

# The Impact of UK Minimum Wage Reform on Employment

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**Abstract**—This dissertation focuses on the impact of minimum wage increases on poverty in the United Kingdom. It acknowledges that labor market earnings are a significant component of household income and that policy makers aim to increase the income of lower-income households without compromising employment opportunities for low-paid workers. Unemployment is a concern as it can reduce consumption and exacerbate poverty, potentially hindering economic growth. The minimum wage is intended to boost the wages of low-paid workers, protect them from exploitation, and improve their standard of living, but its effect on poverty is controversial. The competitive labor market model suggests that higher minimum wages may lead to reduced employment among low-paid workers, worsening their situation. This study will investigate the actual impact of minimum wage increases on poverty in the UK by examining whether low-paid workers are more likely to lose their jobs compared to other workers not directly affected.

**Keywords**—minimum wage increases, poverty in the UK, employment impact, standard of living, economic growth

## I. INTRODUCTION

Reducing the poverty rate in the society may be one of most the concerns that policy makers attempt to achieve. Since labour-market earnings are the major part of household income (Machin, 1996), therefore, it is important for the government trying to increase the household income of the bottom part of household, which attempts to help the low-paid workers to increase their wage income without hampering their position of employment. Unemployment is a serious problem that policy makers attempt to avoid when designing a minimum wage strategy, since it may decrease the consumption of low-income households. If there is no sufficient demand, firms may have to decrease their production levels which requires fewer workers, and in turn may even aggravate the unemployment problem, increase poverty of society and then hamper the economy growth.

The minimum wages is a price floor that employers must legally pay their workers and it is the minimum amount of compensation an employee must receive from performing labour. It is aimed at helping the low paid workers to increase their wage income, protect low-paid employees from exploitation, allowing them to afford the necessities of life, increase their standard of living and then reduce poverty (Neumark and Wascher, 2008). However, the minimum wage effect on poverty is controversial. In relation to the effect of minimum wage on employment, the competitive labour market model suggests that increases in the minimum wage rate increase the labour cost of employers who will react by demanding less workers (Stigler, 1946). If increases in the minimum wage leads to reduced employment of low paid workers, those workers who have been fired are then made even worse off. Therefore, all of this makes the minimum wage effects on poverty ambiguous. This dissertation will examine the actual impact of increases in the minimum wage

rate in the United Kingdom on poverty by focusing on whether low-paid workers are more likely to lose their jobs relative to other workers who are not directly affected by the minimum wage increase.

The increased minimum wages in the UK may have a different impact on the employment rate in different periods, based on different institutional changes and different technology change in the society. There are many existing papers that examine the effect of increasing minimum wages on the employment in the UK. Stewart (2004) used individual panel data from the New Earnings Survey and the Labour Force Survey and adopt difference-in-difference methodology to examine the employment effects of the introduction of minimum wage in 1998 and finds no adverse employment effects of the introduction or subsequent increases in the minimum wage rate in the UK for any of the demographic groups considered (men and women, adult and youth). In addition, the minimum wage may have different effect under different periods of the economic cycle. Fidrmuc and Tena-Horillo (2011) use micro-data based on the UK Labour Force Survey and a difference-in-difference approach to investigate employment effects of the changes in the national minimum wage rate on young workers and find negative impacts during the recessions. Dickens *et al.* (2015) use data from New Earnings Survey and the Labour Force Survey to examine the impact of the introduction of the minimum wage and the subsequent increase in minimum wage rates on employment retention. Their results suggest that the national minimum wage is associated with reductions in employment retention, particularly for part-time females, which is exacerbated by the recession. So, this may raise the question whether early findings of no adverse employment effects may be due to the growing economy? Therefore, it is worthwhile to examine whether the no adverse employment trend is still hold in recent years when the economy are relative smooth and steady. Furthermore, the minimum wage effect on employment may be different during a period of technology change. Minimum wage earners are mainly low-skilled and less educated workers. And the skill-biased technology may raise the demand for more educated workers relative to less skilled workers. Machin (1996) reports some estimates of returns to education based on the UK Family Expenditure Survey, and finds in an era of rising wage inequality, returns to education have risen in combination with a simultaneous relative increase in white-collar (likely more highly educated) employment. Lindley and Machin (2013) use the wage differential between more and less skilled workers as a measure of wage inequality and changes in relative demand and supply. And the result suggests of the increased demand for more educated workers has been an important aspect explaining the rising in relative unemployment rate of low-skilled workers and rising wage

inequality, which was true in both the conservative and labour political regimes. They explain that the educational wage differentials have been driven by skill-biased technological change. Minimum wage earners are mainly low-skilled workers and the skill-biased technology may adversely affect their employment position.

Comparing with earlier works, this paper makes several contributions. Firstly, it considers the effect of the rise in the living wage rate to employment which was examined by comparing the employment differential between treatment and control group through a difference-in-difference strategy. This paper not only examines the all workers in the labour market, but also focuses on female workers (which were deemed as easily affected group). In addition, this paper also examines the effect on actual working hours for all, for women only, for low-skilled worker and also examines the part-time effects on hours worked to see whether the adverse employment is offset by decrease working hours. Furthermore, it is worthwhile to examine the minimum wage effect on hours work by focusing on specific low-paid sector (Manufacturing, Wholesale and Hotels), in which sectors the employees tend to be easily affected by the minimum wage increases.

Then, this paper explains whether the change in minimum wage can actually help the poor according to the results. Secondly, this paper exploits the fact that the April 1, 2016 minimum wage policy only raised the minimum wage rates for low-skilled workers aged 25 and over while keeping rates unchanged for workers aged between 21 and 24. This allows me to make comparisons between the treatment group and the control group. Thirdly, it seems that the UK was coming out of a particularly severe recession in 2016 and the economy is relatively stable. In addition, as this paper focusing on a short time horizon, I am able to abstract from any technological changes. Therefore, it is interesting to see the minimum wage reform effect on poor people under the normal economic condition and no significant changes in technology.

## II. LITERATURE REVIEW

This paper aims at examining the impact of minimum wages on low-income earners and to investigate whether it is a useful tool to make them better off. In order to do this, this paper will mainly focus on employment effect of changes in the UK national minimum wages. This section will justify the minimum wage impact according to both the UK and the US evidence (since the majority of the existing literature examining the minimum wage effect is based on US evidence).

### **Minimum wage effect on employment:**

A large body of literature investigates the impact of minimum wages on employment. Supporters of the raising minimum wage hold the view that it can raise the wage income of low-paid workers with no harmful effects to employment (Card and Krueger, 1994; Katz and Krueger, 1992; Machin and Manning, 1996; Stewart, 2004; and Leonard *et al.*, 2014). However, there are different views argue that the minimum wage is harmful to employment and leads to a large proportion of workers are fired, particularly for low-skilled workers, which is consistent with the competitive labour market model which suggests that the minimum wage will increase the wage bill to employers and

they react by demanding less workers which then leads to firings.

