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The Effect of Real Wages on Employment after the Global Financial Crisis: The Case of the Turkish Manufacturing Industry

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Küresel Finansal Kriz Sonrasında Reel Ücretlerin İstihdam Üzerindeki Etkisi: Türk İmalat Sanayi Örneği

Abstract

This paper analyzes the effect of real wages on employment in the Turkish manufacturing industry after the 2008 global financial crisis. The effect was estimated for 24 manufacturing sectors using panel data analysis covering the period from 2009Q1 to 2019Q4. The panel cointegration results demonstrated a significant long-run relationship between real wages and employment, while the panel augmented mean group (AMG) estimator results indicated a significant long-run positive effect of real wages on employment. At the sectoral level, the effect was either insignificant or positive except for one sector. These findings indicate that an increase in real wages can raise employment by positively affecting the goods market and national income through the effective demand channel. That is, the manufacturing industry's wage policies for enhancing effective demand can raise employment in Türkiye.

Keywords : Employment, Real Wage, Turkish Manufacturing Industry, Panel Data Analysis.

JEL Classification Codes : J01, J30, C23.

Öz

Bu çalışma, 2008 küresel finansal krizi sonrasında Türk imalat sanayinde reel ücretlerin istihdam üzerindeki etkisini analiz etmektedir. Etki, 24 imalat sektörü için 2009Ç1-2019Ç4 dönemini kapsayacak şekilde panel veri analizi kullanılarak tahmin edilmiştir. Panel eşbütünleşme sonuçları reel ücretler ve istihdam arasında uzun dönemli anlamlı bir ilişki olduğunu ortaya koyarken panel genişletilmiş ortalama grup (AMG) tahmincisi sonuçları reel ücretlerin istihdam üzerinde uzun dönemde anlamlı pozitif etkisi olduğunu göstermektedir. Sektör düzeyindeki etki, bir sektör haricinde anlamsız veya pozitiftir. Bulgular, reel ücretlerdeki artışın, etkin talep kanalıyla mal piyasasını ve milli geliri olumlu etkileyerek istihdamı artırabileceğini göstermektedir. Dolayısıyla, imalat sanayinde efektif talebi iyileştirmeye yönelik ücret politikaları Türkiye'de istihdamı artırabilir.

Anahtar Sözcükler : İstihdam, Reel Ücret, Türk İmalat Sanayi, Panel Veri Analizi.

1. Introduction

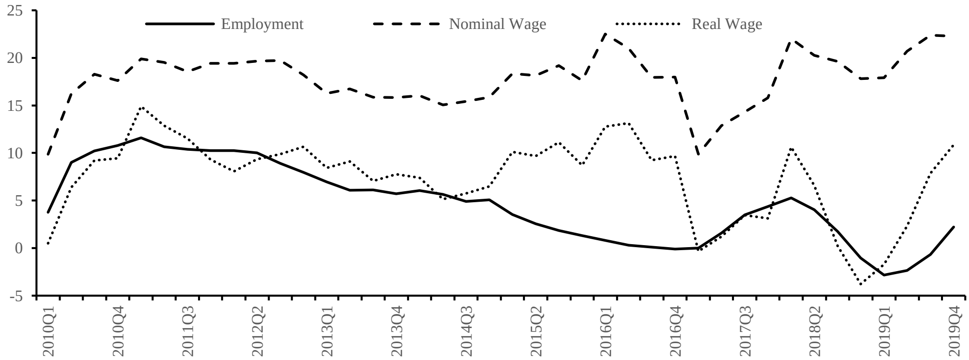
Real wages and employment have always been on economists' agendas due to their importance in both the supply and demand sides of the economy. Debates regarding the relationship between the two variables have caused sharp divergences in economic theory. In addition, there is no consensus in the empirical literature on the direction and sign of the relationship. Thus, the relationship needs to be reconsidered, especially when employment performance weakens.

The 2008 global financial crisis (GFC) severely affected labour markets, with unemployment rates in some countries doubling from pre-crisis levels while national incomes fell below their long-term trend values (Lavoie & Stockhammer, 2013; OECD, 2022a). To alleviate growing unemployment, governments implemented a series of regulations to make labour markets more flexible (Johnstone et al., 2019). Employment rates then increased remarkably due to the more flexible labour markets and the recovery in economic growth. However, wage growth has slowed considerably (OECD, 2018), reaching its lowest level since 2008 in 2017 (ILO, 2018).

As in many countries, the GFC damaged labour markets in Türkiye, with unemployment increasing from around 10% in 2007 to 14% in 2009 while employment suffered negative growth. Soon after the GFC, employment recovered significantly, rising by more than 4.5% compared to 2009, while unemployment decreased by 9.2% in 2012. Since 2013, however, the momentum in employment has been lost. Unemployment has risen again, while employment growth remained limited before turning negative in 2019 (OECD, 2022b; TURKSTAT, 2021a). Real wage growth has also decreased gradually since 2013, except for 2016, to stand at -0.4% in 2018 (ILO, 2018: 119; ILO, 2020: 182).

The manufacturing industry, which is vital for sustainable growth, accounts for a substantial share of Türkiye's total employment. However, its contribution to total employment has not increased since the GFC (TURKSTAT, 2021a). Figure 1 shows employment, nominal wage, and real wage growth rates for the Turkish manufacturing industry.

