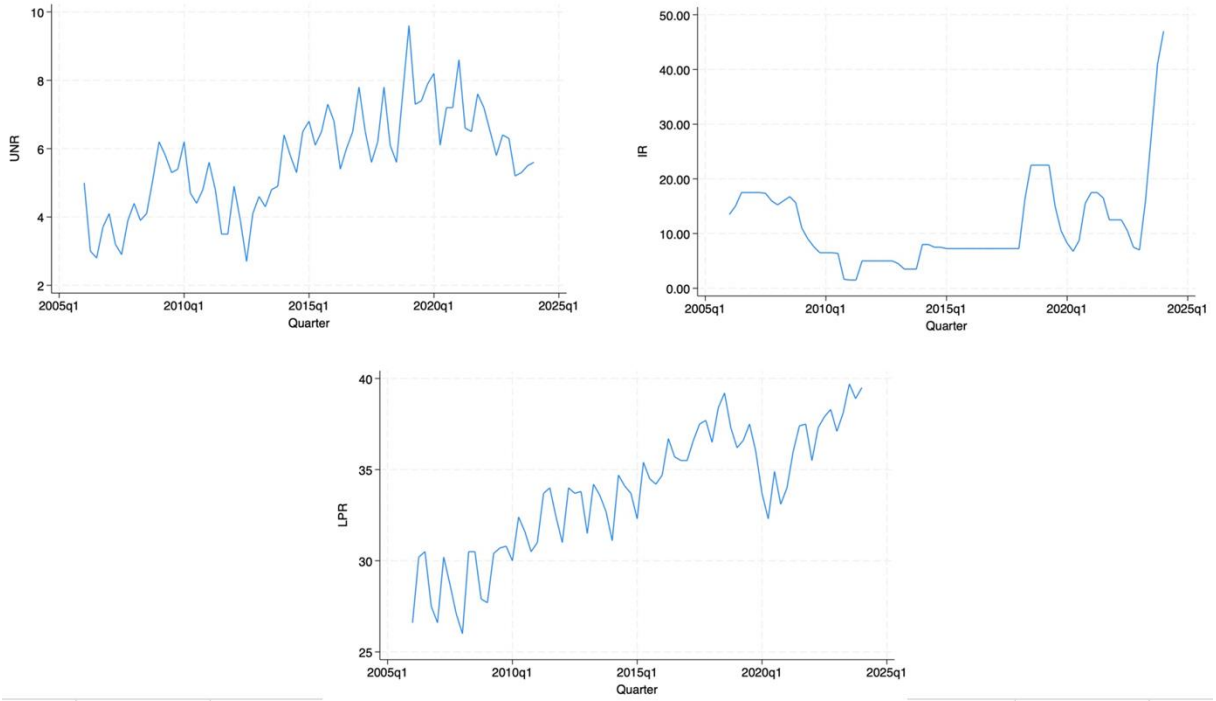
$$UNR_t = \beta_0 + \beta_1 IR_t + \beta_2 LPR_t + \varepsilon_t \quad (1)$$

where $\varepsilon$ is the error term.

## 4. EMPIRICAL RESULTS AND ANALYSIS

In this part, the results of the ARDL test, which is the analysis method used in the study, are presented. First, the graphs of the variables were examined. Figure 1 illustrates time series plots of variables.

**Figure 1. Time Series Plots of Variables**




Thus, to determine the degree of integration of variables, we perform unit root tests of ADF. Table 2 presents the results of the test.