### **Minimum wage is not harmful to employment:**

Card and Krueger (1994) investigate the impact of a rising in minimum wage on employment in the US fast food industry. The reason why they choose fast food stores is that the workforce consists mainly of low-wage workers and they are complied with the minimum wage regulation. For their analysis, the authors compare the full-time equivalent employment between New Jersey (where the minimum wage rate increased) and Pennsylvania (where the minimum wage was left unchanged) and find no evidence that increases in the New Jersey state minimum wage reduced employment. Katz and Krueger (1992), using longitudinal data for fast-food restaurants, investigate the impact of a minimum wage increase in 1991 on employment in fast-food restaurants in Texas and find no negative effects on employment.

In relation to the UK evidence, Machin and Manning (1996) use two ways to evaluate the impact of minimum wages on employment. First to consider employment effects of the wage councils whilst they were in operation, the authors examine the changes in employment against changes in the ratio of minimum wages to averages in the larger wages council industries between 1978 and 1992 but cannot identify any evidence of employment falls that coincide with larger minimum wage increases. In a second approach, Machin and Manning (1996) use the abolition of the national minimum wage by the government in 1993 and carry out a Difference-in-difference strategy before and after the minimum wage abolition. The finding is that the abolition of the minimum wage in August 1993 resulted in no employment gains but wages fell in new jobs and consequently led to increases in wage inequality. Therefore, they conclude that the minimum wage can be raised without negative employment consequences. In addition, Machin and Manning (1996) also suggest that if the minimum wage is set at an appropriate level, it can be regarded as a useful tool to alleviating low pay and poverty. In addition, Stewart (2004) used longitudinal individual panel data from three contrasting data sets (Labour Force Surveys, the British Household Panel Survey, and New Earnings Surveys) to examine employment effects of the introduction of the UK national minimum wage in 1999. He uses a difference-in-difference methodology and examines the probability of remaining in employment for low wage workers. In this respect, low paid workers who are directly affected by the minimum wages are set as treatment group and individuals with wages slightly above the minimum wage rates as comparison group and find a positive impact of the minimum wage on the probability of remaining in employment for the group directly affected. Therefore, the authors conclude that there are no adverse employment effects of the introduction and the subsequent increase in the minimum wage in Britain for the four demographic groups considered (adult and youth, men and women). Furthermore, Leonard *et al.* (2014) use a meta-analysis of 236 estimated minimum wage elasticities and 710 partial correlation coefficients from 16 UK studies and find no overall partially significant adverse employment effect (except the residential home care industry) resulting from increases in the British national minimum wage. Also, their general finding is robust to the research sample used and the meta-regression model

employed. In addition, there is no evidence of reporting bias in the UK research literature. And Leonard *et al.* (2014) conclude that there are four different reasons to explain why the minimum wages does not harm jobs of low-paid workers.

#### **Empirical evidence explains why the minimum wage does not destroy jobs:**

It appears that policy makers attempt to minimise their employment effects by setting the minimum wage rate (Low Pay Commission, 2000). Metcalf (2008) suggests that policy makers attempt to design minimum wages as a successful policy tool and are used alongside with in-work benefits to increase the work incentives. Therefore, a well-designed minimum wage accompany with the appropriate tax rate and welfare system may make it is possible to increase the pay of low paid workers without harmful their employment position.

It seems that adverse employment effects may be offset by movements in productivity, prices, profits and adjustments to hours worked from a firm's perspective (Metcalf, 2008). Which means that the increased wage income of low-paid workers may incentivise them to work harder and therefore to increase their productivity; a minimum wage increase implies higher labour costs and employers may respond by passed their higher labour costs on to consumers in terms of higher final product prices; In relation to the final price of the low paid industry, Katz and Krueger (1992) find no adverse employment effects of increase in the US minimum wages but they also find little evidence of relative price increases in the fast food industry (medium soda, French fries and main course). Card and Kureger (1995), in contrast, who also examine the effect of increases in the minimum wage in the US fast food industry, find that the prices of fastfood meals increased in New Jersey, where the minimum wage increases relative to Pennsylvania (no minimum wage increase), suggesting that much of the burden from the rise in costs was passed on to consumers. However, the authors find no evidence that prices increased more in stores that were most affected by the minimum-wage rise within the New Jersey. Secondly, the decrease number of hours per worker may be another reaction if employers cannot pass on the higher costs to consumers by increasing prices. This way, labour costs will be reduced in response to the minimum wage increase by reductions in hours (called adjustment at the intensive margin). In relation to the hours worked of employees, Card and Kureger (1995, 2000) use the number of worker as dependent variable and find New Jersey minimum wage increase did not reduce total employment, but it did slightly reduce the average number of hours worked per employee. In relation to the UK evidence, Stewart (2004) finds that the overall effect of an introduction of the national minimum wages on employment in the UK in 1999 has been broadly neutral but finds negative outcomes for both basic and total working hours and for man and women.

The efficiency wages might be an explanation of no adverse employment associated with minimum wage, which means employers pay workers more than market-clearing wages in order to give the employee an incentive to increase productivity. This would result in increases in productivity of firms at a more aggregate level as a result of increased minimum wages in the short-run (Leonard *et al.*, 2014). (Rizov *et al.*, 2016) examine increase in the UK national minimum wage impact on productivity. They examine firm-

specific productivity measures and aggregate them to the level of low-paying sectors. The difference-in-difference result suggests that the national minimum wage positively affected productivity in the low-wage sector.

All of the above findings might be potential reasons to explain why there is no evidence for unemployment associated with minimum wage increases as predicted by the competitive model of the labour market.

#### **Evidence of the minimum wages harming employment, particularly for specific group:**

Contrary to the previous discussion that minimum wage does not harmful to employment, a large body of literature finds adverse impacts of employment associate with the minimum wage, particularly for the most easily affected group. Machin and Manning (1996) use data from the BHPS and the Labour Force Survey to compare the percent of UK employees who are paid below different hourly rates by gender and find that women are much more likely to be low paid than men, and that a large burden of the low pay incidence falls on part-time women. Manning and Petrongolo (2008) also hold the view that minimum wages have a larger impact on part-time workers than on full-time workers. Therefore, part-time workers have a larger risk of losing their jobs. Dickens *et al.* (2014) finds that part-time women are about four times more likely to be affected by changes in the NMW than full-time women. All of the above findings suggest that part-time women are easily affected by minimum wage and its changes over time. In addition, Dickens *et al.* (2014) argues that the absence of unemployment of Stewart's (2004) findings may be because the author examined the introduction of the UK national minimum wages for men and women separately. However, the problem is that Stewart (2004) excluded part-time women from his sample, which may generate a different result.

Dickens, Riley and Wilkinson (2015) re-examine the impact of the UK national minimum wage on employment and find no impact on employment among full-time workers from the introduction and subsequent up-rating of the minimum wages. However, when they focus on the most vulnerable groups, part-time females, which the authors deem to be the most directly affected by the minimum wages, they find that employment falls. The authors use the data from the New Earnings Surveys and the Labour Force Survey to construct a yearly panel and adopt a difference-in-difference strategy (workers with wage initially below minimum wage are defined as treatment group and workers who are not directly affected by the minimum wage are the control group). Therefore, the authors conclude that the UK national minimum wage is harmful to employment, particularly for part-time women. They provide two possible explanations why there was no observed employment impact in previous UK paper. The first reason is that prior UK work covered a period of economic buoyancy, which did not continue beyond 2008. The second reason is that earlier work has tended not to focus on the most vulnerable groups of workers in terms of low pay.

