The UK National Minimum Wage and Reservation Wages

Ryan J. Papale

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Abstract

In the third and final chapter I look at how labor market beliefs and job search behavior are affected by the UK National Minimum Wage introduction. To do so, I use a triple difference-in-differences to estimate the effect of the National Minimum Wage in low wage, high dose, areas relative to high wage, low dose areas. My preferred estimation strategy estimates treatment effects on a subset of the data that excludes people with children as they would also be subject to the Working Families' Tax Credit, a policy aimed at incentivizing people with children into work, which began around the same time. I find no evidence that the minimum wage introduction affected reservation wages or expected wages in high dose areas relative to low dose areas. I do find some evidence, however, that it affected other search behavior, such as the probability of looking for work and search effort.

Keywords: Minimum wage, reservation wage, beliefs, difference-in-differences, DiD.

JEL Codes: J22 - Time Allocation and Labor Supply, J38 - Public Policy, J64 - Unemployment: Models, Duration, Incidence, and Job Search.

1 Introduction

In this paper I will look at how the National Minimum Wage (NMW) in England affected reservation wages, expected wages, and other search behavior. The reservation wages that people report are an important part of their job search in that it reveals their sentiment towards the job market. Any changes in their reservation wages, which may arise due to a policy such as the minimum wage, may indicate changes to their beliefs about the job market. If individuals respond by setting their reservation wage too high, perhaps due to incorrect beliefs about the job market, they risk rejecting jobs that they would have otherwise accepted if they had more information. Conversely, if it is set too low, they risk accepting jobs that they would have otherwise rejected. As a result, changes in reservation wages are an important aspect of job search that influence workers' search behavior and the jobs they are willing to accept.

This paper seeks to contribute to the literature on minimum wages and reservation wages, which is currently relatively small and inconclusive, by estimating treatment effects while accounting for other policies introduced simultaneously which may bias treatment effect estimates of interest. To do so, I use the British Household Panel Survey (BHPS) to estimate treatment effects using a triple Difference-in-Differences (DiD) estimator, which differences across the reservation wage distribution, regions, and time. There are several drawbacks to this identification strategy. Mainly, that there is no pure control group. Because of this, I estimate treatment effects for the high dosage group (areas with low median wages) relative to the low dosage group (areas with high median wages). The logic behind this is to use differences in treatment intensity, in this case how much the minimum wage "bites" into the wage distribution, to determine the high and low dosage groups. Areas with low median wages will have a higher bite than areas with higher median wages and are therefore more affected by the minimum wage introduction.

As I previously mentioned, the literature in this area is relatively small. Currently I am aware of four papers on reservation wages and the minimum wage, of which one is a laboratory experiment. As a result, I seek to contribute to the small existing empirical literature. Because reservation wages determine labor force participation and contribute to employment and unemployment rates, it is an important topic that deserves attention from researchers. In addition to looking at reservation wages I also examine the effect of the minimum wage on expected wages and other factors that may contribute to reservation wage changes as an attempt to determine why reservation wages may change from the introduction of a minimum wage. Several other outcomes of interest related to job search behavior are used in this paper, such as search effort, which is also relatively understudied empirically. In addition to being a relatively understudied topic, another contribution of this paper is to take into account other policies introduced in the UK at the same time, for example the Working Families' Tax Credit (WFTC). This is an important aspect of this paper, as the implementation of other policies may contribute to changes in search behavior leading to the erroneous conclusion that such effects are being driven by changes in the minimum wage. This is not something that I have seen discussed in related papers despite it having the potential to significantly affect findings.

I find that the introduction of the NMW had no significant effect on reservation or expected wages for the high dose areas relative to low dose areas. One potential explanation for the lack of significant results is that the minimum wage was introduced at such low levels that it did not cause a discernible effect. Another potential explanation is biased beliefs. Individuals may have incorrect information regarding the job market and how it is affected by the introduction of the minimum wage. This could result in job seekers failing to adjust their reservation wage whereas they would have if they had full information. I do find some evidence, however, that other search behavior, such as looking for a job and search effort, are affected.

There are several other empirical papers that estimate the causal effect the minimum wage has on reservation wages. For example, Luttmer (2007) does this in the US using Current Population Survey data, Fedorets and Shupe (2021) in Germany using the Socio-Economic Panel data, and Sousounis and Lanot (2022) in the UK using the BHPS. This final paper by Sousounis and Lanot is the most similar to this chapter as we both use the same data but different methodologies to estimate treatment effects. Overall, the findings in the literature are relatively mixed. Sousounis and Lanot do not find any significant effects in the UK. One of the main problems with their paper is that it does not account for other policies introduced around the same time as the NMW, particularly the WFTC. This is problematic as this policy could also affect reservation and expected wages and may be driving their lack of results. In fact, another paper by Brown and Taylor (2013) looks at the adoption of the WFTC in the UK using the same data, but they also fail to account for the introduction of the NMW.

The layout of this paper is as follows. In the next section I will introduce the conceptual framework briefly, discussing how reservation wages can be affected by a minimum wage. Then I will present the related literature, focusing particularly on empirical papers that examine how reservation wages are affected by policy, how minimum wages affect various labor market outcomes, and how the minimum wage affects reservation wages. After, I will discuss some background information regarding the minimum wage and other policies introduced around the same time. I then describe the data sources and how I prepare the data along with some summary statistics. I will then present my estimation strategy along with the main results before concluding the chapter.

