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Article

Determining the relationship between unemployment and minimum wage in Turkey

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SUMMARY

The minimum wage, which has increased more than tenfold in Turkey since 2014, has been a controversial topic for Turkish economic policy in the last few years. This controversy is due to a variety of factors including the high rate of minimum wage-bound workers and the minimum wage dropping below the hunger and poverty limits because of inflation despite rapid increase in the nominal minimum wage. The literature on the Turkish labor market, as well as the broader empirical and theoretical literature in economics, is divided about the employment effect of minimum wage. We hypothesized that the minimum wage has a positive and a Granger causal relationship with unemployment because the high rate of minimum wage bound workers suggests a minimum wage increase might introduce a lot of rigidity in the labor market. To test this hypothesis, we conducted Ordinary Least Squares (OLS) regression and Granger causality tests using unemployment, minimum wage, gross domestic product (GDP), and producer price index (PPI) data from 2014 to 2023. We concluded that there is a positive correlation between minimum wage and unemployment and that the minimum wage has a Granger causal link to unemployment. Although further research is required to establish a definite causal link, the findings in this paper establish a positive relationship and strengthen the case that a higher minimum wage has a causal link to a higher level of unemployment. These results imply that greater consideration of the of minimum wage on unemployment is needed in minimum wage setting.

INTRODUCTION

The minimum wage and its effect on unemployment has been a widely discussed issue in economics. The Classical/Neoclassical school claims that a higher real minimum wage will increase unemployment due to the increase in the cost of labor (1). The equilibrium quantity between labor demand of employers and the price determined by minimum wage will decrease due to a downward-sloping labor demand curve arising from diminishing marginal productivity (1). In other words, the higher cost of labor will discourage employers from hiring, increasing the unemployment rate. The Keynesian school believes that a higher minimum wage will not increase unemployment, due to increased aggregate demand as a result of workers receiving higher wages, hence increased level of output, resulting in no negative effect on employment (2). According to Keynesian theory, a higher minimum wage leads to people having more money that they can spend on goods and services, and this increase in demand causes the economy to grow and creates more job opportunities (2). The evidence from around the world is mixed on this and seems to fit neither hypothesis fully, some studies find no evidence of increase in unemployment following a minimum wage increase, whereas others find evidence of such a causal relationship (3-6). Some potential reasons for the discrepancies in the evidence on minimum wage's effect on employment may be different structures of the labor markets (such as different ratios of minimum wage bound workers), and the relative amounts of the minimum wage and the equilibrium wage in the labor market. Classical theory predicts minimum wage has little effect on employment if it is below the equilibrium price. The different sizes of the informal economy in the country where the studies are conducted could also account for such differences in results.

Minimum wage has been an even more controversial issue in Turkey due to the high proportion of minimum wage-bound workers and of people who work for or just above minimum wage. Of Turkish workers, approximately 52.2% work for or just above minimum wage as of December 2022 (7). The high level of minimum wage-bound workers suggests that the effects of minimum wage can be observed better in Turkey than in labor markets that are not as bound by minimum wage. Because there is a greater proportion of minimum wage-bound workers in Turkey compared to other OECD countries, the minimum wage becomes significant in a higher proportion of the hiring decisions in the labor market, potentially introducing more rigidity in the labor market (8). The rapid increase in the nominal minimum wage, from 1,071 liras in 2014 to 11,402 liras in 2023 also contributed to the controversy surrounding minimum wage (9). Inflation soared to 85%, leaving the minimum wage below the poverty and hunger limits, despite the recent increases (10,11).

There has been little research focusing on the effect of a higher minimum wage on unemployment in the Turkish labor market. In recent years, there have been two papers published on this topic. One paper, by Pelek, used data from the Annual Household Labor Force Survey by TURKSTAT, and accounted by regional disparities by using the Kaitz index, the ratio of the minimum wage to the median wage in the region (3). Pelek concluded that the minimum wage has no effect on employment but found a positive relationship between the minimum wage and informal employment, suggesting a shift to the informal sector as a result of higher minimum wage (3). Another paper, by Biçerli and Kocaman, examined the relationship between minimum wage and unemployment, prices and production using an ARDL approach, which is a model that uses lagged values of the dependent and

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independent variables, unemployment, and minimum wage, to explain changes in the dependent variable, unemployment (4). They concluded that minimum wage has a significant positive causal effect on unemployment and prices, which means that as the minimum wage increases, the price level and unemployment also increase (4). Our methodology and data are more similar to this second paper, as the Granger causality test also uses lagged values of the independent variable. Resolving the conflict in the conclusions of these papers was one of the motivations for this paper.