Figure: 1
Employment, Nominal Wage, and Real Wage Growth Rates for the Turkish Manufacturing Industry: 2010Q1-2019Q4



Source: Authors' representation based on TURKSTAT (2021b) and OECD (2021).
Notes: The manufacturing industry employment index (2015=100) and the manufacturing gross wage-salary index (2015=100) represent employment and nominal wage, respectively. Both series are seasonally and calendar-adjusted. Real wages are calculated using the gross wage-salary and consumer price indices (2015=100). All series are transformed into an annual percentage change to obtain growth rates.

Employment growth in the Turkish manufacturing industry has gradually slowed before turning negative recently. Meanwhile, real wage growth has fallen due to recently rising inflation. Contrary to the global trend, employment and real wages in the Turkish manufacturing industry have changed in parallel since the GFC, except for short periods. Motivated by this co-movement, we address the following three research questions.

First, is there a cointegration relationship between real wages and employment? Second, do real wages have a statistically significant effect on employment? Third, if there is an impact, is its sign positive? These questions are being explored empirically within the framework of theoretical foundations for the Turkish manufacturing industry and its sectors at the NACE Rev.2 two-digit level. Based on Figure 1, our empirical expectations align with the post-Keynesian approach.

This study uses panel data analysis to investigate the effect of real wages on employment for 24 sectors in the Turkish manufacturing industry since the GFC. More specifically, it investigates the long-run relationship between real wages and employment using Westerlund's (2007) panel cointegration test. The long-run coefficients for the industry and its sectors are estimated using the panel augmented mean group (AMG) estimator (Eberhardt & Bond, 2009; Eberhardt & Teal, 2010) for 2009Q1-2019Q4. Furthermore, a robustness test is performed using the cross-sectionally augmented autoregressive distributed lag (CS-ARDL) of Chudik and Pesaran (2015).

Our study's main contribution to the literature is to provide evidence on the relationship between real wages and employment, for which empirical consensus is still lacking. We explore this relationship by also focusing on the individual sectors. By highlighting the importance of effective demand, our findings of a positive relationship can guide both policymakers trying to increase employment and also firms seeking to maximize profits.

In what follows, Section 2 presents theoretical approaches to the relationship between real wages and employment along with the empirical literature, while Section 3 introduces the model and data set, and Section 4 presents the empirical analysis findings along with their methodologies. The final section of the study evaluates the findings and offers policy recommendations.

2. Literature Review

This section reviews the theoretical and empirical literature on the relationship between real wages and employment. To do so, we classify the theoretical approaches that explain the real wage-employment nexus: neoclassical, orthodox Keynesian, and post-Keynesian. After providing each approach's theoretical explanations of the relationship, we consider empirical studies of countries other than Türkiye and the Turkish economy that support the predictions of these approaches.

The first effort to explain the relationship between real wages and employment comes from neoclassical economics. Neoclassical economic theory defines labour as a product, while the supply and demand mechanism determines the labour market balance. Labour supply is specified by income and consumption decisions (Ioannidis, 2011: 3-4). More specifically, rising real wages motivate utility-maximising workers to work more. Rising wages also increase consumption potential and encourage economic agents to increase their working hours by sacrificing leisure time. Labour demand is determined by the marginal product of labour for which the law of diminishing returns is valid. That is, for a given physical capital stock, each additional worker contributes less to the total physical product than the previous one. Accordingly, profit-maximising companies continue to hire workers as long as the physical product of additional workers is higher than real wages. In other words, companies hire more labour only when real wages are falling (Herr, 2002: 8-10).

In the neoclassical approach, the wage decrease required for employment growth has three effects. First, declining wages reduce unemployment rates because more people leave the labour market because the wages are no longer worth working for. Second, companies want to employ more workers due to decreasing labour costs. Third, this process accelerates due to the Pigou effect: namely, the fall in prices due to decreasing wages increases demand for goods and services from those people who are unaffected by wage cuts because their income is not wage-based. Rising demand results in more employment (Ioannidis, 2011: 6; Melitz, 1967: 270-271). In conclusion, one of the main claims of the neoclassical approach regarding the labour market is that rising real wages decrease employment.

Neoclassical economists believe that if wages are flexible, mechanisms that bring the economy into equilibrium will enable a rapid adjustment toward full employment. The validity of Say's Law eliminates the possibility of permanent unemployment caused by downward wage rigidity. Therefore, real wages, which are supposedly too high, should be decreased to eliminate persistent unemployment (Apergis & Theodosiou, 2008: 40-41).

Many empirical studies have confirmed the predictions of neoclassical economists, namely that rising real wages significantly reduce employment (Neftçi, 1978; Sargent, 1978; Russel & Tease, 1988; Nickell & Symons, 1990; Smith & Hagan, 1993; Carruth & Schnabel, 1993; Arestis & Biefang-Frisancho Mariscal, 1994; Klein, 2012; Bakker, 2015; Mora & Muro, 2019; Habanabakize et al., 2019; Hasanov et al., 2021; Cruz, 2023). Similarly, most studies of the Turkish economy confirm the neoclassical expectations. Using panel data, Aydiner-Avsar and Onaran (2010) analyzed the effects of real wages, real GDP, export share, and import share on employment in the Turkish manufacturing industry between 1973 and 2001. They found that increases in real wages reduce employment. Özata and Esen (2010) explored the relationship between real wages and employment in Türkiye from 1998 to 2008, employing cointegration and Granger causality methods. They confirmed the expectations of the neoclassical approach for the long-run relationship between these variables. Demir (2010) demonstrated that an increase in real wage growth decreased employment growth between 1983 and 2005. Using error correction models, Yıldırım (2015) examined the dynamic interactions between productivity, employment, and real wage in the Turkish labour market from 1988 to 2012. Increases in real wages only reduced employment in the short-run. Finally, Kılıçaslan and Töngür (2019) reported that rising real wages significantly reduced employment in the Turkish manufacturing industry for 2003-2013.