**Table 4. Unit Root Tests Results[1]**

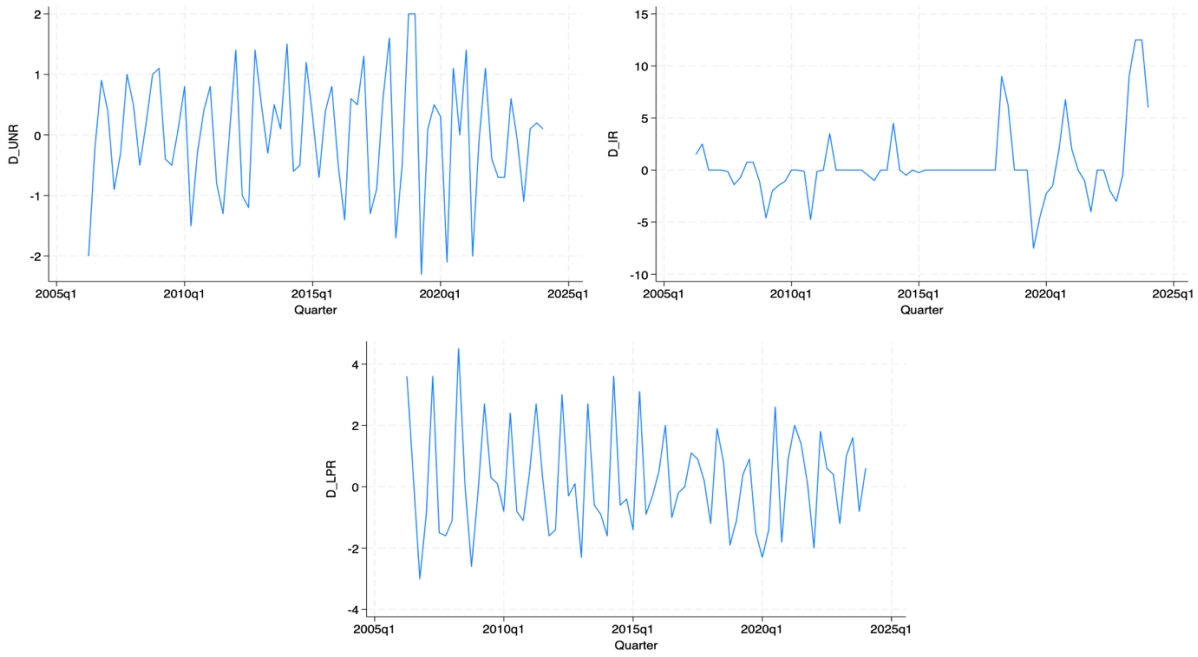
| Variables | ADF |
|---|---|
| **IR** | -0.929 |
| **DIR** | -2.916* |
| **UNR** | -2.096 |
| **DUNR** | -2.981* |
| **LPR** | -0.982 |
| **DLPR** | -2.916* |

* indicates that series are stationary at % 5 significance level.

[1] The impressions will be used for first differential unemployment rate series (D_UN), the first differential labor force participation rate series (D_LPR) and first differential interest rate series (D_IR).

The unit root test results given in Table 4 show that the series are not stationary at their levels. Otherwise, they are stationary at their first differences. Figure 2 also shows the time series plots of the first differences of variables.

**Figure 2. The Time Series Plots of the First Differences of Variables**




In addition to the unit root test results, the graphs in Figure 2 indicate that the first differences in IR, UNR and LPR are stationary; that is, they are I (1).

After determining the stationarity levels of the variables using unit root tests, the ARDL method was chosen. What plays a role in selecting the ARDL method is its applicability in the presence of I (0) or I (1) variables, a well-known advantage of this method. It also allows it to produce consistent results in small samples and does not suffer from the endogeneity problem (Özer, Žugić, Tomaš-Miskin, 2018).

This study uses ARDL test results to analyze the three different variables. The optimum lag length has been selected as 4, considering the minimum AIC (Akaike Information Criterion) value when the unemployment rate is dependent and the labour force participation rate and interest rate are independent variables. The UECM (Unrestricted Error Correction Model) regression equation estimated for the ARDL model is as follows:

$$\Delta \text{UNR} = \alpha_0 + \sum_{i=1}^{m} \beta_{1i} \Delta UNR_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta LPR_{t-i} + \sum_{i=0}^{p} \beta_{3i} \Delta IR_{t-i} + \beta_4 ECM_{t-i} + \delta_1 UNR_{t-i} + \delta_2 LPR_{t-i} + \delta_3 IR_{t-i} + \varepsilon_i \quad (2)$$

The F bound test determines the long-term relationship between variables. Also, the first step in implementing the ARDL test is determining the F statistic values.

$$H_0 = \delta_1 = \delta_2 = \delta_3 = 0$$

$$H_1 \neq \delta_1 \neq \delta_2 \neq \delta_3 \neq 0$$

In this case, the null hypothesis $H_0$ implies no cointegration between variables. If the statistical value of F is greater than the critical upper limit value, $H_0$ it is accepted; otherwise, it is rejected.