Considering the business cycle, indicates that unemployment may be lower during boom periods relative to economic recession. Dickens *et al.* (2014) suggests that prior UK work covered a period of economic buoyancy, which did not continue beyond 2008. In a period of economic recession

associated with an increase in minimum wages, employers are unable to adjust wages downwards in reaction to the economic recession since the national minimum wage is a wage floor. Consequently, unemployment may be created. Dickens *et al.* (2014) argue that when the minimum wage increases faster than average wages, as was the case in the mid-2000s and during the 2008 recession, a fall in employment retention among the part-time women is observed.

If increases in the minimum wage destroy jobs of part-time women, it raises the question of what is the impact on poverty? In order to answer this question, it is necessary to know whether part-time females actually come from poor families. In relation to the low pay incidence and family income, Johnson and Browning (1983) state that even if the minimum wage raises wages of low paid workers, it may do little to alleviate income inequalities. Since the typical minimum wage worker lives in a family with other labour market earners and since lots of low paid workers are young and female earnings are pin-money and are hence not important to the family income. However, Machin and Manning (1996) argue that minimum wages could have an equalising impact on the income distributions of employed households. They use data from the British Household Panel Survey to examine household income deciles of low paid workers. The evidence suggests that low paid workers are more highly concentrated in lower household income deciles and are more likely to come from poorer working households. The limitation in their paper is that they ignore tax or benefit effects, which may play a significant role to the household income since the increase in the minimum wage may leads to increases in taxes and a loss of social benefits. In addition, the households with no workers are not affected by the minimum wage, which groups have no wage income and are considered as poor group.

### III. MATERIALS AND METHODS

The UK minimum wage was first introduced in 1909, the system is known as Wages councils, set minimum wage rates in a number of different industries and most of which were low wage service industries (Machin and Manning, 1996). A variety of wage control systems existed in certain industries as specified by the Trade Boards Act. The wages councils act 1945 then defined some sectoral minimum wage. By the early 1990s there were 26 wages councils that set minimum wages for approximately 2.5 million workers (Machin and Manning, 1996). Minimum wages set by the Wages councils were finally abolished in August 1993 in the Government's Trade Union Reform and Employment Rights Bill under the conservative party, which is because the government blame that minimum wage do harmful to employment. Then a period of no minimum wages followed (except in agriculture) until the introduction of the new national minimum wage in 1998 following a change of government. The adult rate was set at £3.6 per hour and the minimum wage was increasing over the following years (Machin and Manning, 1996). In recent years, the new national living wage was introduced, which distinguishes the wage rate by age and also this was a significant increase in the wage rate and was aimed at providing people with enough income to live off comfortably. In April 1, 2016, the new national minimum wage for workers aged 25 and above was increased to £7.2 per hour from £6.7

in 2015. While the national minimum wage for workers aged between 21 to 24 remained unchanged at £6.7 per hour; for workers aged 18 to 20 is remained at £5.55 per hour; for workers under 18 it is £4.0 per hour and apprentices receive £3.40 per hour (GOV.UK). Therefore, this dissertation will focus on the effect of the 2016 April increase in the minimum wage rate on employment for low-paid workers who are directly affected and have an increase in hourly earnings after the policy.

This paper addressed the question by using micro data from the Labour Force Survey and adopts the difference-in-difference strategy. Firstly, this paper selects the period January to March 2016 as before period, and then choose a period July–September 2016 as after period. Secondly, low-skilled workers aged 25 and above were directly affected by the minimum wage increase and make up the treatment group; while the minimum wage for those workers aged 21 to 24 remains unchanged as control group. I also set the wage earners whose wage was initially above the minimum wage as control group because they are not directly affected by the minimum wage increase. Therefore, the difference-in-difference can identify the employment differences after the minimum wage increase on treatment and control group.

In April 1, 2016, the national minimum wage in the UK for low paid workers aged 25 and over rose from £6.7 to £7.2 per hour. This paper uses the difference-in-difference methodology to estimates the effects of the increase in minimum wage on employment prospects of low paid workers whose wages increases following the minimum wage policy. As mentioned before, the competitive model states that a minimum wage increase is harmful to employment, which means that directly affected lower wage workers are less likely to be employed compared to people who are not directly affected. So, this paper set the group of workers' wages directly affected by the new minimum wages as treatment group. In choosing the control group, since one assumption of the difference-in-difference methodology is parallel trend assumption. Parallel controls are a theoretical assumption that needs to be satisfied for difference-in-difference to work, the assumption is that employment trends would have been the same in both groups in the absence of the treatment (Pischke, 2005). As this might not possible since even in the absence of the minimum wage, such as those at the bottom of the wage distribution have lower subsequent employment probabilities (Stewart, 2004). One assumption of the difference-in-difference to be suitable is that the employment trends follow the similar trend between the treatment and control group in the absence of minimum wage increases (Stewart, 2004). Only this assumption is satisfied, the minimum wage reform effect on employment for treatment and control groups can then be measured and compared. Therefore, workers whose wage is above the minimum wages as the control group is natural one to take, which group is designed to be above the minimum as close as possible to the treatment group in wage term to make their behaviour, including labour supply, as similar as possible (Stewart, 2004).

The second key identifying assumption is that the minimum wage does not alter employment probabilities in the control group. However, by simply including initially higher wage earners as control group has its limitations since

the distinction may be threatened by spill-overs effects or by measurement error in the wage variables (Stewart, 2004). Wage spill-over effects mean workers who were paid initially higher than the minimum wage may also demand to receive a pay boost in order to maintain their wage differential, which may be indirectly affected by the minimum wage increases. The spill-over effects may lead to misclassification due to the measurement error (Stewart, 2004). Dickens and Manning (2004) use Labour Force Survey data and data from a postal survey of Residential Care Homes respectively, which provided evidence that the UK national minimum wage only benefitted those workers who were directly affected, the implication of this being that the minimum wage has no spill-over effect. However, Bucher, Dickens and Manning (2012) find that the national minimum wage in the UK does seem to have had sizeable spill-over effects.

In addition to this, it might be necessary to include the second control group in order to find a robust result of minimum wage effects on employment. The interesting points of the April 1, 2016 minimum wage reform is that it remained wage rate unchanged for workers who were aged between 21- and 24 at £6.7 per hour. Those younger low paid workers enjoy the similarities with treatment group is that they are all low-skilled workers earn the minimum wage and might have the same employment probabilities. Therefore, this paper selects those younger workers who were not directly affected by the reform as the second control group to see whether the increase in minimum wages can have more effect on the treatment group (either positive or negative) than control group. However, the second control group are not without its own limitation since there may be substitution between groups as a result of the minimum wage reform (Stewart, 2004), which means the employment of those younger workers may be indirectly affected by the minimum wage increase. The intuition here is that the direct wage increases in the worker aged 25 and over while keeping the younger workers' wage unchanged may alter the employers' decision to hiring more younger workers instead of to pay a higher wage rate to those workers comply with the minimum. Thus, the employment rate of those younger workers might increase accompany with the minimum wage reform.