Unlike Neoclassical economic theory, Keynesian approaches do not suggest a negative impact of real wages on employment. According to the orthodox Keynesian approach, the labour market has no mechanism that automatically increases employment (Christopoulos, 2005: 25). Therefore, Keynesians treat the labour market differently from neoclassical economists. Contrary to the neoclassical approach, which believes that all markets are at the same level, the orthodox Keynesian approach assumes a hierarchy between markets with the labour market at the bottom (Herr, 2002: 19). Labour demand depends on effective demand. Aggregate demand determines production, which in turn determines employment. The employment level corresponds to a certain wage rate. In other words, employment determines wages, not vice versa (Ioannidis, 2011: 8-10).

Keynes suggested that real wages are not determined solely by labour market participants because although workers and employers bargain on nominal wages, the general level of prices is beyond their control. To reduce real wages, nominal wages must be lowered relative to the price level, or the price level must be increased relative to nominal wages (Snowdon & Vane, 2005: 66). However, even if real wages fall, the net effect on production and employment is ambiguous. Lower real wages reduce the cost burden on employers' profits but also reduce workers' income and real demand. Thus, a fall in real wages will raise employers' real income, but it will also reduce workers' spending and, therefore, effective demand for production (Apergis & Theodosiou, 2008: 41).

Some empirical studies support the orthodox Keynesian expectations. Geary and Kennan (1982), Bender and Theodossiou (1999), and Christopoulos (2005) found no significant relationship between wages and employment, while Apergis and Theodossiou (2008) and Adudu and Ojonje (2015) found a long-run but not a short-run relationship. McFarlane et al. (2014) reported that employment growth causes real wage growth. Regarding studies of the Turkish economy, Metin and Üçdoğruk (1998) investigated the long-run relationship between prices, wages, and employment in the Turkish manufacturing industry from 1962 to 1992 using cointegration and Granger causality methods. They showed a significant positive relationship between real wages and employment. Furthermore, the causality was unidirectional from employment to wages. Adaş (2003) analysed the relationship between real wages and employment in the Turkish manufacturing labour market between 1960 and 2000. Cointegration results indicated no relationship between these variables. Finally, Akkemik (2007) found no significant effect of real wages on employment from 1988 to 2004.

Post-Keynesian economists offer a different explanation to their predecessors regarding the relationship between real wages and employment. Drawing on Keynes' concept of effective demand, they argue that aggregate demand factors determine employment. Furthermore, they emphasise the effect of wage incomes on consumption and investment by highlighting functional income distribution in their effective demand analysis (Appelbaum, 1979: 47; Stockhammer, 2011: 5). According to Kalecki (1971), effective demand consists of workers' stimulated consumption spending, which depends on their wage income, and autonomous consumption and investment spending, which depends on capitalists' long-run profits (Cin, 2012: 38). For a given level of real autonomous spending, capitalists' profits only rely on real aggregate expenditures. An increase in real wages reduces the profit margin per unit. However, because workers tend to consume more than capitalists, a rise in real wages increases aggregate demand and national income (Lavoie, 2006: 94). The fact that changes in real wages indirectly affect the goods market creates the possibility of a positive relationship between real wages and employment (Fernandez-Huerga & Garcia-Arias, 2019: 119).

The post-Keynesian analysis takes no dogmatic stance regarding the relationship between real wages and employment (Fernandez-Huerga & Garcia-Arias, 2019: 125). Bhaduri and Marglin (1990), for example, analysed demand regimes under the assumption that the economy has an unutilised capacity while workers tend to consume more than capitalists. They found that higher wages increase workers' consumption but reduce investments because they reduce capitalists' profits. Thus, the net effect of wage increases on aggregate demand cannot be determined a priori. If the consumption effect is more dominant than the investment effect, a wage-led demand regime is valid, and the net impact is positive. Otherwise, a profit-led demand regime prevails with a negative net effect (Stockhammer & Ali, 2018: 7). Thus, it is possible to have a positive relationship between wages and employment in the wage-led demand regime and a negative relationship in the profit-led demand regime (Lavoie & Stockhammer, 2012: 9-10).

There is also empirical support for the post-Keynesians' expectations regarding the wage-employment nexus. Mehra (1982) and Tadjoeddin (2016) demonstrated that real wages have a significant positive impact on employment. Empirical studies of the Turkish economy also confirm post-Keynesian expectations. Bakır and Eryılmaz (2020) investigated the relationship between real wages and employment between 1988Q2 and 2019Q4 using cointegration and causality tests based on the vector error correction mechanism. They reported a short-run causality from real wages to employment, while rising real wages increased employment in the long run. Topcu (2021) reported that rising real wages between 1996 and 2017 increased the share of industrial sector employment in total employment. Using the autoregressive distributed lag boundary test, Köse and Avcı (2023) explored the relationship between real wages, employment, and labour productivity from 2009Q1 to 2021Q4 in the Turkish manufacturing industry. They found that real wages had significant positive short- and long-run impacts on employment.

