The Impact of the National Minimum Wage on Employment: A Case Study of the UK

Jiahui Wang

The University of Leeds

*Corresponding author. Email: jiahuiwangboston@gmail.com

Abstract. The government uses the minimum wage system as a policy tool to intervene artificially in the labour market, thereby guaranteeing that low-wage workers in the sub-labour market receive a salary that meets a minimum standard of living. The community has widely discussed the impact of the minimum wage system on employment. However, there is currently no consensus in the academic community on the impact of a minimum wage system on employment. The UK government introduced the National Minimum Wage (NMW) by legislation in 1994. It increased the actual and relative salaries of the low pay workers during the past decades. Using time-series data from Labour Force Surveys of the United Kingdom from 2012 to 2021, this paper examines the impact of this system on employment using time-series analysis with the employment of young workers aged 16-17, who are most vulnerable to the minimum wage system. The empirical findings show that the minimum wage has no significant effect on 16-17-year-old adolescent workers.

Keywords: Minimum Wage, Employment, Time Series Data, Regression, Young Workers

1 Introduction

New Zealand first introduced a minimum wage system in 1894 with the Industrial Conciliation and Arbitration Act, which other countries subsequently established. As a legal system enforced by the government, the minimum wage system guarantees the right of workers to be paid a minimum living wage in the labour market. The UK Government introduced the National Minimum Wage (NMW) by legislation in 1994. In the same year, the Low Pay Commission (LPC) was established as an independent public body to carry out surveys and analyses of the labour market, and then the LPC subsequently submitted annual recommendations to the government for adjustments to NMW [1]. Current academic research on the NMW in the UK has focused on whether it impacts employment. Opposing studies argue that the national minimum wage worsens the employment situation of young people and minority groups such as women [2][3]. In contrast, studies favour NMW believe the minimum wage system not only has no impact on unemployment but even provides incentives for employment and protection of workers' fundamental rights [4][5].

© The Author(s) 2023
H. Mallick et al. (Eds.): ICEMCI 2022, AEBMR 231, pp. 172–180, 2023.
https://doi.org/10.2991/978-94-6463-098-5_21

This paper aims to study whether teenage workers are affected by the minimum wage system in the labour market and to provide some references for the government to improve the minimum wage system in the future. This paper uses time series data from the Labour Force Survey (LFS) to empirically analyse the impact of the minimum wage system on the employment of disadvantaged groups in the labour market, using the employment of young people most sensitive to the minimum wage as the target population. The paper's structure shows as follows: Part two briefly reviews the related research on minimum wages; Part three introduces the paper's research subject; Part four describes the model, variables, and data used; Part five presents the model estimation and the stationarity test; and finally, the conclusion.

2 Literature Review

Since the introduction of the minimum wage system, economists have been widely concerned about its impact on employment. Neoclassical theory suggests that in a perfectly competitive market, employment will decrease when the minimum wage exceeds the equilibrium point of supply and demand [6]. Summarising the literature using time series estimation prior to the 1980s in the 1920s, Brown et al. found that most findings indicated that increases in the minimum wage significantly impacted on the employment of 16-19-year-olds, particularly for females more than males [7]. In the 1990s, Card and Krueger conducted a difference-in-difference analysis of fast food restaurants in New Jersey and Pennsylvania and found no negative impact of minimum wage increases on employment [8]. Nevertheless, Neumark and Wascher re-investigated the subjects of Card and Krueger in 1993 and came to the opposite conclusion [9].

In studies of minimum wage systems in countries other than the United States, the negative impact of minimum wages on vulnerable groups of workers has also been found. In Canada, Sen et al. used OLS and instrumental variable models for time series estimation and found that a 10% increase in the minimum wage was associated with a 3-5% decrease in youth employment [10]. In China, on the other hand, Wang and Yao used feasible generalised least squares to analyse panel data on minimum wages in 30 Chinese provinces, and they found that a 10% increase in the minimum wage leads to a 2.3% decline in employment among institutionally sensitive labour groups [11].