Therefore, this paper will analyse the differential effect of a significant increase in the UK national minimum wage between the treatment group and two control groups using a difference-in-difference methodology. In order to apply the difference-in-difference methodology, this paper firstly selects the period from January to March 2016, as period before the minimum wage change such that the same hourly rate of £6.7 was paid to all workers. Then, this paper selects the period from July to September 2016, in which period after the minimum wage increased to £7.2 for the low paid workers who were aged 25 and over. Therefore, the difference between the treatment group and control group can be compared with the equivalent difference in an earlier period when no minimum wage increase was in place (Stewart, 2004).

#### Difference-in-difference process:

Difference-in-difference is a version of an OLS specification. To see this more formally:

$y_{1,it}$ : denotes the employment probability of individual  $i$ , belonging to the treatment group ( $>25$ ), in time  $t$ .

$y_{0,it}$ : denotes the employment probability for individual  $i$ , belonging to the control group (21–24 & initially higher wage earner), in time  $t$ .

We then assume for the control group that:

$$E[y_{0,it}|i, t] = \gamma_i + \lambda_t$$

Assume the control group used contains those younger workers and above the minimum as close as possible to the treatment group in terms of their behaviour. This means that in the absence of a minimum wage change in employment are given by similar group effects  $\gamma_i$  and time effects  $\lambda_t$ , which are common across groups (Stewart, 2004).

In terms of the treatment, a higher minimum wage, changes the employment probability conditional on  $i$  and  $t$ :

$$E[Y_{1,it}|i, t] = E[Y_{0,it}|i, t] + \beta = \gamma_i + \lambda_t + \beta_3$$

Let ( $Treat * Post$ ) be a dummy variable denoting whether a person belongs to the treatment group, the observed employment outcome of the different groups can be written as:

$$E[Y_{1,0}|i, t] = \gamma_i + \lambda_t + \beta_3(Treat \times Post) + \varepsilon$$

$E[Y_{1,0}|i, t]$  is the expected probability and  $Y_{1,0}$  is the observed outcome, and because of the OLS estimator is an unbiased estimator with the mean of zero, therefore,  $E[Y] = Y$

$$Y_{1,0} = \gamma_i + \lambda_t + \beta_3(Treat \times Post) + \varepsilon$$

Then, for the treatment group, the employment difference before and after the minimum wage increase can be expressed as:

$$E[Y_{1,it}|i = \text{treatment group}, t = \text{July–September}] - E[Y_{1,it}|i = \text{treatment group}, t = \text{January–March}] = \lambda(\text{July–September}) - \lambda(\text{January–March}) + \beta_3$$

Therefore, the difference-in-difference methodology amounts to comparing the change in employment status of the treatment to the change in employment status of the control group.

The population difference-in-difference can be expressed as (Pischke, 2005):

$$\{E[Y_{1,it}|i = \text{treatment group}, t = \text{July–September}] - E[Y_{1,it}|i = \text{treatment group}, t = \text{January–March}]\} - \{E[Y_{0,it}|i = \text{control groups}, t = \text{July–September}] - E[Y_{0,it}|i = \text{control groups}, t = \text{January–March}]\} = \beta_3$$

Therefore, the estimation equation can be written as follows:

$$Y = \beta_0 + \beta_1(Treat) + \beta_2(Post) + \beta_3(Treat \times Post) + \varepsilon$$

$Y$  stands for the employment effects of the treatment group after the minimum wage reform

$Treat$  is a dummy variable and will take the value of 1 if it is the treatment group, 0 otherwise.

And  $Post$  is the dummy variable and will take the value of 1 at the period of July–September after the minimum wage increase, 0 otherwise.

$\beta_0$  is the constant coefficient:

$$\beta_0 = (y|Treat = 0, After = 0)$$

$\beta_1$  is the coefficient for treatment group:

$$\beta_1 = (y|Treat = 1, After = 0) - (y|Treat = 0, After = 0)$$

$\beta_2$  is the coefficient after the minimum wage increases:

$$\beta_2 = (y|Treat = 0, After = 1) - (y|Treat = 0, After = 0)$$

$\beta_3$  is the coefficient of the difference between the treatment group and control group, after the minimum wage increases.

$$\beta_3 = [(y|Treat = 1, After = 1) - (y|Treat = 1, After = 0)] - [(y|Treat = 0, After = 1) - (y|Treat = 0, After = 0)]$$

Then, the difference-in-difference strategy amounts to comparing the change in employment in treatment group to the change in employment in controlled group to see whether the minimum wage have adverse impact to employment. The coefficient  $\beta_3$  denotes the treatment effect. If the coefficient is non-zero, the slope is different between the two groups, which mean that the increase in minimum wage has had an effect on employment. The coefficient can be positive or negative, which means the increase in minimum wage can have either positive or negative influence on employment.

#### **The reason why DID methodology is appropriate:**

Simply run the regression (ordinary least square) to get the differences between the treatment group and control groups can only compare the different impact of employment between the groups within a cross-section and no time effect considered. In contrast, just simply compare the employment difference of an individual who were affected by the minimum wage use time series analysis before and after is also not an appropriate method. This is because the time series analysis only refers to differences in the same group regarding differences in time only and no differential group effects. The purpose of this paper is to investigate whether an individual whose wage had to be increased to comply with the new minimum wage regulations, have a higher probability of losing their job than the control group in the age group of 21–24 and in the wage group just above the new minimum wage. It is important to have control group since there may be other independent variables that may affect the employment probabilities such as age, education level, sex, health status, nationality, business cycle and marital status etc. In order to capture the minimum wage impact and only the minimum wages reform effect. It may need to control these variables and the effect of these independent variables needs to be as similar as possible between the treatment group and control group. Therefore, the difference-in-difference methodology is an appropriate method to take. It uses data to measure differences in employment between the treatment and control group that occurred before and after the increase in the minimum wage (Stewart, 2004).

In this approach, the effect of minimum wage increases on employment are computed by comparing the average change in employment over time for the treatment compared to the average change in employment for the control group. This means the employment difference between the treatment and control groups can then be compared before and after the minimum wage increases, and the significant of the estimated coefficient can tell whether the treatment group is more positive or negative affected by the policy (The coefficient

only shows the minimum wage effects).

#### **IV. RESULT AND DISCUSSION**

The analysis of this paper is based on the UK Labour Force Survey (LFS). The reason why this paper chooses LFS data is that it provides a good representation of low-earnings workers and provides a large sample (Stewart, 2004). The LFS was started in 1973 as an annual survey. From March 1992, quarterly data were made available and the survey became known as the Quarterly Labour Force Survey. It is the largest household study in the UK and provides official measures of employment and unemployment (Labour Force Survey). The LFS contains detailed demographic and socio-economic information on the respondents and is a study of the employment circumstances of the UK population, covering approximately 60 thousand households and over 100 thousand individuals above the age of 16 each quarter. The LFS retains each sample household for five consecutive quarters, with a fifth of the sample being replaced each quarter (Fidrmuc and Horrillo, 2011).