We aimed to test the hypothesis that the real minimum wage has a positive relationship and Granger causality with the unemployment rate. Granger causality means that one data set, in this case, the differences in the unemployment rate, follows the other data set, the differences in the minimum wage, over time with some lag. In other words, an increase in the minimum wage is followed by an increase in unemployment after some time. We used the formal sector employment data, which is the employment that businesses report to government agencies, in the ordinary least squares (OLS) regression models and Granger causality tests. It is hard to estimate the effect of minimum wage on informal employment, which is employment outside the social security system, due to limited data availability (annual and not monthly); therefore, informal employment was not examined in this study. Our hypothesis arises from the increase in minimum wage compared to other wages in the economy, and the increased level of minimum wage bound workers since the Pelek published his findings in 2015. These structural changes led us to hypothesize that minimum wage introduces greater rigidity to the market, decreasing employment more significantly. We conclude that there is a positive correlation and Granger causality, but we do not prove the causal relationship. Our findings provide information on the employment effect of minimum wage, which may help policymakers make more informed decisions about labor market policies.

RESULTS

The unemployment, producer price index, and gross domestic product (GDP) data used in the study was taken from TURKSTAT, and the minimum wage data used was taken from the Turkish Ministry of Labor and Social Security (9,12-14). We ran OLS regressions to determine if there is a relationship between the minimum wage and unemployment, and to find the strength and direction of this relationship. We used GDP and the rate of inflation as control variables. In all three OLS models, we found a positive and statistically significant relationship between unemployment and minimum wage (**Figure 1, Table 1-2**). Therefore, there is evidence for a positive relationship between the minimum wage and unemployment in Turkey.

We ran Augmented Dickey-Fuller (ADF) tests in order to verify that the data were stationary, as this is an assumption required for the Granger causality tests (15). Stationary data are data that are not dependent on time. The ADF tests for differences in unemployment and minimum wage levels resulted in statistically significant p-values less than 0.01, providing statistical evidence that the data is stationary, therefore appropriate to use for Granger causality tests.

We used a Granger causality test to determine whether the unemployment rate follows the minimum wage level over time (**Figure 2**). As a result of the Granger test, we found that there is a short-term Granger causal relationship between the data sets (**Table 3**). We also ran the Granger test in reverse to ensure that this is not a case of reverse causality, and the result did not indicate a reverse causal relationship (**Table 3**). These results support that the changes in unemployment follow the changes in the minimum wage and not the other way around.

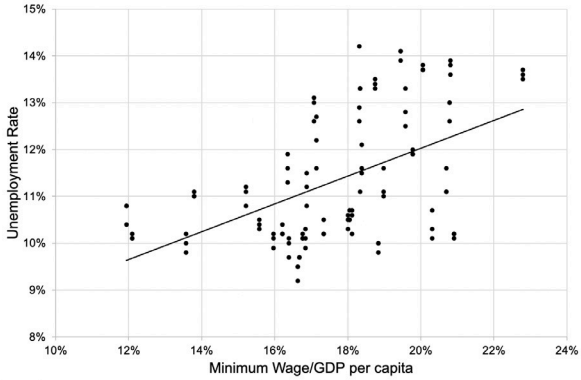

Figure 1: Positive relationship between minimum wage and unemployment rate in Turkey. The unemployment rate and minimum wage for each month between 2014-2023 (9,12,13). Best-fit line from OLS regression analysis has a slope of 0.297. t-test for slope, $p < 0.01$.

	slope	t-value	p-value
MW	0.3914	6.995	2.32e-10***
GDP	3.352e-12	2.894	0.004603***

Table 1: OLS Regression Analysis. We used a multivariate regression (Eq. 8) to assess the effect of minimum wage (MW) on unemployment, GDP was used as a control variable. The slopes show the change in dependent variable (unemployment) per changes in independent variables (minimum wage and GDP). As a result of the t-test for slope, we concluded the relationships are statistically significant ($p < 0.05$).

	slope	t-value	p-value
MW	0.3269	6.558	1.99e-09***
GDP	2.442e-13	0.215	0.83
PPI	-4.17e-05	-5.985	2.92e-08***

Table 2: OLS Regression Analysis. We added PPI as another control variable to the OLS regression shown in Table 1, controlling for inflation (Eq. 9). The slopes show the change in dependent variable (unemployment) per changes in independent variables (minimum wage, GDP and PPI). The t-tests for slope indicated that the relationships between unemployment and MW and PPI are statistically significant ($p < 0.05$). In contrast to the analysis in Table 1, the effect of GDP on unemployment is not statistically significant ($p > 0.05$).