There is currently no consensus in the academic community on the impact of a minimum wage system on employment. Most relevant empirical studies in the UK used cross-sectional data, treating the minimum wage system as a quasi-experiment, dividing the data into treatment and observation groups, and then estimating differentially [5] [12]. Studies generally focus on specific industries, with fewer studies estimating the economy. In response to these studies, Machin et al. point out that extrapolating from a specific industry study to the economy as a whole is one-sided and dangerous [12]. In this paper, the author takes inspiration from Steward [5], Stigler [7], and Wang & Yao [11] to use a time series study for overall economic estimation in the UK.

3 Research Subject

In the UK labour market, there is a mainstream labour market as well as a secondary labour market. In the mainstream market, workers have more stable employment and higher wages and benefits than the minimum wage and are therefore less affected by the minimum wage system. In contrast, workers in the secondary labour market, where they perform hard work, have high job mobility, are subject to job substitutability, and are paid at significantly lower levels than in the mainstream market. These workers are the most vulnerable to a minimum wage system in the market.

The UK's minimum wage system differentiates the workforce according to age distribution, with 16-17-year-olds considered apprentices. Under the system they receive a minimum wage of just £4.81, the lowest paid age group. In 2004, Canada's Labour Force Survey (LFS) found that youth workers aged 15-19 accounted for half of the lowest paid workers [13]. Wang & Yao's study of China also found that young people's short working hours and inexperience lead to low wages, and therefore they are highly vulnerable to the minimum wage system [11]. At the same time, the young people's lower bargaining power in the labour market and less choice of employer results in the apprentice having to passively accept the wage level offered by the employer, who naturally prefers to offer a salary equal to or lower than the minimum wage. In order to study the impact of the minimum wage system, this paper must select the groups most affected. Therefore, this paper selects young workers in the UK's 16-17-year-old age range as the study population.

4 Model setting, selection of variables and description of data

In this study, the following basic econometric model was developed.

$$Y_t = \beta_0 + \beta_1 MW_t + \beta_2 GDP_t + \beta_3 CPI_t + \beta_4 UNEMP_t + e_t \quad (1)$$

In this expression, t=1, 2, ..., T, represents the year and e represents error.

Y(EMP) is the explanatory variable, the ratio of employment of young workers aged 16-17 to total employment, both of which are sourced from the Labour force summary(LPS) of the Office for National Statistics (ONS) [14].

The explanatory variables include:

1. Minimum Wage(MW). The minimum wage system used in the UK applies to all businesses within the country. The NMW is in contrast to the uniform federal minimum wage used in the US, where each state also has the right to set a state minimum wage system higher than the federal minimum wage. Also, the UK's system differs from China's, where each province has a different minimum wage classification system. The UK minimum wage levels are therefore not subject to coverage weighting or the consolidation of all bands into a single minimum wage variable. This paper follows the previous empirical analysis and uses the absolute minimum wage level [5].

Minimum wage data for 2012-2021 came from LPS and the annual report of the low pay commission [1][15][16][17][18]. The minimum wage (MW) is the percentage derived by dividing the absolute minimum wage (in hours) for 16-17-year-olds by the average wage (in hours). The average wage is derived by dividing the average weekly wage (nominal) by the actual weekly hours worked. The reason for choosing actual weekly hours worked rather than usual weekly working hours is that actual hours worked represent the accurate supply of hours worked by workers during the week. At the same time, the calculated result of the minimum wage (MW), which uses actual weekly hours worked, is closer to the actual economic average weekly wage.

2. Gross domestic product growth index (GDP), unemployment rate (UNEMP) and consumer price index (CPI). The GDP growth index is an essential indicator of the overall economic performance of a society. It directly impacts employment, with high GDP often related to the high opportunity that more workers gain employment. The unemployment rate reflects the overall employment situation in society, where the link between youth employment and overall employment in society can be estimated. Consumer Price Index (CPI) represents an index of the price level within the economy, which affects not only the cost of resources in the production of firms but also the real wages of workers. These three data are from ONS [19][20][21].