The data on each individual has been linked to provide longitudinal information. In relation to this paper, longitudinal information is useful for monitoring the effects of changes in the UK national minimum wages on employment. It can be used to determine the employment responses of people affected by the minimum wage increases and to compare them with other groups in the population. Since the purpose of this paper is mainly to examine the employment effects of the April 2016 UK national minimum wage increases, I will choose two quarterly datasets from the LFS before and after the UK national minimum wage increases: data for the period January–March 2016 as first waves prior to the living minimum wage change and data for the period July–September 2016 as second wave covering the time period afterwards. Following the specifications of the reform, I define the treatment group is the low-paid workers aged 25 and above whose wages increased in April 2016. This paper will then examine the minimum wage effects on employment by setting two control groups as defined early and comparing the employment differences with treatment group separately.

To find the minimum wage effect on employment, this paper will first need to control for other observable differences which may affect the employment probability. Firstly, employment probabilities for women might differ from those of men as women tend to take over care responsibilities or because of traditional gender roles. In addition, there may be gender discrimination in the labour market and females might lose their jobs more easily. Therefore, I will control for SEX by a dummy variable which takes the value 1 if the respondent was a man and 0 otherwise. Younger employees may be less educated and therefore less skilled than older workers, which may affect their employed probabilities. A similar argument may hold for older workers who have a chance to go early retirement or alternatively to have different skills than desired in the labour market so that their employment probabilities are affected. Therefore, there is a need to control for AGE. Married women, especially if they have children to take care of tend to be less likely to work. The LFS datasets contains information on gender and marital status, as well as the number of dependent children in the

household under the age of 19 which I include in my regressions.

The education level of individuals might also be an important independent variable to influence the potential employment probabilities. High-skilled workers are more likely to work relative to less-skilled workers. In addition, I also consider the health condition as an important factor, which suggests that people with bad health condition tend to be less likely to be employed. The variable HEALTH gives the respondent's main/most significant health problem. Moreover, a worker's nationality may also influence their employment condition. Since immigrants from other countries may be less likely to be protected by a labour union and hence their employment probability may be affected. For this purpose, I include a dummy variable considering whether the employee hold an English identity (English=1, 0 otherwise). Furthermore, considering that economic and working condition might differ across the regions of the UK, there is a need to control for the geographic effect. I therefore include dummy variables identifying different parts within the UK: England, Wales, Scotland, Scotland North of Caledonian Canal and Northern Ireland.

The above observable differences among the employees that might affect the employment condition of individuals need to be controlled in order to find the minimum wage reform effects.

After controlling for other observable differences among the employees which affect the employment probability, I then need information regarding the employment status: employed, unemployed and inactive. The LFS contains a variable, which identifies the standard economic activity of the respondent and is consistent with current ONS practice as it gives the International Labour Organisation standard definitions of employment, unemployment and economic activity and inactivity. Then, in order to examine the employment effect, I need information on the individual's hourly rate of pay at January–March and the employment status information. The LFS contains information on gross pay before deductions (GROSS99) and the actual paid hours per week (PAIDHRA). GROSS99 applies to all respondents who are employees or on a government scheme (not New Deal in the voluntary sector or environmental task force); PAIDHRA accounts for the total paid hours the respondent actually worked in the main job during the reference week, including paid overtime work. If a respondent is away from their job, or are off sick for the week in question, I code PAIDHRA=0. The reason for using actually hours worked in the reference week is because it provides a more accurate measure than that based on usual or contractual hours. Then, we get the hourly wage of workers by dividing the gross pay to the number of paid hours usually worked in the reference week.

Considering that the minimum wage effects on employment may be offset by adjustments in working hours of low-paid workers. It is essential to examine the differential effect on actual hours worked among treatment group and control group for all workers and for women only separately. Then, since the minimum wage earners are regard as low-skilled workers, therefore it is important to measuring the effect on actual working hours focus on low-skilled workers. I utilize information contained in the variable HIQUL15D to

identify whether the worker is high-skilled or low-skilled, which is done by setting workers with less than GCSE grades A\*–C or equivalent qualifications or with no qualification are regard as low-skilled workers. This variable applies to all respondents 16–69 or those in employment with qualifications. In addition, this paper also controls for part-time work in the hours' regression to account for the significantly lower average hours. I utilize information contained in the variable FTPTWK to identify whether the worker is full-time or part-time employed in the main job. This variable applies to all respondents who are employed, self-employed, or who are unpaid family helpers or on work-based government training schemes. Furthermore, I also control for the industry in which the respondents work to determine low-wage sectors that might be more easily affected by the minimum wage increases. This paper will then focus on the Manufacturing; Wholesale, retail & motor trade and Hotel & restaurants sectors to see whether the working hours are different in low-paid sectors.

The purpose of this paper is to find out whether the UK national minimum wage increases is negatively affect the employment probability of workers directly affected. In order to do this, this paper use the difference-in-difference strategy to examine the differential employment probabilities between the treatment group and two control groups separately. Then, this paper also focuses on the employment probabilities when focus on only women to see whether the effect is larger. In addition, considering that the negative employment probabilities may be offset by the decrease in actual working hours, I then examine the minimum wage effect on actual working hours for all people, for women only, for low-skilled workers and also for part-time employed workers. Furthermore, it is likely that the results are hiding the effects on people who are truly affected by the reform. This is why I focus on the low-paid sectors that tend to have the greatest share of minimum wage earners such I expect there to be the strongest effects. The sector I choose is mainly on the Manufacturing, Whole and Hotels, which is regard as low wage sectors. Then, I examine the effect on actual working hours for part-time employed workers and also for part-time female employed workers to see whether the minimum wage earners are tended to be more negatively affected by the minimum wage compared with the control groups.

#### **Difference-in-difference effect on employment probability:**

The results in Table 1 suggest that among the 88846 individuals, female workers are 8.16% less likely to be employed than men. Age is positively related with and suggests that older employees are more likely to be employed. Married people are 7.4% more likely to be employed than non-married employees. People with kids have a lower employment probability which is reduced the more children a person has. I find that people with higher education level are more likely to be employed. In relation to the health condition, the results suggest that people with bad health condition are –17% less likely to work compared with workers with relatively good health condition. In relation to nationality, I find that people who have the British citizenship to be 4% more likely to be employed compared to Non-English individuals. The coefficient of the after period suggests that the employment rate in the period of July–

September was 0.8% higher than in the period of January–March of the same year. Considering regional effects, I find that employment tends to be more likely in Wales, Scotland and the Scotland North of Caledonian Canal compared to England. In contrast, Northern Ireland have lower employment probabilities compared to England. Then, Table 1 compares differential impact of the minimum wage increases between the treatment group and control group of everybody who earns higher than minimum wages, the results suggest that negative impact of the minimum wage on the employment probabilities for the group directly affected.