To sum up, there are three different theoretical approaches regarding the sign and direction of the relationship between real wages and employment. The neoclassical approach predicts that rising real wages reduce employment. The orthodox Keynesian approach predicts that the direction of the relationship is from employment to real wages. Finally, the post-Keynesian approach predicts that real wage increases may raise employment depending on the economy's demand regime. The empirical literature provides mixed support for these theories, depending on sampling periods and countries studied. The lack of consensus regarding the relationship between the two variables' existence, direction, and sign indicates the need for further research in this field.

3. Model and Data

The empirical literature largely determines our model specification for investigating the impact of real wages on employment. Hence, we also include production and productivity variables as determinants of employment. The model is as follows:

$$emp_{i,t} = \alpha_i + \beta rw_{i,t} + \delta ip_{i,t} + \omega p_{i,t} + u_{i,t} \tag{1}$$

where $emp_{i,t}$ is employment; $rw_{i,t}$ is real wages; $ip_{i,t}$ is production; $p_{i,t}$ is productivity; i represents the manufacturing sectors; t is time; and $u_{i,t}$ is the error term.

The data comprises 24 sectors in the Turkish manufacturing industry, selected based on the NACE Rev. 2 two-digit classification. The relevant NACE Rev. 2 sector codes range from 10 to 33, with all sectors at the same level (EUROSTAT, 2008). The sample starts with 2009Q1 and ends with 2019Q4 to exclude the effects of the COVID-19 pandemic on labour markets. Employment, productivity, and production are represented by, respectively, the sectoral employment indices, sectoral production per employee indices, and sectoral industrial production indices. Real wages are calculated by dividing the sectoral gross wage-salary indices by the consumer price index. The sectoral gross wage-salary indices, sectoral employment indices, and sectoral production per employee indices were retrieved as adjusted seasonal and calendar effects. We also seasonally adjusted the sectoral industrial production indices via Census X-13. The base year of all indices is 2015 (2015=100). All series are transformed into logarithmic form. Table 1 shows the descriptive statistics and correlation matrix of the series.

Table: 1
Descriptive Statistics and Correlation Matrix

Descriptive Statistics						
Variable	Obs.	Mean	SD	Min.	Max.	Data Sources
$emp_{i,t}$	1056	95.510	27.538	53.7	469.1	TURKSTAT (2021b)
$rw_{i,t}$	1056	0.943	0.245	0.441	2.683	Authors' calculation based on TURKSTAT (2021b) and OECD (2021)
$ip_{i,t}$	1056	92.271	21.607	33.060	202.698	TURKSTAT (2021b)
$p_{i,t}$	1056	97.622	14.260	16.49	161.64	Turkish Ministry of Industry and Technology (2021)

Correlation Matrix				
	$emp_{i,t}$	$rw_{i,t}$	$ip_{i,t}$	$p_{i,t}$
$emp_{i,t}$	1.000			
$rw_{i,t}$	0.897	1.000		
$ip_{i,t}$	0.686	0.801	1.000	
$p_{i,t}$	-0.154	0.114	0.608	1.000

Source: Authors' calculations.
Note: The descriptive statistics of the series are presented without logarithmic transformation.

The minimum and maximum values of the variables can be used to compare individual sectors. The maximum and minimum employment values were, respectively, for tobacco (2009Q3) and furniture (2009Q1). The highest real wage value was in tobacco (2009Q1), which is also consistent with its high employment level. The lowest industrial production index value was in motor vehicles, trailers, and semi-trailers (2009Q1), possibly due to the GFC's impact on the automotive industry at that time. The highest production index value was in the other transport equipment (2019Q3). Finally, tobacco had the lowest productivity index value (2009Q3) due to high employment in that sector. The maximum productivity level was in the computer, electronic, and optical products sector (2019Q3). The lowest and highest values of the variables corresponding to the beginning and end of the sample period indicate no sharp fluctuations in the series. Finally, the correlation matrix shows that employment was positively correlated with real wages and industrial production but negatively correlated with productivity.

4. Empirical Results

4.1. Preliminary Test Results

This study used panel data analysis to examine the long-run effects of real wages on employment for the manufacturing industry and its sectors. To this end, whether there are long-run relationships between the series was investigated through panel cointegration analysis. Panel unit root tests should first be performed to test whether the prerequisite for cointegration analysis, that the series are integrated in the same order, has been met. However, because cross-sectional dependence (CD) among the series and homogeneity of slope coefficients affect the choice of unit root test, cointegration test, and long-run estimator (Yerdelen-Tatoğlu, 2017: 3-5), the CD and homogeneity tests were performed first.

In panel data analysis, a shock to one variable in any cross-sectional unit may influence others. This is known as the CD. To ensure correct estimations and valid test statistics, CD between the series should not be ignored (Tachie et al., 2020: 35540). Furthermore, the number of cross-sectional units and the time dimension are important in selecting the appropriate CD test. Because (T=44) > (N=24), we used the following tests to analyze CD: Breusch and Pagan (1980) Lagrange Multiplier (LM) test, Pesaran (2004) CD_{LM} test and Pesaran et al. (2008) bias-adjusted LM_{adj} test. We also used Pesaran and Yamagata's (2008) homogeneity test to detect whether the slope coefficients are homogeneous. Table 2 presents the CD and homogeneity test results.