The entire data is time series data for the UK from 2012 to 2021. Time series have the following advantages over panel data as well as cross-sectional data in this study:

1. Time series data can show the change in data for each variable over time in a single region of the UK.
2. The statistics from the ONS data source are recorded as observations over time, so time series analysis is used for dynamic data processing to investigate the statistical patterns of random data series.
3. Time series can avoid some effects of omitted variables.

The impact of the minimum wage on employment depends on the minimum wage level and the system's enforcement rate. Similar studies' most typical omitted variable is the minimum wage enforcement rate, which is challenging to analyse and count [5][11]. Time series studies tend to introduce annual dummy variables, which can somewhat overcome the omitted variable of enforcement rate.

Table 1. Descriptive statistics of variables

Variables	Definition of Variables	Mean	Standard Error	Minimum Value	Maximum Value
Employment for 16-17-year-olds (EMP)	Ratio of 16–17-year-olds to total employment (%)	22.75	2.07	18.51	24.56
Minimum Wage (MW)	Ratio of absolute minimum wage to average wage (%)	25.50	0.62	24.16	25.99

Gross Domestic Product Growth Index (GDP)	GDP growth index (%)	0.94	0.57	-0.20	2.08
Unemployment Rate (UNEMP)	Overall unemployment rate (%)	5.49	1.52	3.92	8.22
Consumer Price Index (CPI)	CPI (%)	1.74	0.94	0.04	2.68

5 Estimation results and analysis

In the following empirical analysis, the author uses a stepwise regression approach. Firstly, this method estimates the relationship between employment and the minimum wage level for teenage workers aged 16-17. Then the author added GDP, UNEMP and CPI to the base estimates of employment and minimum wage levels. Afterwards, the author observes changes in the minimum wage's elasticity and identifies the best model. Finally, the author tests the time series stationarity of the best model.

5.1 Model Estimation

Model 1 includes only one explanatory variable, the minimum wage (MW). The initial estimation determines the relationship between the minimum wage and employment and shows a significant positive relationship.

Model 2, with the addition of the GDP growth index and the unemployment rate, shows that the minimum wage still has a significant positive relationship with employment, significant at the 5% level. The coefficients on the GDP growth index and the unemployment rate (UNEMP) are both negative, but GDP is significant at the 10% level while UNEMP is insignificant. The elasticity of the minimum wage variable increases slightly with the addition of the two macroeconomics control variables.

Model 3 adds the CPI to model 2. Model 3 includes three microeconomic control variables representing the market's demand for the labour force. The estimation results show that the minimum wage and employment relationship remains positive, with GDP, unemployment, and CPI negatively correlated, but none are significant. With the inclusion of the CPI variable, little difference is found for the minimum wage coefficient and the elasticity compared to model 2.

Including the year dummy variable in Model 4 resulted in a notable change in the regression results. After controlling for year-effects, there is no significant effect of the minimum wage on the employment of 16-17-year-olds. At the same time, the CPI index, which was negatively correlated in model 3, becomes positively correlated, but the relationship between the three macroeconomics control variables remains insignificant. The minimum wage elasticity in model 4 is considerably lower compared to model 3, being only equivalent to 3/8 of that in model 3.

The relevant academic papers have different views on whether annual dummy variables should be included in the estimation. Early time series studies have generally included this variable, concluding that minimum wage has a negative impact on youth employment [7]. Neumark and Wascher argue that if macro control variables do not effectively demonstrate national trends associated with changes in the minimum wage, the exclusion of annual effects from the estimates may lead to them being subject to unobserved heterogeneity bias [22]. However, Burkhauser et al. argue that annual effects should be excluded from the regression model because controlling for annual effects removes dispersion from the minimum wage variable. They reestimated the earlier data and found that the original estimates of a significant effect of the minimum wage on employment were insignificant when annual effects were excluded [23]. The estimates of Model 4 are generally consistent with the findings of Burkhauser et al. [23] that there is no significant effect of the minimum wage on youth employment after controlling for annual effects.