**Table 5. The Result of ARDL Co-integration Test Results**

**Predicted Model: D_UNR = f (D_LPR, D_IR)**

| | | |
|---|---|---|
| **F-Statistics** | 5.096 | |
| **Optimal Lag Length** | [4,0,4] | |
| **Level of Significance** | **Bound Critical Values** | |
| | **I(0)** | **I(1)** |
| %5* | 3.874 | 5.050 |
| %10* | 3.185 | 4.242 |

**Note:** * means the rejection of the no cointegration at 5 and 10 % significance level.

In Table 5, the hypothesis is at the 10% and 5% significance levels. Accordingly, we conclude that the variables are co-integrated, meaning there is a long-term relationship between the variables.

After determining the existence of a long-run relationship, the parameters reflecting the long-run relationship were determined using the equation below and the results are presented in the table.

$$\text{D\_UNR}=\alpha_0 + \sum_{i=1}^{m} \alpha_{1i} D\_UNR_{t-i} + \sum_{i=0}^{n} \alpha_{2i} D\_LPR_{t-i} + \sum_{i=0}^{p} \alpha_{3i}\, D\_IR_{t-i} + \varepsilon_i \quad (3)$$

**Table 6. ARDL [4,0,4] Model Results**

| **Predicted Model: D_UNR = f (D_LPR, D_IR)** | | | |
|---|---|---|---|
| **Variables** | **Coefficients** | **T-statistics** | **P-value** |
| L1 | -.3012326 | -2.41 | 0.019 |
| L2 | -.3516754 | -2.62 | 0.011 |
| L3 | -.1846794 | -1.46 | 0.151 |
| L4 | .332896 | 2.59 | 0.012 |
| D_IR | -.0555077 | -1.54 | 0.129 |
| D_LPR | -.0485689 | -0.68 | 0.5 |
| L1 | .0409702 | 0.92 | 0.362 |
| L2 | .0077655 | 0.17 | 0.866 |
| L3 | .0530098 | 1.13 | 0.264 |
| L4 | -.0369658 | -0.78 | 0.437 |
| c | .0561389 | 0.64 | 0.527 |

The short-term dynamic parameters are obtained by estimating an error correction model (ECM) associated with long-term estimations. The results of long-run and short-run estimates are shown in Table 7. Therefore, equation (4) can be rewritten as the error correction of the augmented-ratio difference (ARDL) model as follows:

$$\Delta D\_UNR=\alpha_0 + \sum_{i=1}^{m} \theta_{1i}\Delta D\_UNR_{t-i} + \sum_{i=0}^{n} \theta_{2i}\Delta D\_LPR_{t-i} + \sum_{i=0}^{p} \theta_{3i}\, \Delta D\_IR_{t-i} + \theta_4 ECM_{t-i} + \varepsilon_i \quad (4)$$

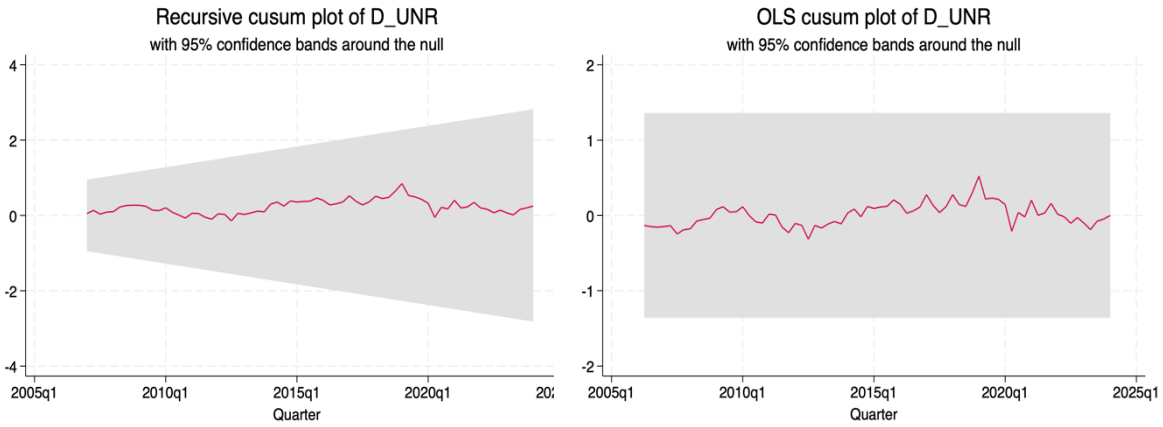
**Table 7. ARDL Model Long and Short Run Results**