Table 1. Difference-in-difference estimates: the differential impact of the increase in the UK minimum wage on the employment probabilities between all workers higher than minimum wages (control group 1) and treatment group.

|           | (1)       |
|-----------|-----------|
|           | All       |
|           | b/t       |
| Treat     | 0.287***  |
|           | (29.09)   |
| After     | 0.008***  |
|           | (3.22)    |
| Policy    | –0.006    |
|           | (–0.40)   |
| Female    | –0.086*** |
|           | (–33.29)  |
| Age       | 0.007***  |
|           | (53.48)   |
| Married   | 0.074***  |
|           | (24.98)   |
| Kidmum    | –0.045*** |
|           | (–35.82)  |
| Education | 0.055***  |
|           | (66.95)   |
| Badhealth | –0.170*** |
|           | (–52.07)  |
| English   | 0.040***  |
|           | (14.16)   |
| region_2  | 0.019***  |
|           | (2.97)    |
| region_3  | 0.003     |
|           | (0.68)    |
| region_4  | 0.003     |
|           | (0.08)    |
| region_5  | –0.026*** |
|           | (–3.81)   |
| _cons     | 0.301***  |
|           | (41.56)   |

\* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

Notes: Based on Quarterly Labour Force Surveys using datasets January–March 2016, July–September 2016.

In relation to the second control group, which comparing the employment probabilities after the minimum wage reform between the treatment group and younger workers aged 21 to 24, who are not titled to the minimum wage increase, the results (0.012) are shown in Table 2 and suggests that the minimum wage do not harmful to employment and even have

a positive effect among the treatment group. However, the results are not significant at any level of significance.

Table 2. Difference-in-difference estimates: the differential impact of the increase in the UK minimum wage on the employment probabilities between younger workers (control group 1) and treatment group.

|           | (1)        |
|-----------|------------|
|           | younger MW |
|           | b/t        |
| Treat     | –0.005     |
|           | (–1.10)    |
| After     | –0.007     |
|           | (–1.00)    |
| Policy    | 0.012      |
|           | (1.40)     |
| Female    | 0.006      |
|           | (1.41)     |
| Age       | –0.000     |
|           | (–0.89)    |
| Married   | 0.005      |
|           | (1.11)     |
| Kidmum    | 0.001      |
|           | (0.96)     |
| Education | 0.000      |
|           | (1.13)     |
| Badhealth | 0.004      |
|           | (1.37)     |
| English   | 0.006      |
|           | (1.41)     |
| region_2  | 0.006      |
|           | (1.38)     |
| region_3  | 0.006      |
|           | (1.37)     |
| region_4  | –0.000     |
|           | (–0.01)    |
| region_5  | 0.007      |
|           | (1.40)     |
| _cons     | 0.992***   |
|           | (162.20)   |
| N         | 720        |
| tabr2     |            |

\* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

Notes: Based on Quarterly Labour Force Surveys using datasets January–March 2016, July–September 2016.

Table 3. Difference-in-difference estimates: the differential impact of the increase in the UK minimum wage on the employment probabilities between all workers higher than minimum wages (control group 1) and treatment group when focus on only women.

|           | (1)       |
|-----------|-----------|
|           | All       |
|           | b/t       |
| Treat     | 0.295***  |
|           | (27.92)   |
| After     | 0.003     |
|           | (0.69)    |
| Policy    | –0.007    |
|           | (–0.46)   |
| o.female  | 0.000     |
|           | (.)       |
| Age       | 0.003***  |
|           | (11.79)   |
| Married   | 0.006     |
|           | (1.33)    |
| Kidmum    | –0.066*** |
|           | (–33.71)  |
| Education | 0.060***  |
|           | (45.88)   |
| Badhealth | –0.171*** |
|           | (–35.16)  |
| English   | 0.050***  |
|           | (11.37)   |



|          |          |
|----------|----------|
| region_2 | 0.046*** |
|          | (4.98)   |
| region_3 | 0.021*** |
|          | (2.70)   |
| region_4 | 0.024    |
|          | (0.50)   |
| region_5 | 0.004    |
|          | (0.38)   |
| cons     | 0.432*** |
|          | (31.86)  |
| N        | 37852    |
| tabr2    |          |

\* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

Notes: Based on Quarterly Labour Force Surveys using datasets January–March 2016, July–September 2016.

As I discussed before, since women tend to be more affected by the minimum wage and therefore it is worthwhile to examine the minimum wage reform when focus on only women. The results are shown in Table 3.

The results in Table 3 suggest that all other coefficient estimates are in line with the previous findings. In addition, the employment probability tends to be more negative in the treatment group by comparing with the workers who earn higher than minimum wage when considering only women.

#### Difference-in-difference effect on hours worked:

Table 4. Effect on actual working hours for all workers

|           | (1)        | (2)        |
|-----------|------------|------------|
|           | low wage   | younger MW |
|           | b/t        | b/t        |
| Treat     | -4.154***  | 2.782      |
|           | (-4.05)    | (1.30)     |
| After     | -2.408***  | 3.038**    |
|           | (-2.99)    | (2.36)     |
| Policy    | 4.005**    | -1.416     |
|           | (2.48)     | (-0.70)    |
| Female    | -6.285***  | -2.148*    |
|           | (-7.66)    | (-1.93)    |
| Age       | 0.034      | 0.058      |
|           | (0.80)     | (0.66)     |
| Married   | -1.305*    | -3.596**   |
|           | (-1.75)    | (-2.16)    |
| Kidmum    | -0.978***  | -1.442***  |
|           | (-3.10)    | (-2.98)    |
| Education | -1.178***  | 0.101      |
|           | (-4.81)    | (0.21)     |
| Badhealth | -1.701**   | -2.375*    |
|           | (-2.10)    | (-1.92)    |
| English   | -0.999     | -2.049*    |
|           | (-1.28)    | (-1.79)    |
| Parttime  | -17.041*** | -17.906*** |
|           | (-20.95)   | (-14.88)   |
| region_2  | -2.197     | -3.462     |
|           | (-1.28)    | (-1.32)    |
| region_3  | 0.883      | -2.197     |
|           | (0.78)     | (-1.20)    |
| region_4  | -1.026     | -1.521     |
|           | (-0.50)    | (-0.70)    |
| region_5  | 0.598      | 2.600      |
|           | (0.47)     | (1.26)     |
| _cons     | 46.024***  | 32.402***  |
|           | (20.83)    | (10.29)    |
| N         | 1671       | 720        |
| r2        | 0.377      | 0.365      |

\* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

Notes: Based on Quarterly Labour Force Surveys using datasets January–March 2016, July–September 2016.

When considering the effect of minimum wage increase on

working hours considering all workers, the results are shown in Table 4, which suggests that the working hours tend to be increase in the treatment relative to the control group by comparing with all higher wage earners. However, the results suggest that there are negative impacts of the minimum wage increase on the working hours for the group directly affected by comparing with the younger minimum wage earners.

When considering only female in relation to the effect of minimum wage increase on working hours, the results are shown in Table 5, which suggests that positive impact of the minimum wage reform on the effect of actual working hours for the group directly affected by comparing with initially higher wage earners. In addition, the results are statistically significant. In contrast, the minimum wage reform tend to negatively affected the actual working hours when comparing treatment group with younger minimum wage earners. The result is also significant at 10% level of significance.