As can be seen from the primary regression results in Table 2, the minimum wage is positively related to adolescent employment, whether annual effects are controlled. After adding the three macroeconomics control variables, the positive effect of the minimum wage on employment is significant at 1%, with an elasticity of approximately 3.244, meaning that for every 1% increase in the minimum wage for 16-17-year-olds relative to the average wage, the ratio of 16-17-year-old employment in total UK employment increases by 3.244%.

Table 2. Estimation of the underlying model of the employment impact of the minimum wage

Explanatory variables	Model 1 Includes only the minimum wage (MW)	Model 2 Add macroeconomic control variables (GDP & UNEMP)	Model 3 Add macroeconomic control variables (GDP, UNEMP&CPI)	Model 4 Controlling annual effects
Minimum Wage (MW)	2.644 (0.715)	2.896 (0.618)	2.894 (0.681)	1.215 (2.166)
Gross Domestic Product Growth Index (GDP)	-	-1.422 (0.676)	-1.415 (0.821)	-0.968 (1.010)
Unemployment Rate (UNEMP)	-	-0.179 (0.249)	-0.178 (0.275)	-1.489 (1.624)
Consumer Price Index (CPI)	-	-	-0.009 (0.492)	0.195 (0.566)
Constant Term	-44.687 (18.232)	-48.785 (15.649)	-48.744 (17.278)	1547.920 (1947.409)

Annual Dummy Variables	NO	NO	NO	YES
Elasticity of Minimum Wage	2.964	3.246	3.244	1.362

5.2 Stability Tests

The following regressions will be tested for stability using Model 3 from the base estimates as a benchmark. For time series data, the stability of the data is essential to the construction of the model; otherwise, the t-test may fail or there may be false correlations, or pseudo-regression between independent variables. The prevailing test checks whether there is a unit root in the variables; if there is no unit root, then the data is stable.

The first unit root test for model 3 was conducted using the augmented dicky-fuller test (ADF). The ADF test assumes that there is a unit root in the data. If the confidence interval cannot reject the Z(t) value, there is a unit root in the variable's data, and then a first-order difference is required before the test. If there is still a unit root, the difference is continued until the confidence interval can reject the Z (t) value. For example, in the minimum wage (MW) data after the ADF test, Z (t) value is -1.368, so the confidence interval cannot reject the original hypothesis, and MW has a unit root. Then the MW data does first-order differencing. First-order differencing in the ADF test shows the Z (t) value of -3.505 by the confidence interval of 1% rejected, so the MW of the first-order differencing is stable. After running ADF tests on the remaining variables, the results show that there are no unit roots for the second-order difference in the youth employment to the overall ratio (EMP), the second-order difference in GDP, the third-order difference in the unemployment rate, and the fourth-order difference in the CPI.

Afterwards, the regression was re-run with the order difference after the ADF test for the above variables, which avoids the appearance of a pseudo-regression. After re-regression, the model's F-value was 0.743 and the P-value was 0.696, indicating that the model as a whole was insignificant, i.e., the original regression of model 3 was a pseudo-regression. The R-square value of the model was 0.696, and the modified R-square value was -0.519, indicating that the model has considerable explanatory power. The regression equation was constructed as follows:

$$\mathrm{d2.EMP} = -905 + 0.902 * \mathrm{d.MW} - 0.830 * \mathrm{d2.gdp} - 2.433 * \mathrm{d3.UNEMP} - 0.066 * \mathrm{d4.CPI} \quad (2)$$

The analysis of the p-values of all coefficients revealed that none were significant. The regression model after the ADF test yielded the conclusion that employment of 16-17-year-olds increased with the minimum wage. At the same time, for the three macroeconomics control variables, GDP and the overall unemployment rate (UNEMP) had a negative effect on employment. In contrast, the CPI had a positive effect on employment. The results of the stability test are not consistent with the results of the original regression.