Table: 2
Cross-sectional Dependence and Homogeneity Test Results

	LM	CD_{LM}	LM_{adj}
$emp_{i,t}$	803.908 (0.000)	22.469 (0.000)	25.879 (0.000)
$rw_{i,t}$	743.551 (0.000)	19.900 (0.000)	44.082 (0.000)
$ip_{i,t}$	393.406 (0.000)	4.997 (0.000)	28.356 (0.000)
$p_{i,t}$	436.585 (0.000)	6.835 (0.000)	19.405 (0.000)
Model	2106.325 (0.000)	77.904 (0.000)	88.251 (0.000)

	$\tilde{\Delta}$	$\tilde{\Delta}_{adj}$
Model	8.173 (0.000)	8.669 (0.000)

Source: Authors' calculations.
Note: Probability values are shown in parentheses.

The probability values of the LM, CD_{LM}, and LM_{adj} tests strongly rejected the null hypothesis for all series and the model, thereby demonstrating the existence of CD between the series. That is, a shock to one variable in any manufacturing industry sector can affect other manufacturing industry sectors. Furthermore, the $\tilde{\Delta}$ and $\tilde{\Delta}_{adj}$ test results showed that the null hypothesis, which means the slope coefficients are homogenous for the model, was rejected at the 1% significance level, thereby indicating heterogeneity across sectors.

Before proceeding to the cointegration analysis, the unit root properties of variables should be examined using panel unit root tests. Based on the existence of CD, these tests are divided into two groups. First-generation panel unit root tests assume that the cross-sectional units are independent, whereas second-generation tests assume the dependence between cross-sectional units (Shahbaz et al., 2014: 187). Because we found CD across the series, we used Pesaran's (2007) cross-sectionally augmented Dickey-Fuller (CADF) test to examine the unit root properties of the series. The CADF test augments standard ADF regressions with the cross-sectional means of the lagged levels and the first differences of each unit. Table 3 shows Pesaran's (2007) CADF unit root test results for the model with intercepts and trends.

Table: 3
Pesaran (2007) CADF Panel Unit Root Test Results

Level				
	$emp_{i,t}$	$rw_{i,t}$	$ip_{i,t}$	$p_{i,t}$
CIPS	-1.805	-2.364	-2.703	-2.837*
First-difference				
	$emp_{i,t}$	$rw_{i,t}$	$ip_{i,t}$	$p_{i,t}$
CIPS	-3.341**	-5.168**	-4.873**	-5.078**

Source: Authors' calculations.
*Notes: ** and * denote that the null hypothesis, which means the series contains a unit root at the 1% and 5% significance level, respectively, is rejected. The maximum lag number is set as 4. The critical values for the panel at the model's 1% and 5% significance levels with intercept and trend are -2.85 and -2.71, respectively (Pesaran, 2007: 281).*

The CIPS statistics, obtained from the sectoral CADF test means, indicated that all series except for productivity had a unit root at the 5% significance level. Moreover, all series were nonstationary at the 1% significance level. When the first difference of the series was taken, all series were stationary at the 1% significance level. Because all the series were I(1), cointegration analysis is appropriate.

4.2. Panel Cointegration Test Results

As for the panel unit root tests, there are two kinds of panel cointegration tests depending on the existence of the CD. Because the second-generation tests consider CD between series, Westerlund's (2007) panel cointegration test was used. The test statistics are based on the conditional error correction model for y_{it}, as follows:

$$\Delta y_{it} = \delta_i' d_t + \alpha_i\left(y_{i,t-1} - \beta_i' x_{i,t-1}\right) + \sum_{j=1}^{pi} \alpha_{i,j} \Delta y_{i,t-j} + \sum_{j=0}^{pi} \gamma_{i,j} \Delta x_{it-j} + e_{it} \quad (2)$$

where $d_t = (1, t)'$ presents the deterministic components and $\delta_i = (\delta_{1i}, \delta_{2i})'$ represents the parameters vector. Equation (2) can be rewritten as follows to estimate the error correction parameter (α_i):

$$\Delta y_{i,t} = \delta_i' d_t + \alpha_i y_{i,t-1} + \lambda_i' x_{i,t-1} + \sum_{j=1}^{pi} \alpha_{i,j} \Delta y_{i,t-j} + \sum_{j=0}^{pi} \gamma_{i,j} \Delta x_{i,t-j} + e_{i,t} \quad (3)$$

Equation (3) was estimated for each cross-section to construct the group mean statistics:

$$\Delta y_{i,t} = \hat{\delta}_i' d_t + \hat{\alpha}_i y_{i,t-1} + \hat{\lambda}_i' x_{i,t-1} + \sum_{j=1}^{pi} \hat{\alpha}_{i,j} \Delta y_{i,t-j} + \sum_{j=0}^{pi} \hat{\gamma}_{i,j} \Delta x_{i,t-j} + \hat{e}_{i,t} \quad (4)$$

The lag (p_i) and lead (q_i) orders were determined based on the selection criteria ,while the composite error term ($u_{i,t}$) was estimated through $\hat{e}_{i,t}$ and $\hat{\gamma}_{i,j}$:

$$\hat{u}_{i,t} = \sum_{j=0}^{pi} \hat{\gamma}_{i,j} \Delta x_{i,t-j} + \hat{e}_{i,t} \quad (5)$$

The group mean statistics were obtained by estimating $\hat{\alpha}_i$ with the long-run variance estimators based on $\hat{u}_{i,t}$ and $\Delta y_{i,t}$:

$$G_\tau = \frac{1}{N}\sum_{i=1}^{N}\frac{\hat{\alpha}_i}{SE(\hat{\alpha}_i)}, G_\alpha = \frac{1}{N}\sum_{i=1}^{N}\frac{T\hat{\alpha}_i}{\hat{\alpha}_i(1)} \quad (6)$$

Rejection of the group's null hypothesis indicates cointegration for at least one cross-section in the panel. Like the group mean statistics, the panel test statistics were obtained in a three-step process. The panel test statistics are as follows:

$$P_\tau = \frac{\hat{\alpha}}{SE(\hat{\alpha})}, P_\alpha = T\hat{\alpha} \quad (7)$$

The alternative hypothesis of the panel statistics means that the whole panel is cointegrated (Westerlund, 2007: 711-718; Persyn & Westerlund, 2008: 233-234). Table 4 shows the Westerlund (2007) panel cointegration test results.