DISCUSSION

Our results from the OLS regressions support our hypothesis that there is a positive correlation between minimum wage and unemployment in Turkey, and the results of the Granger causality tests show that changes in unemployment follow changes in minimum wage. In other

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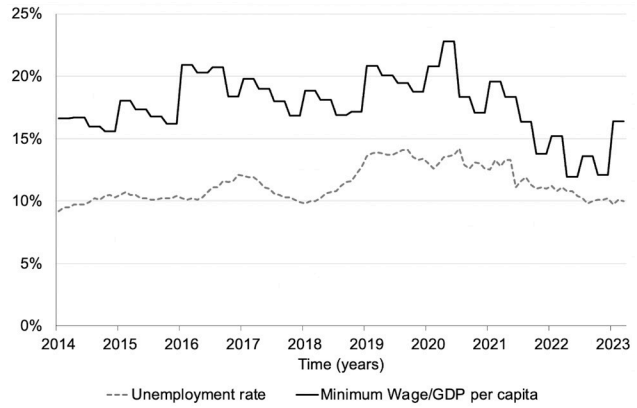

Figure 2: Granger causality between minimum wage and unemployment rate in Turkey. The monthly minimum wage per GDP per capita and unemployment rate from 2014 to 2023 (9,12,13). Granger causality test with lag 1, $p < 0.1$. The unemployment rate follows the minimum wage over time.

words, these results strengthen the case that an increase in the minimum wage is associated with an increase in unemployment. These findings are in line with the findings of the study by Biçerli and Kocaman, who used an ARDL approach, similar to the approach we used in this paper (4). Our findings do not align as well with the findings of the study by Pelek, which found no causal relationship using data from household surveys (3). The differences in methodology, Pelek's use of household surveys, and structural changes in the Turkish labor market since 2015 might be a few reasons for this divergence in results between Pelek's paper and the other two.

The internal validity of this paper is supported by the ADF test results that show the differences in the data were stationary data sets, thus satisfying the Granger causality test assumptions. The structural difference of the Turkish labor market from other markets, namely the high percentage of minimum wage-bound workers, lowers the external validity of this paper. Therefore, the findings of this paper should only be applied in other countries' labor markets or the Turkish labor market at a different time with consideration of this structural difference. For example, a classic study of the minimum wage's unemployment effect by Card and Krueger, using data from New Jersey and Pennsylvania, found no such employment effect following a rise in the minimum wage (5). The structural difference in the labor markets of Turkey and the US might be one explanation for this contradiction as only 1.4% of US workers work for the federal hourly minimum wage opposed to the 62.5% of Turkish workers who work for or just above the minimum wage (16). In a study by Maloney and Mendez on Latin America, where a higher percentage of workers are bound by the minimum wage, they found a large employment effect of the minimum wage (6). The comparison between the results of these studies from different regions suggests that this study might have higher validity in labor markets similar to the Turkish labor market with a higher percentage of minimum wage bound workers.

The greatest limitation of this work is the lack of data on informal employment. In the event of a minimum wage hike, employment could be shifting to the informal sector instead of decreasing. The validity of the research would increase if the tests were run using informal unemployment as a control variable, or by using the total formal and informal employment. In interpreting our results, it is important to highlight the difference between causality and Granger causality. Here, Granger causality means that the unemployment rate, follows the minimum wage. Therefore, while our results do not prove that there necessarily is a causal effect between minimum wage and unemployment, they do suggest a causal relationship and provide evidence that the minimum wage is a useful predictor of the unemployment rate. These findings are in line with some previous papers from the literature, and they do strengthen the case that minimum wage affects the unemployment rate positively. Further research using informal sector data and methodologies such as difference-in-differences analyses, such as comparing the changes to employment following a minimum wage increase in regions with different rates of minimum wage bound workers, can be used to test for a causal relationship between employment and minimum wage.

Model	lags	F-value	p-value
UE ~ MW	1	2.8197	0.09606
UE ~ MW	2	2.6665	0.07429
UE ~ MW	3	1.4439	0.2346
MW~ UE	2	1.1512	0.3203

Table 3: Granger Causality Test Results. We ran Granger Causality tests in order to assess whether changes in unemployment (UE) follow changes in the minimum wage (MW) with lags of 1, 2, and 3 periods (Eq. 3, 4, 5). We concluded there is Granger causality with lags 1 and 2 using a confidence level of 0.1. The test was conducted in reverse (Eq. 4), in order to ensure there is no reverse Granger causality, which the p-value supported ($p > 0.1$).