6 Conclusions

The use of the minimum wage system as a policy tool for government intervention in the labour market has received widespread attention from society and academics since the Industrial Conciliation and Arbitration Act came into being in New Zealand. This paper examines the national minimum wage's impact on the employment of 16-17-year-olds using time series data for the UK from 2012 to 2021. The study population selected for this paper is 16-17-year-old workers, who are the most sensitive to the minimum wage system in the UK labour market. The study found a positive but insignificant correlation between the National Minimum Wage and adolescent employment in the UK. The result suggests that the national minimum wage has no effect on teenage employment and that teenage employment may be influenced by other factors. The government may need to consider factors other than employment before adjusting the minimum wage.

A limitation of the research in this paper is the lack of attention paid to inter-regional differences. The paper uses a time series study that focuses on the UK as a whole and neglects to look at specific regions within the UK. In the future, the authors will conduct a more detailed study using panel data, adding regional dummy variables to examine whether the minimum wage's impact on youth employment in the UK differs by region.

References

1. Low Pay Commission. (2022). The National Minimum Wage in 2022. GOV.UK.
2. Dickens, R., Riley, R., & Wilkinson, D. (2015). A Re-examination of the Impact of the UK National Minimum Wage on Employment. Economica, 82(328), 841-864.
3. Fidrmuc, J., & Tena, J. (2018). UK national minimum wage and labor market outcomes of young workers. Economics, 12(1), 20180005.
4. Metcalf, D. (2008). Why has the British national minimum wage had little or no impact on employment? Journal of Industrial Relations, 50(3), 489-512.
5. Stewart, M. B. (2004). The impact of the introduction of the UK minimum wage on the employment probabilities of low-wage workers. Journal of the European Economic Association, 2(1), 67-97.
6. Stigler, G. J. (1946). The economics of minimum wage legislation. The American Economic Review, 36(3), 358-365.
7. Brown, C., Gilroy, C., & Kohen, A. (1982). The effect of the minimum wage on employment and unemployment. Journal of Economic Literature, 20(2), 487-528.
8. Card, D., & Krueger, A. B. (1993). Minimum wages and employment: A case study of the fast food industry in New Jersey and Pennsylvania. American Economic Review, 84(4), 772-793.
9. Neumark, D., & Wascher, W. (1994). Employment effects of minimum and subminimum wages: Reply to Card, Katz, and Krueger. ILR Review, 47(3), 497-512.
10. Sen, A., Rybczynski, K., & Van De Waal, C. (2011). Teen employment, poverty, and the minimum wage: Evidence from Canada. Labour Economics, 18(1), 36-47.
11. Wang, G.X., & Yao, X.G. (2014). The impact of minimum wage on employment in China. Economic Theory and Business Management, 34(11), 16.

12. Machin, S., Manning, A., & Rahman, L. (2003). Care home workers and the introduction of the UK National Minimum Wage. Journal of the European Economic Association, 1(2), 154-80.
13. Galarneau, D., & Fecteau, E. (2014). The ups and downs of minimum wage. Canadian Electronic Library.
14. Watson, B. (2022). A06: NSA: Educational status and labour market status for people aged from 16 to 24 (not seasonally adjusted). Office for National Statistics.
15. Low Pay Commission. (2020). The National Minimum Wage in 2020. GOV.UK.
16. Low Pay Commission. (2019). 20 years of the National Minimum Wage. GOV.UK.
17. Leaker, D. (2022). A01: Summary of labour market statistics. Office for National Statistics.
18. White, N. (2022). Earnings and hours worked, all employees: ASHE Table 3. Office for National Statistics.
19. Rizzo, M. (2022). Gross Domestic Product: quarter on quarter growth rate: CP SA %. Office for National Statistics.
20. Watson, B. (2022). A04: Summary of employment, unemployment, and economic inactivity for people below state pension age. Office for National Statistics.
21. Gooding, P. (2022). Consumer price inflation, UK: May 2022. Office for National Statistics.
22. Neumark, D., & Wascher, W. L. (2008). Minimum wages. Cambridge: MIT press.
23. Burkhauser, R. V., Couch, K. A., & Wittenburg, D. C. (2000). A reassessment of the new economics of the minimum wage literature with monthly data from the Current Population Survey. Journal of Labor Economics, 18(4), 653-680.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (http://creativecommons.org/licenses/by-nc/4.0/), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.