| **Predicted Model: D_UNR = f (D_LPR, D_IR)** | | | |
|---|---|---|---|
| **Variables** | **Coefficients** | **T-statistics** | **P-values** |
| **Long-run results** | | | |
| D_LPR | -.0322783 | -0.66 | 0.510 |
| D_IR | .0061621 | 0.15 | 0.879 |
| **Short-run results** | | | |
| D_UNR(-1) | .2034588 | 0.66 | 0.509 |
| D_UNR(-2) | -.1482166 | -0.70 | 0.487 |
| D_UNR(-3)* | -.332896 | -2.59 | 0.012 |
| D_IR | -.0647797 | -1.20 | 0.235 |
| DLR(-1) | -.0238095 | -0.42 | 0.673 |
| DLR(-2) | -.0160441 | -0.32 | 0.753 |
| DLR(-3) | .0369658 | 0.78 | 0.437 |
| c | .0561389 | 0.64 | 0.527 |
| ECM(-1)* | -1.504691 | -3.81 | 0.000 |
| **Test** | **Probabilities** | | |
| Heteroscedasticity (Breusch-Pagan-Godfrey) | 0.8953 | | |
| Serial Correlation (LM TEST) | 0.1713 | | |

**Note:** * denotes the rejection of the null hypothesis at %5 and %10, respectively.

According to ARDL Long and Short Run results, the relationships of D_UNR variable with D_LPR and D_IR regarding the long-run relationships were not statistically significant. In particular, the coefficient of the D_LPR variable is -0.0322783. The coefficient of the D_IR variable is 0.0061621 and the p-values of both variables are well above the significance level of 0.05 with 0.510 and 0.879, respectively. This shows that both variables do not significantly affect D_UNR in the long run. As for the short-run results, the D_UNR(-3) coefficient is statistically significant with -0.332896 and a p-value of 0.012. This shows that the unemployment rate three periods ago had a significant negative effect in the short run. Most of the other short-run variables, especially D_UNR(-1), D_UNR(-2), D_IR and DLR, did not show a significant effect. However, the coefficient of ECM(-1) is highly significant with -1.504691 and a p-value of 0.000, indicating that the model moves towards equilibrium and the transition from the short-run to the long-run is achieved through a strong adjustment process. Moreover, the heteroskedasticity test (Breusch-Pagan-Godfrey) and autocorrelation test (LM Test) reveal that there is no heteroskedasticity and autocorrelation in the model with p-values of 0.8953 and 0.1713, respectively. These results support the overall validity and reliability of the model.

**Figure 3. CUSUM Test Graphs**




Furthermore, Figure 3 shows the results of Recursive CUSUM and OLS CUSUM tests to assess the structural stability of the estimated model, respectively. Both graphs show that the red line representing the cumulative error sum is within the grey boundaries, indicating the 95% confidence interval. While the Recursive CUSUM graph emphasises that there is no structural break in the model's forecasting performance, the OLS CUSUM graph reveals that the error terms are stably distributed over time. The model has a stable structure in general. The fact that both graphs do not show any deviation outside the confidence limits proves that the predictability and structural integrity of the model used are reliable. These findings support the appropriateness of the methodology used in the analysis and the fact that the model is robust to time.