Table: 4
Westerlund (2007) Cointegration Test Results

Statistic	Value	Z-Value	Probability	Robust Probability
G_τ	-4.359	-11.046	0.000	0.000
G_α	-24.378	-9.339	0.000	0.000
P_τ	-19.309	-9.368	0.000	0.016
P_α	-23.441	-11.940	0.000	0.010

Source: Authors' calculations.
Notes: The maximum values of lag, lead, and bandwidth are set as 3 based on $4(T/100)^{2/9}$ *(Newey & West, 1994). According to the Akaike Information Criterion, 1.42 lags and 1.33 leads exist. The constant model was used as the deterministic component. To obtain the robust probability values, bootstrapping with 500 iterations was performed.*

Since the slope coefficients are heterogeneous, the group mean statistics (G_τ and G_α) should be considered. Furthermore, the robust probability values should be taken into account due to the CD between the series (Gaberli & Can, 2020: 254). The robust probability values of the group mean statistics rejected the null hypothesis of no cointegration at the 1% significance level. A long-run cointegration relationship exists between employment, real wages, production, and productivity.

4.3. Panel AMG Test Results

The long-run coefficients of the whole manufacturing industry and its sectors were estimated using the panel AMG estimator developed by Eberhardt and Bond (2009) and Eberhardt and Teal (2010). This test is robust against both CD and heterogeneity. The estimator is obtained in two stages (Eberhardt & Bond, 2009: 3; Eberhardt & Teal, 2010: 7).

$$\text{Stage} - 1: \Delta\gamma_{i,t} = b'\Delta X_{i,t} + \sum_{t=2}^{T} c_t \Delta D_t + e_{i,t} \implies \hat{c}_t = \hat{\mu}_t^* \quad (8)$$

In the first stage, called the common dynamic process, the dummy coefficients ($\hat{\mu}_t^*$) are obtained by estimating the first-difference OLS regression enhanced with $T-1$ time dummies.

$$\text{Stage} - 2: \gamma_{i,t} = a_i + b_i' X_{i,t} + c_i t + d_i \hat{\mu}_t^* + e_{i,t}, \hat{b}_{AMG} = N^{-1}\sum_i \hat{b}_i \quad (9)$$

In the second stage, the omitted idiosyncratic process is captured by adding $\hat{\mu}_t^*$ to each of the N-standard group-specific regressions, which contain the linear trend terms. Alternatively, $\hat{\mu}_t^*$ can be subtracted from γ_{it}. Thus, $\hat{\mu}_t^*$ is imposed on each cross-section with a unit coefficient. In both cases, the AMG estimates are obtained as the means of the individual cross-section estimates, as in Pesaran and Smith's (1995) MG method.

AMG provides a post-estimation for investigating the model's significance using Wald χ^2 test statistics (Osinubi et al., 2023). The Wald χ^2 of our model was 1320.45 with a probability value of 0.00, thereby indicating that the estimated model was highly significant. Table 5 presents the AMG test results.