Table 5. Effect on actual working hours for women

|            | (1)        | (2)        |
|------------|------------|------------|
|            | low wage   | younger MW |
|            | b/t        | b/t        |
| Treat      | -3.058**   | 3.176      |
|            | (-2.47)    | (1.10)     |
| After      | -3.992***  | 4.765***   |
|            | (-3.66)    | (2.74)     |
| Policy     | 3.908**    | -4.719*    |
|            | (1.99)     | (-1.85)    |
| o.female   | 0.000      | 0.000      |
|            | (.)        | (.)        |
| Age        | 0.099*     | 0.090      |
|            | (1.74)     | (0.81)     |
| Married    | -2.855***  | -5.956***  |
|            | (-2.97)    | (-3.10)    |
| Kidmum     | -2.105***  | -2.192***  |
|            | (-4.73)    | (-3.09)    |
| Education  | -1.323***  | -0.187     |
|            | (-4.24)    | (-0.30)    |
| Badhealth  | -2.252**   | -1.125     |
|            | (-2.41)    | (-0.81)    |
| English    | -1.219     | -3.924***  |
|            | (-1.21)    | (-2.70)    |
| Parttime   | -14.211*** | -14.932*** |
|            | (-13.28)   | (-8.73)    |
| region_2   | -4.243*    | -2.902     |
|            | (-1.79)    | (-0.91)    |
| region_3   | 1.888      | -4.182*    |
|            | (1.37)     | (-1.88)    |
| o.region_4 | 0.000      | -6.866***  |
|            | (.)        | (-3.77)    |
| region_5   | 0.995      | 1.480      |
|            | (0.55)     | (0.60)     |
| _cons      | 38.707***  | 30.523***  |
|            | (12.77)    | (7.53)     |
| N          | 831        | 421        |
| r2         | 0.319      | 0.321      |

\* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

Notes: Based on Quarterly Labour Force Surveys using datasets January–March 2016, July–September 2016.

Table 6 shows the results when considering the minimum wage effect on actual working hours for low-skilled workers only. When comparing the treatment group with both control groups, the results suggests that minimum wage reform can increase the actual hours in the group directly affected. And the effect is even larger by comparing with the second control group (younger workers). However, the results are not significant.

Table 6. Effect on actual working hours for Low-skilled workers only

|            | (1)                    | (2)                   |
|------------|------------------------|-----------------------|
|            | low wage               | younger MW            |
|            | b/t                    | b/t                   |
| Treat      | -6.137***<br>(-3.64)   | 2.888<br>(0.69)       |
| After      | -1.147<br>(-0.83)      | -1.507<br>(-0.29)     |
| Policy     | 2.350<br>(0.85)        | 5.322<br>(0.92)       |
| Female     | -5.437***<br>(-4.04)   | -1.814<br>(-0.68)     |
| Age        | -0.030<br>(-0.40)      | -0.038<br>(-0.25)     |
| Married    | -1.724<br>(-1.35)      | -6.307**<br>(-2.03)   |
| Kidmum     | -1.773***<br>(-3.84)   | -1.093<br>(-1.44)     |
| Education  | 0.386<br>(0.35)        | 1.877<br>(0.86)       |
| Badhealth  | -2.564*<br>(-1.68)     | -3.320<br>(-1.09)     |
| English    | -2.401*<br>(-1.65)     | -3.970<br>(-1.52)     |
| Parttime   | -17.655***<br>(-13.61) | -14.207***<br>(-5.68) |
| region_2   | -3.531<br>(-1.04)      | -3.503<br>(-0.47)     |
| region_3   | -0.357<br>(-0.19)      | -7.794<br>(-1.16)     |
| region_4   | -2.688<br>(-1.25)      |                       |
| region_5   | 1.264<br>(0.65)        | 8.001<br>(1.64)       |
| o.region_4 |                        | 0.000<br>(.)          |
| _cons      | 45.780***<br>(9.83)    | 28.995***<br>(3.89)   |
| N          | 484                    | 168                   |
| r2         | 0.424                  | 0.328                 |

\* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

Notes: Based on Quarterly Labour Force Surveys using datasets January–March 2016, July–September 2016.

Since the employment effect of minimum wage increase tend to be offset by decreased in working hours of part-time employed workers, I then include the differential impact on actual working hours for part-time employed workers. The results are shown in Table 7, which suggests that minimum

wage tend to be positive impact the actual working hours when comparing with the treatment group with initial higher wage earners, and the results is significant. In contrast, the actual working hours tend to be decreased in the treatment group when comparing with younger minimum wage earners. The result is not significant at any level of significance.

Table 7. Effect on actual working hours for part-time workers only

|            | (1)                  | (2)                  |
|------------|----------------------|----------------------|
|            | low wage             | younger MW           |
|            | b/t                  | b/t                  |
| Treat      | -2.546**<br>(-2.33)  | 4.902**<br>(2.15)    |
| After      | -3.247***<br>(-3.28) | 3.344***<br>(3.03)   |
| Policy     | 4.702***<br>(2.71)   | -2.599<br>(-1.36)    |
| Female     | -2.309**<br>(-2.23)  | 0.424<br>(0.43)      |
| Age        | -0.028<br>(-0.55)    | -0.006<br>(-0.06)    |
| Married    | -0.403<br>(-0.48)    | -0.508<br>(-0.32)    |
| Kidmum     | -0.633*<br>(-1.72)   | -0.755<br>(-1.52)    |
| education  | -0.445<br>(-1.55)    | 0.184<br>(0.35)      |
| badhealth  | -0.896<br>(-1.05)    | -0.622<br>(-0.58)    |
| English    | -0.848<br>(-0.92)    | -1.167<br>(-1.10)    |
| o.parttime | 0.000<br>(.)         | 0.000<br>(.)         |
| region_2   | 0.216<br>(0.11)      | -1.339<br>(-0.59)    |
| region_3   | 1.376<br>(0.99)      | -2.754<br>(-1.39)    |
| region_4   | 3.218**<br>(2.20)    | -5.087***<br>(-3.41) |
| region_5   | -0.515<br>(-0.34)    | -1.318<br>(-0.79)    |
| _cons      | 23.402***<br>(8.65)  | 11.218***<br>(4.23)  |
| N          | 630                  | 402                  |
| r2         | 0.0419               | 0.067                |

\* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

Notes: Based on Quarterly Labour Force Surveys using datasets January–March 2016, July–September 2016.

Since previous argument suggests that the minimum wage effect may be more negative when focus on the easily affected low-wage sector. Therefore, this paper also considers the minimum wage impact on actual working hours for part-time employed workers when focusing on the Manufacturing, Wholesale and Hotels. Surprising, the results in Table 8 provides difference-in-difference estimator and does not show any negative impact of minimum wages on actual hours worked by comparing treatment group with both control groups.