## 5. CONCLUSION and POLICY IMPLICATION

This study utilises the Autoregressive Distributed Lag (ARDL) method to analyse the relationships between the unemployment rate, interest rate (IR), and labour force participation rate (LR) in the Turkish context. The findings indicate that the IR and LR do not exert a long-run effect on unemployment. However, the values from the previous period significantly impact the unemployment rate in the short run. These results demonstrate both similarities and differences with those found in studies conducted in different contexts.

In the extant literature, there is a divergence of opinion regarding the impact of interest rates on unemployment. Several studies have been conducted which appear to demonstrate a positive relationship between the two variables in Türkiye (see Doğrul and Soytaş, 2010; Yüksel and Adalı, 2017). However, Doğan (2012) have argued for the contrary, suggesting that the relationship is in the opposite direction. This study, however, demonstrates that, in the long run, interest rates do not have a significant effect on unemployment. However, Akcan and Ener's (2018) finding that the effect of interest rates on unemployment is unstable and may change periodically is consistent with the findings of this study regarding short-term dynamics.

Secondly, the results of this study on the relationship between labour force participation rate and unemployment are consistent with some results in the literature. Tansel et al. (2016) and Sivri (2019) did not find a long-run relationship between the labour force participation rate and unemployment, which is supported by this study. However, Dündar (2024) has asserted that the labour force participation rate significantly influences unemployment within the 55-64 age demographic in age-specific analyses. This discrepancy suggests that the relationship between labour force participation and unemployment may vary according to age and demographic characteristics.

In the international context, Putriani (2013) and Apergis and Arısoy (2017) posit that interest rates exert a long-run effect on unemployment; however, Ahmad (2013) and Panigrahi et al. (2020) posit that there is no relationship between these two variables. The present study supports these disparate findings by rejecting the long-run relationship between interest rates and unemployment. Furthermore, Emerson (2011) and Yilancı and Özgür (2024) demonstrate that a long-run relationship between the labour force participation rate and unemployment is invalid for Türkiye.

In light of the long-term ramifications of two variables that influence the unemployment of this age group, it can be posited that an augmentation in the labour force participation rate is more efficacious than an increase in interest rates. Consequently, it can be deduced that a more effective policy would be to proffer employment opportunities for the 55-64 age group instead of interest rate reductions. Another policy implication to increase the employment of older workers is that the government can provide employers with wage support or tax reductions. Finally, the establishment of private employment agencies exclusively dedicated to the employment of older workers can be encouraged, as well as the formation of a commission within the Turkish Employment Agency that would be tasked with developing policies for the employment of older workers.

Compared to other studies in the literature, the findings of this study show that the effects of interest rates and labour force participation rates on the unemployment rate are complex and variable. Therefore, policymakers should encourage flexible working models, organise awareness campaigns for employers and introduce stricter legal regulations against age discrimination to reduce unemployment. In addition, lifelong learning programmes and technology training should be offered to older workers to help them adapt to technological changes and career counselling and job placement programmes should be developed. Pension policies should be restructured to enable workers to stay in the labour force longer and health benefits should be increased. These policies will reduce the disadvantageous situation of older workers in the labour market and improve their economic and social contribution.

**REFERENCES**

Ahmad, Fawad. (2013) "The Effect of Oil Prices on Unemployment: Evidence from Pakistan. Business and Economics Research Journal. 4. 43-47.

Agboola, E., Johnson, O., Yusuph, G., Adelakun, and O.Johnson. (2019) "Economic Growth, Unemployment And Interest Rate In Nigeria: Application Of Fourier Toda-Yamamoto", International Journal of Science and Research (IJSR). 8. 36-40.

Ağazade, Seymour. (2014) "Türkiye'de İşsizlik ve İşgücüne Katılım İlişkisinin Doğrusal ve Doğrusal Olmayan Koentegrasyon Yöntemleri ile Analizi", Eskişehir Osmangazi Üniversitesi İİBF Dergisi, 9(3), 145- 161.

Akcan, A.T., and Ener, M. (2018) "Makroekonomik Değişkenlerin İşsizlik ile İlişkisi: Türkiye Örneği", Journal of Administrative Sciences, 16(31), 263-285.