The positive and Granger causal relationships between unemployment and minimum wage have some implications for Turkish minimum wage policy. This relationship suggests that a larger increase in the minimum wage might not necessarily increase the well-being of minimum wage-bound workers due to higher unemployment rates. Therefore, policymakers and unions need to consider the relationship between minimum wage and unemployment while setting the yearly minimum wage.

MATERIALS AND METHODS

The quarterly nominal GDP per capita, the nominal minimum wage in Turkish liras, the seasonally adjusted quarterly unemployment rate, and the Production Price Index from 2014 to 2023 were used for this analysis. The ratio of the minimum wage to GDP per capita was used as a measure of the real minimum wage. Due to the high volatility of the Turkish lira, the nominal wage or the minimum wage in USD were not reliable measures of the real level of minimum wage. The Granger Causality test requires the use of stationary time series data, which means the data should have constant volatility and should not be time-dependent. Neither the minimum wage nor unemployment data were stationary as they are time series data and are time dependent. Therefore, the differences in the time series data were used to conduct the Granger causality test. Augmented-Dickey-Fuller tests were used to test the differences in the data for a stationary hypothesis.

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$$\Delta^2 MW_t = \alpha \Delta MW_{t-1} + \sum_{k=1}^{4} \theta_k \Delta MW_{t-k} + \mu_t \quad \text{(Eq. 1)}$$
$$\Delta^2 UE_t = \alpha \Delta UE_{t-1} + \sum_{k=1}^{4} \theta_k \Delta UE_{t-k} + \mu_t \quad \text{(Eq. 2)}$$

Granger causality tests were ran, using different lags, of the difference in unemployment on the difference in the minimum wage to determine if there is a Granger Causal relationship between the variables. A Granger causal relationship means one set of data follows the other with some lag, and should not be confused with causality. The Granger test model was also ran in reverse to confirm that this is not a case of reverse causality.

$$UE_i = \alpha_0 + \sum_{j=1}^{1} a_j UE_{i-j} + \sum_{j=1}^{1} \beta_j MW_{i-j} + \varepsilon_i \quad \text{(Eq. 3)}$$
$$UE_i = \alpha_0 + \sum_{j=1}^{2} a_j UE_{i-j} + \sum_{j=1}^{2} \beta_j MW_{i-j} + \varepsilon_i \quad \text{(Eq. 4)}$$
$$UE_i = \alpha_0 + \sum_{j=1}^{3} a_j UE_{i-j} + \sum_{j=1}^{3} \beta_j MW_{i-j} + \varepsilon_i \quad \text{(Eq. 5)}$$
$$MW_i = \alpha_0 + \sum_{j=1}^{2} a_j MW_{i-j} + \sum_{j=1}^{2} \beta_j UE_{i-j} + \varepsilon_i \quad \text{(Eq. 6)}$$

OLS regressions were used to determine the strength and direction of the relationship between unemployment and minimum wage. Inflation as measured by the Production Price Index and output as measured by the nominal Gross Domestic Product, were introduced to control for potential confounders. Three OLS models were used in this study:

$$UE_i = \beta_0 + \beta_1 MW + \varepsilon_i \quad \text{(Eq. 7)}$$
$$UE_i = \beta_0 + \beta_1 MW + \beta_2 GDP + \varepsilon_i \quad \text{(Eq. 8)}$$
$$UE_i = \beta_0 + \beta_1 MW + \beta_2 GDP + \beta_3 PPI + \varepsilon_i \quad \text{(Eq. 9)}$$

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APPENDIX

RStudio scripts used for the analyses in this paper:
ADF tests:
adf1 <- adf.test(diff(alp_metadata$MW))
adf2 <- adf. test (diff (alp_metadata$issizlik))

Granger Causality Tests:
grangertest(diff(alp_metadata.issizlik) ~ diff(alp_metadata.MW), order = 1, data = df)
grangertest(diff(alp_metadata.issizlik) ~ diff(alp_metadata.MW), order = 2, data = df)
grangertest(diff(alp_metadata.issizlik) ~ diff(alp_metadata.MW), order = 3, data = df)

grangertest(diff(alp_metadata.MW) ~ diff(alp_metadata.issizlik), order = 2, data = df)

OLS Regressions:
linreg1 <- lm(issizlik ~ MW, data = alp_metadata)
linreg2 <- lm(formula = issizlik ~ MW + gsmh, data= alp_metadata)
linreg3 <-lm(formula =issizlik ~ MW + gsmh + UFE, data= alp_metadata)