Table: 5
AMG Test Results

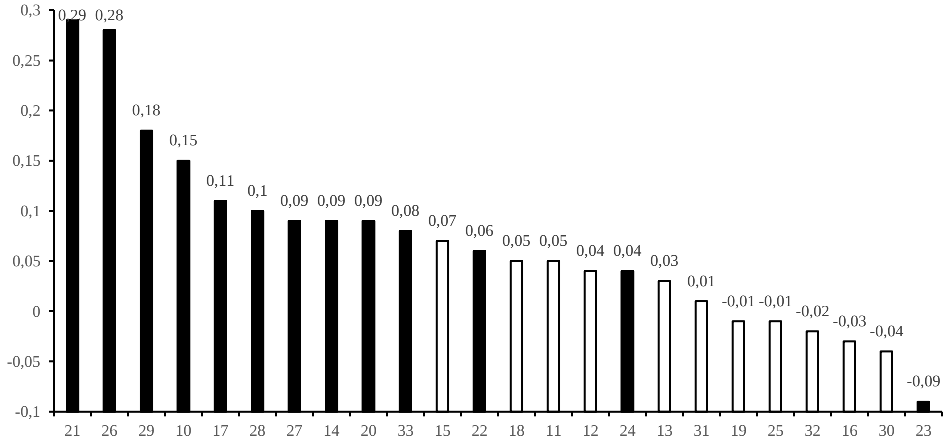
Sectors		$rw_{i,t}$		$ip_{i,t}$		$p_{i,t}$	
Code	Name	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
10	Food products	0.157	0.000	0.508	0.000	-0.654	0.000
11	Beverages	0.052	0.273	0.588	0.000	-0.530	0.000
12	Tobacco products	0.046	0.344	0.829	0.000	-1.009	0.000
13	Textiles	0.030	0.152	0.693	0.000	-0.858	0.000
14	Wearing apparel	0.097	0.002	0.645	0.000	-0.810	0.000
15	Leather and related products	0.073	0.134	0.680	0.000	-0.903	0.000
16	Wood and products of wood and cork	-0.039	0.186	0.777	0.000	-0.768	0.000
17	Paper and paper products	0.119	0.001	0.639	0.000	-0.648	0.000
18	Printing and reproduction of recorded media	0.056	0.424	0.686	0.000	-1.010	0.000
19	Coke coal and refined petroleum products	-0.016	0.538	0.685	0.000	-0.697	0.000
20	Chemicals and chemical products	0.095	0.007	0.536	0.000	-0.507	0.000
21	Basic pharmaceutical products and pharmaceutical preparations	0.294	0.000	0.670	0.000	-0.733	0.000
22	Rubber and plastic products	0.067	0.007	0.691	0.000	-0.749	0.000
23	Other non-metallic mineral products	-0.096	0.000	0.869	0.000	-0.871	0.000
24	Basic metal industry	0.042	0.072	0.629	0.000	-0.622	0.000
25	Fabricated metal products	-0.018	0.562	0.835	0.000	-0.872	0.000
26	Computer, electronic and optical products	0.285	0.000	0.300	0.000	-0.286	0.000
27	Electrical equipment	0.098	0.004	0.634	0.000	-0.614	0.000
28	Machinery and equipment not elsewhere classified	0.101	0.000	0.585	0.000	-0.514	0.000
29	Motor vehicles, trailers and semi-trailers	0.181	0.000	0.511	0.000	-0.490	0.000
30	Other transport equipment	-0.049	0.101	0.000	0.000	-1.016	0.000
31	Furniture	0.013	0.686	0.792	0.000	-0.894	0.000
32	Other manufacturing	-0.027	0.389	0.532	0.000	-0.565	0.000
33	Repair and installation of machinery and equipment	0.085	0.000	0.713	0.000	-0.672	0.000
Manufacturing industry		**0.068**	**0.000**	**0.667**	**0.000**	**-0.720**	**0.000**

Source: Authors' calculations.
Note: The common dynamic process was imposed with a unit coefficient in the AMG estimation. Codes show the NACE Rev. 2 sector codes.

As shown in the last row of Table 5, real wages significantly positively impact employment. More specifically, a 1% increase in real wages raises employment by 0.07% in the long run. This finding contradicts previous studies confirming the predictions of the neoclassical and orthodox Keynesian approaches regarding the Turkish manufacturing industry, whereas it confirms Köse and Avcı (2023). Furthermore, production and productivity also significantly affect employment. A 1% rise in production increases employment by 0.67% in the long run, whereas a 1% increase in productivity decreases employment by 0.72%.

The sectoral long-run coefficients show mixed results. Following Güloğlu et al. (2020), we constructed a figure to summarise the sectoral coefficients of the real wage variable, which is the critical variable of our sample (Figure 2).

Figure: 2
Sectoral Coefficients of Real Wages



Source: Authors’ calculations.
Note: The vertical axis denotes coefficients while the horizontal axis represents the NACE Rev. 2 sector codes named in Table 5. Black and white bars indicate statistically significant and insignificant coefficients, respectively.

Real wages significantly positively impact employment in 12 sectors, of which 11 reach a 1% significance level. The highest coefficient is for basic pharmaceutical products and pharmaceutical preparations, with 0.29, whereas the lowest is for the basic metal industry, with 0.04. On the other hand, real wages have an insignificant effect in 11 sectors. Manufacturing other non-metallic mineral products is the only sector where rising real wages significantly reduce employment.

Many sectors with positive coefficients are suitable for activating the effective demand channel. For instance, food products, paper products, wearing apparel, and most motor vehicles are manufactured for consumption. Therefore, enhancing demand for these goods through rising wages may have increased employment by accelerating sales and profits in these sectors (Onaran & Aydiner-Avsar, 2006). Furthermore, sector dynamics may have led to this positive wage-employment relationship. The two sectors with the highest positive coefficient of real wages (basic pharmaceutical products and pharmaceutical preparations; computer, electronic, and optical products) are high-technology sectors in the EUROSTAT (2024) classification. Because these sectors are fast-growing and employ highly skilled labour, high wages may be required to close the employment gap. Therefore, an increase in wages may raise employment in these sectors where labour has high added value.

4.4. Robustness Check

We performed a robustness check by using a different panel estimator. Given the presence of CD and heterogeneous slope coefficients, we preferred the CS-ARDL of Chudik and Pesaran (2015), which deals with both. Moreover, the CS-ARDL is also robust to the endogeneity bias problem, misspecification bias, and serial correlation of error terms (Zeqiraj et al., 2020: 2). Equation (1) can be rewritten as the CS-ARDL equation as follows.