Alam MS, Ansari Y, Sha N., and Khan K. (2024) "The Influence of Unemployment and Labor Force Participation Rates on Economic Development in GCC Countries: A Cointegration Approach", Journal of Infrastructure, Policy and Development. 8(2): 2962. https://doi.org/10.24294/jipd.v8i2.29 62

Apergis,N., and Arısoy,İ. (2017) "Unemployment and Labour Force Participation Across The US States: New Evidence from Panel Data", Journal of Economics and Business, Vol.67 Issue 4, pp. 45-84.

Bahadorkhah,F., and Aminifard, A. (2014) "Online International Journal", 4, 996-1004.

Capistrano, M. J. C. (2023) "Exploring the Drivers of Unemployment and Forecasting the Unemployment Rate: A Time Series and Regression Analysis", International Journal of Research Publication and Reviews, 4(8), 1461-1473. https://doi.org/10.55248/gengpi.4.823.50845

Çalış, G. (2022) "Türkiye'de İşsizliğin Makroekonomik Belirleyicileri, Master's thesis, Pamukkale University, Institute of Social Sciences, Denizli.

Devlet Planlama Teşkilatı (1963) "Birinci Beş Yıllık Kalkınma Planı", http://www.sbb.gov.tr/wp-content/uploads/2018/11/Birinci-Be%C5%9F-Y%C4%B1ll%C4%B1k-Kalk%C4%B1nma-Plan%C4%B1-1963-1967%E2%80%8B.pdf (Accessed on 19 August 2019).

Doğan, T.T. (2012) "Macroeconomic Variables and Unemployment: The Case of Türkiye", International Journal of Economics and Financial, Issues Vol. 2, No. 1, pp.71-78.

Doğrul, H.G., Soytaş, U. (2010), Relationship between oil prices, interest rate and unemployment: Evidence from an emerging market, Energy Economics 32, 1523–1528.

Dündar, S. (2024) "Türkiye'de Yaşlı İş Gücüne Katılım Oranı, İşsizlik Oranı ve İstihdam Oranı İlişkisinin Analizi", Senex: Yaşlılık Çalışmaları Dergisi, 7(2), 34-45.

Emerson, J. (2011) "Unemployment and Labour Force Participation in the United States", Economic Letters 111, 203-206.

Kadiroğlu, A. (2023) "Enflasyon ve Kamu Borçlarının İşsizlik Üzerine Etkisi: Türkiye Üzerine Bir Uygulama", Abant Sosyal Bilimler Dergisi, 23(2), 1200-1210. https://doi.org/10.11616/asbi.1270565

Kim Karlsson H, Li Y, and Shukur G. (2018) "The Causal Nexus between Oil Prices, Interest Rates and Unemployment in Norway Using Wavelet Methods", Sustainability. 10(8):2792.

Kuzgun, İ. K. (2002) "Nüfusun Yaşlanmasının İşgücü Arzına Etkisi", Turkish Journal of Geriatrics, 5(1)

Maijama'a, Rabiu and Musa, Kabiru Saidu. (2021) "Crude Oil Price, Interest Rate and Unemployment Nexus in Nigeria: An Application of Toda and Yamamoto Long-Run Causality Procedure", 8. 1-16. 10.33844/mbr.2021.60326.

Merdan, K. (2023) "Ekonomik Büyüme, İşsizlik ve İstihdam İlişkisi: Türkiye Örneği", Yönetim ve Ekonomi Dergisi, 147-166. https://doi.org/10.18657/yonveek.1361775

Murat, S. (2007) "Dünden Bugüne İstanbul'un İşgücü ve İstihdam Yapısı", İstanbul: İstanbul Ticaret Odası. Yayın No: 2007-73.

Natsiopoulos, K. and Tzeremes, N. (2022) "ARDL: An R Package for the Analysis of Level Relationships", Journal of Open Source Software, 7(79), 3496. https://doi.org/10.21105/joss.03496

Oktay, E. Y. (2014) "Türkiye'de Cumhuriyet'in İlanından Günümüze Uygulanan Nüfus Politikaları", Yalova Sosyal Bilimler Dergisi, 4(7).