Table 8. Effect on actual working hours for part-time employed workers only when focus on workers in manufacturing, wholesale and hotels.

|           | (1)<br>low wage<br>b/t | (2)<br>younger MW<br>b/t |
|-----------|------------------------|--------------------------|
| Treat     | -4.942***<br>(-3.86)   | 0.955<br>(0.37)          |
| After     | -2.602**<br>(-2.24)    | 2.296<br>(1.53)          |
| Policy    | 5.606***<br>(2.70)     | 1.095<br>(0.44)          |
| Female    | -5.232***<br>(-4.82)   | -2.766**<br>(-2.11)      |
| Age       | -0.001<br>(-0.01)      | 0.073<br>(0.68)          |
| married   | -0.437<br>(-0.41)      | -1.456<br>(-0.69)        |
| kidmum    | -1.026**<br>(-2.38)    | -1.411**<br>(-2.58)      |
| education | -0.797**<br>(-2.15)    | 0.287<br>(0.48)          |
| badhealth | -1.789<br>(-1.62)      | -3.804***<br>(-2.68)     |
| English   | -0.742<br>(-0.69)      | 0.542<br>(0.40)          |
| parttime  | -16.155***<br>(-15.00) | -17.785***<br>(-11.34)   |
| region_2  | -7.853***<br>(-2.79)   | -5.738<br>(-1.54)        |
| region_3  | 2.046<br>(1.14)        | 0.764<br>(0.34)          |
| region_4  | -2.942<br>(-1.60)      | -2.304<br>(-1.17)        |
| region_5  | 0.837<br>(0.56)        | 3.013<br>(1.12)          |
| _cons     | 44.784***<br>(14.72)   | 31.394***<br>(8.01)      |
| N         | 801                    | 428                      |
| r2        | 0.36                   | 0.413                    |

\* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ 

Notes: Based on Quarterly Labour Force Surveys using datasets January–March 2016, July–September 2016.

It is likely that the previous results are hiding the effects on people who are truly affected by the reform. Then, I also want to find out the part-time effect on actual working hours when focus on only female workers. As the results shown in Table 9, the differences between the treatment group and initially higher wage earners does not change much when focus on only women. However, it is important to notice that the working hours of the treated are generally lower compared to younger control group when considering only women, that hours increased in the second period on average and that the treated after the policy reform also increased their working hours.

To sum up, this paper provide following findings. Firstly, the April 1, 2016 UK national minimum wage increase tends to decrease the employment probabilities of the treatment group (-0.006) when comparing with all other workers earn higher than minimum wages. And the effect tend to be more negative when focus on only women (-0.007). Secondly, although the result suggests that there are no negative employment effects by comparing the treatment group with the younger minimum wage earners. However, when comparing the actual hours worked, the minimum wage increases tend to decrease the working hours (-1.416) of the treatment group and the effect is more negative when considering women only (-4.719). Thirdly, the actually working hours is also tend to be more negative when considering Part-time employed workers only (-2.599). Furthermore, this paper also examines the effect of minimum

wage on hours worked focus on the low paid sector (Manufacturing, Wholesale and Hotels), and the results do not suggest negative effect associated when considering part-time employed workers only. However, by narrowing the sample down and focus on part-time female employed workers only, the effect on working hours is negative (-2.050) when comparing with the younger minimum wage earners. Therefore, it can be concluding that the UK 2016 minimum wage reform tends to decrease the employment probabilities of workers, and women tend to be more affected. In addition, the actual working hours tend to decrease associated with the minimum wage increase, particularly for part-time women.

Table 9. Effect on actual working hours for part-time females employed workers only

|            | (1)<br>low wage<br>b/t | (2)<br>younger MW<br>b/t |
|------------|------------------------|--------------------------|
| Treat      | -3.501**<br>(-2.29)    | 0.684<br>(0.19)          |
| After      | -2.359<br>(-1.46)      | 4.817**<br>(2.35)        |
| Policy     | 4.747*<br>(1.78)       | -2.050<br>(-0.64)        |
| o.female   | 0.000<br>(.)           | 0.000<br>(.)             |
| Age        | 0.059<br>(0.76)        | 0.159<br>(1.12)          |
| married    | -2.094<br>(-1.58)      | -3.584<br>(-1.42)        |
| kidmum     | -1.760**<br>(-2.38)    | -2.312**<br>(-2.40)      |
| education  | -0.611<br>(-1.17)      | 0.325<br>(0.37)          |
| badhealth  | -3.061**<br>(-2.32)    | -2.593<br>(-1.55)        |
| English    | -1.863<br>(-1.34)      | -0.353<br>(-0.21)        |
| parttime   | -13.059***<br>(-8.73)  | -14.717***<br>(-6.13)    |
| region_2   | -10.401***<br>(-2.75)  | -4.254<br>(-0.96)        |
| region_3   | 1.881<br>(1.00)        | -1.014<br>(-0.41)        |
| o.region_4 | 0.000<br>(.)           | -4.029*<br>(-1.73)       |
| region_5   | 0.486<br>(0.23)        | 1.636<br>(0.48)          |
| _cons      | 36.397***<br>(8.65)    | 25.323***<br>(5.16)      |
| N          | 382                    | 237                      |
| r2         | 0.314                  | 0.365                    |

\* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ 

Notes: Based on Quarterly Labour Force Surveys using datasets January–March 2016, July–September 2016.

## V. CONCLUSION

This paper examines whether the UK minimum wage increases in April 1, 2016 can be regard as an efficient policy to help the low paid workers becomes better off. Considering that wages do not grow at the top end of the distribution but increase for people older than 25 only, the wage distribution will not strongly be affected as people younger than 25 still earn lower hourly wages. However, the neoclassical model suggests that in a competitive labour market, the increase in the minimum wage bills to employers will increase labour costs and employers will react by firing workers. Thus, unemployment is created, which is a serious problem that makes individuals who had a job before and then lost it after the minimum wage increases even worse off. Therefore, this

paper examines potential effects of the 2016 minimum wage reform on employment based on a difference-in-difference specification. In addition, this paper also consider the impact of minimum wage on actual working hours to exam the potential effect to workers, especially for the easily affected group.

This paper investigates the employment effects of minimum wage increases by comparing the workers who are entitled to the wage with two comparison group. The first group is all workers earn higher than minimum wages; and the second group is minimum wage earners aged between 21 and 24 but who are not entitled to the wage increase. The regression results suggest that the UK national minimum wage increases in 2016 destroy jobs of treatment group when comparing with all workers earn higher than minimum wages, the result is even more negative when focus on women only. In addition, as comparing with the younger minimum wage earners, although it seems that the minimum wage reform does not appear to create unemployment in the treatment group. However, the actually hourly worked of worker is decreased and tend to offset the adverse employment effect. When focus on the specific low-paid factors, the part-time women working hours is decreased significantly. Therefore, it can be concluded that the 2016 minimum wage reform tends to have adverse employment effects, particularly for part-time females, which is in line with the previous UK finding that no adverse employment is because of the author do not focus on the easily affected group.

There are also some limitations in this paper. Firstly, in relation to the first control group, this paper compares the employment probabilities with all workers earn higher than minimum wages, those workers may enjoy fewer similarities with the minimum wage earners in relation to the personal effects on employment. In addition, those workers who earn slightly higher than minimum wages may also demand for a wage increase with the purpose to maintain their wage differential and therefore may have wage spill over effect. Secondly, in relation to the second control group, younger workers who are not entitled to benefit from the minimum wage reform may be indirectly affected. Since the employer may decide to hire more of them or increased their working hours to avoid paying the higher wage rate. Both control groups are potentially indirectly affected by the minimum wage reform. Another limitation is that this paper does not consider any tax effect on income (Increase in wage income may be offset by paying higher taxes) and does not consider the social welfare effect (Increase in wage income may make the low wage workers not entitled to the social welfare, which may reduce the household income). It may need further exam to consider the tax effect and social welfare effect.

#### CONFLICT OF INTEREST

The author declares no conflict of interest.

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