$$\Delta emp_{i,t} = \delta_i + \vartheta_i \left(emp_{i,t-1} - \beta_i X_{i,t-1} - \theta_{1,i}\overline{emp}_{t-1} - \theta_{2,i}\overline{X}_{t-1} \right) + \sum_{j=1}^{p-1} \tau_{i,j} \Delta emp_{i,t-j} + \sum_{j=0}^{q-1} \varphi_{i,j} \Delta X_{i,t-j} + \mu_{1,i} \Delta \overline{emp}_t + \mu_{2,i} \Delta \overline{X}_t + \varepsilon_{i,t} \quad (10)$$

where $\Delta emp_{i,t}$ is employment, $X_{i,t}$ stands for real wages, production, and productivity variables in the long run; $\overline{emp}_{t-1}$ and $\overline{X}_{t-1}$ are the means of employment and independent variables in the long run, respectively. $\Delta emp_{i,t-j}$ is employment while $\Delta X_{i,t-j}$ denotes all explanatory variables in the short run. $\Delta\overline{emp}_t$ and $\Delta\overline{X}_t$, respectively, are the means of the short-run dependent and independent variables; j is the sectors; t is time; and $\varepsilon_{i,t}$ is the error term. The coefficients of the explanatory variables are shown by β_s. The short-run coefficients of the dependent and independent variables are represented by $\tau_{i,j}$ and $\varphi_{i,j}$, respectively. $\mu_{1,i}$ is the mean of the dependent variables, while $\mu_{2,i}$ is the mean of independent variables in the short run (Zeqiraj et al., 2020: 4-5; Salinas et al., 2023: 445). The CS-ARDL model enables the employment variable of any sector to be estimated by the values of the lagged employment variable, the lagged and current values of weakly exogenous regressors, a serially uncorrelated idiosyncratic error, and unobserved common factors (Chudik & Pesaran, 2015: 394). Table 6 presents the CS-ARDL test results.

Table: 6
CS-ARDL Test Results

	Long-run				Short-run		
	Coefficient	Std. Error	Prob.		Coefficient	Std. Error	Prob.
$rw_{i,t}$	0.328	0.058	0.000	$\Delta rw_{i,t}$	0.177	0.030	0.000
$ip_{i,t}$	0.659	0.049	0.000	$\Delta ip_{i,t}$	0.405	0.041	0.000
$p_{i,t}$	-0.655	0.050	0.000	$\Delta p_{i,t}$	-0.401	0.043	0.000
-	-	-	-	$ECT(-1)$	-0.599	0.034	0.000

Source: Authors’ calculations.

The statistically significant negative coefficient of the lagged error correction term (ECT) indicates a convergence toward long-run equilibrium. Both the short- and long-run real wage coefficients had a positive and statistically significant impact on employment. That is, a 1% increase in real wages raises employment by 0.33% in the long-run and 0.18% in the short-run, thereby confirming our main findings. The coefficients of the other explanatory variables are also consistent with the AMG findings in both the short and long run. Production positively affects employment, whereas productivity has a negative impact.

5. Conclusion

The relationship between real wages and employment is a controversial topic in economics. Besides the different theoretical explanations and expectations of this relationship, the mixed empirical findings indicate a need for further research. Motivated by the mostly parallel movement of employment and real wages in the Turkish manufacturing industry during the 2010s, we explored whether real wages affected employment and, if so, what the sign of this impact was. We, therefore, investigated the effect of real wages on employment in the Turkish manufacturing industry and its 24 sectors through panel data analysis for 2009Q1-2019Q4. Our empirical findings can be summarised as follows.

First, the panel cointegration results demonstrated a long-run relationship between employment, real wages, production, and productivity. Second, regarding the panel AMG results, the coefficient of the manufacturing industry indicates that real wages increased employment in the long run. This contradicts the predictions of both the neoclassical and orthodox Keynesian approaches, but it confirms the conditional predictions of the post-Keynesian approach. Third, the sectoral coefficients of the AMG analysis indicate that real wages can have both a statistically significant positive effect on employment or an insignificant effect, except for one sector. This finding largely contradicts the neoclassical prediction but confirms the orthodox Keynesian and post-Keynesian approaches. Finally, the CS-ARDL results show that real wages have a statistically significant positive impact on employment both in the short and long run. This indicates that the AMG findings are robust. Overall, the empirical findings of this study confirm our empirical expectations.

As Fernandez Huerga and Garcia-Arias (2019) point out, the post-Keynesian analysis assumes that there is no dogma associated with the effect of real wages on employment. The impact of real wages on employment depends on the state of the demand regime in the economy. If the demand regime is wage-led, then a positive impact is possible. Many studies have demonstrated that the demand regime in Türkiye is wage-led (Onaran & Stockhammer, 2005; Onaran & Galanis, 2014; Bölükoğlu, 2019; Kurt, 2020; Oyvat et al., 2020; Mutlugün & İncekara, 2023). That is, wages are the engine of demand growth, which stimulates the production required to increase employment. Therefore, our finding of the positive impact of real wages on employment in the Turkish manufacturing industry is consistent with the abovementioned studies.

Türkiye's export-oriented growth strategy from the 1980s, which was based on low labour costs, failed to boost employment (Aydiner-Avşar & Onaran, 2010). The strategy ignored the demand channel by adopting a flexible labour market approach focused on the cost channel in compliance with the neoclassical approach. By contrast, our findings indicate that an increase in real wages can raise employment by positively affecting the goods market and national income through the effective demand channel. Therefore, by adopting wage policies that can increase effective demand, the Turkish manufacturing industry can increase employment. Furthermore, wage policies should also consider heterogeneity across sectors because each sector has different dynamics. In particular, the type of goods produced in the sector and its technological level can affect the relationship between real wages and employment.

Our study has some limitations. Since we used linear methods to investigate the relationship between real wages and employment, our study could not provide information on the time-varying impact of real wages on employment or the effect of different regimes on this relationship. Moreover, using linear methods limited our sampling period as it forced us to exclude the impact of the COVID-19 pandemic on labour markets. Future studies could update the sample in a nonlinear manner, such as by using time-varying or threshold regression methods.

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