Panigrahi,S.K., Azizan, N.A., Sorooshian, S., and Thoudam, P. "Effects of Inflation, Interest and Unemployment Rates on Economic Growth: Evidence from ASEAN Countries", ABAC Journal, 40(2), 140-155.

Pesaran, M. H. and Y. Shin (1999) "An Autoregressive Distributed Lag Modeling Approach to Cointegration Analysis," in Storm, S. (Ed), "Econometrics and Economic Theory in the 20th Century", The Ragnar Frisch Centennial Symposium, Cambridge University Press.

Putriani, Diyah (2013) "The Effects of Real Interest Rates on Social Dimension: A Case Study of Unemployment in the United State", Paper Proceeding of the 5th Islamic Economics System Conference (iECONS 2013).

Saleem, F. and Ahmed, T. (2023) "Role of Icts in Environmental Degradation: A Cross-Country Analysis", https://doi.org/10.21203/rs.3.rs-2298281/v1

Salmasi, P. J. And Heidari, H. (2012) "Inflation and Money in Iran: An Application of Bounds Test", International Journal of Advances in Management and Economics, 01(04), 07-13. https://doi.org/10.31270/ijame/01/04/2012/02

Sivri, U. (2019) "İşsizlik Oranı ve İşgücüne Katılım Oranı Arasındaki Uzun Dönemli ilişki: Türkiye Örneği", AVRASYA Uluslararası Araştırmalar Dergisi, 7(19), 452 – 467.

Sköld, A. (2020) "The Relationship Between Unemployment and Oil Price, Oil Price Uncertainty and Interest Rates in Small Open Economies", Master Thesis in Economics, Jönköping University.

Sumera, A. and Amjad, A. (2016) "Trade-off Between Inflation", Interest and Unemployment Rate of Pakistan: Revisited, MPRA Paper.

Tansel, A., Ozdemir, Z.A., and Aksoy, E. (2016) "Unemployment and Labour Force Participation in Türkiye", Applied Economics Letters, 23(3), 184-187.

United Nations Department of Economic and Social Affairs (2019) "Population Division", World Population Prospects 2019, Volume II: Demographic Profiles (ST/ESA/SER.A/427).

Ünal, Ç. (2015) "Türkiye Nüfusunun Yaşlanma Endeksi ve Potansiyel Destek Oranlarının Dağılımı", Hasan Ali Yücel Eğitim Fakültesi Dergisi, 12(1).

Zaim, S. (1997) "Çalışma Ekonomisi", İstanbul: Filiz Kitabevi.

OECD (2020) "Working age population (indicator)". Doi: 10.1787/d339918b-en (Accessed on 24 April 2020).

Özer, M., Žugić, J. and Tomaš-Miskin,S. (2018) "The Relationship Between Current Account Deficits and Growth in Montenegro: ARDL Bounds Testing Approach", Journal of Central Banking Theory and Practice, Vol. 7 (3), DOI: https://doi.org/10.2478/jcbtp-2018-0020

Yilanci, V., and Ozgur, O. (2024) "Unemployment and Labour Force Participation in South Korea: Johansen-Type Cointegration Analysis with a Fourier Approach", Politická Ekonomie, 72(1), 122-141.

Yildirim, S. (2024) "A Different Outcome for Unemployment and Labour Force Participation: The Discouraged Female Worker by Male Unemployment", Applied Economics Letters, 1-5.

Yüksel, S. and Adalı, Z. (2017) "Determining Influencing Factors of Unemployment in Türkiye with Mars Method", International Journal of Commerce and Finance, Vol. 3, Issue 2, 2017, 25-36.

World Bank (2019) "World Development Indicators", https://databank.worldbank.org/source/population-estimates-and-projections, (Accessed on August 8, 2019).

Zaheer Khan, M., Said, R., and Amjad, S. (2024) "Relationship Between Labor Force Participation and Unemployment in Pakistan", Economics Bulletin, 44(1), 264-272.

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