2 Conceptual Framework

In this section I will present a simple conceptual framework for reservation wages which is based upon Mortensen (1986) to show that the effect of a minimum wage on reservation wages is theoretically ambiguous. I augment this model slightly to allow for search effort and I differentiate between a worker's perceived wage offer distribution, $\tilde{F}(w)$ and their actual wage offer distribution $F(w)$ similar to Burdett and Vishwanath (1988), but the derivations are similar to those in Mortensen. The reason for this differentiation between perceived and actual wage offer distributions is because workers do not have perfect information about their potential wages, they may have biased beliefs, so that the two distributions differ.

Importantly, workers base their search behavior, such as the decision to search or to accept a job, on what they perceive their distribution to be and not what it actually is. As a final point, I will only focus on the worker because the decision to search and accept a job or not is based entirely upon their beliefs and not on the actions of the firm. I will also discuss some of the intuition for how the minimum wage may affect the reservation wage. For simplicity, assume that there are only two labor market statuses, employed and unemployed. Further assume that only unemployed workers engage in search as this is the case that I will focus on in this chapter. Begin with the Bellman equation:

$$rV = b - c(e) + \tilde{\lambda}(e) \int_0^\infty \max\,[0, W(x) - V] d\tilde{F}(x), \tag{1}$$

where V is the payoff from searching, $W(w)$ is the payoff from accepting a job paying wage w, r is the interest rate, b is benefits, $c(\cdot)$ is the cost of search as a function of effort e, $\tilde{\lambda}(\cdot)$ is the perceived job offer arrival rate as a function of search effort, and $\tilde{F}(w)$ is the CDF of the perceived wage offer distribution. The function $\tilde{\lambda}(\cdot)$ is assumed to be increasing in e but at a decreasing rate, so that more search effort increases the job offer arrival rate but by less and less. Also assume that $c(\cdot)$ is increasing in e at an increasing rate.

For an unemployed person, their reservation wage is defined as the wage at which any offer above it will be accepted and any offer below it will be rejected. In other words, it is the wage at which the payoff from stopping searching and accepting the offer is equal to the payoff from continuing to search. Letting R denote the reservation wage, this is where $rV = rW(R) = R$. The final equality holds because the present value of receiving wage R in perpetuity is $\frac{R}{r}$. Using this, one can rewrite Equation 1 as:

$$c(e) + R - b = \frac{\tilde{\lambda}(e)}{r} \int_R^\infty [w - R] d\tilde{F}(w), \tag{2}$$

where the left-hand side of Equation 2 can be interpreted as the cost to searching and the right-hand side the benefit to searching an additional period, both given that the reservation wage has been offered. Equation 2 can further be rewritten as:

$$(\tilde{\lambda}(e) + r)R = \tilde{\lambda}(e)\mathbb{E}[w] + \tilde{\lambda}(e) \int_0^R \tilde{F}(x)dx + r(b - c(e)), \tag{3}$$

where the wage expectation, $\mathbb{E}[w]$, is taken over the perceived offer distribution.

Using the implicit function theorem, it can be shown that the reservation wage is increasing in net benefits. If the unemployed are given more unemployment benefits or simply value their leisure more than before, then they will be more selective in accepting a job. Generally, the reservation wage is also increasing with improvements in labor market conditions. For example, the perception of more job availability, which would increase the job offer arrival rate, and higher expected wages, would both increase the reservation wage. In good times the prospective workers can be more selective. Other distributional changes to the perceived offer distribution also affect the reservation wage. For example, a mean preserving spread of the perceived wage distribution also increases the reservation wage. The idea behind this is

that any low wage offers would already be rejected, so it would be worthwhile to wait longer for the chance of a higher offer.

With the introduction of a minimum wage, several determinants of the reservation wage could potentially be affected. Foremost, it could affect the perceived wage offer distribution. The direction of the effect on the wage offer distribution is ambiguous and depends on how the perceived distribution is affected. Take for example people with an expected wage just above a future minimum wage. It is possible that they adjust their expected wage downwards, perhaps anticipating that they will be grouped in with workers at the forthcoming minimum wage level. Changes to the perceived offer distribution do not need to mirror changes to the actual wage offer distribution either, workers may have biased beliefs.

An additional channel through which the minimum wage may affect the reservation wage is through the job offer arrival rate, or potentially through effort which influences the arrival rate. Similar to the perceived wage distribution, the effect on the reservation wage through the perceived offer arrival rate entirely depends upon how people believe the minimum wage affects the arrival rate.[1] There is an additional complexity that people can choose their level of effort to influence the arrival rate. The minimum wage could be a source of motivation, workers are eager for work at a higher wage, thus increasing effort and the arrival of offers. Or it could be the opposite, where it discourages them from searching and they reduce their effort as a response.[2]

The final component in Equation 3 that I will discuss is benefits. This is not likely to be affected by the minimum wage directly. The introduction of the NMW coincided with several other policies, which I discuss in detail below. As a result, I present estimates with benefits on the left-hand side below to ensure that any potential changes in the reservation wage are not being misleadingly caused by changes in benefits because of other policies introduced around the same time.

3 Literature Review

In this section I will give a brief overview of the related literature. I separate this into two subsections. The first is papers related to the job search literature, particularly papers that examine the effect of policy interventions on reservation wages, and the second is papers related to the minimum wage literature. Towards the end of the second section, I will discuss the intersection of these two areas, which are papers that are the most related to this one.

3.1 Search Literature

This chapter is related to a large literature on job search, for example Mortensen (1986), which is the basis for the model presented in the conceptual framework. Other papers in

[1] Figure 10 in the appendix shows that there is some heterogeneity in beliefs about the effect of the NMW on job availability.

[2] This could be due to the minimum wage increasing the number of people searching for work. See Laws (2018).

the job search literature are also related to this project. For example, McCall (1970) discusses imperfect information regarding the wage offer distribution. Burdett and Vishwanath (1988) also discuss imperfect information and biased beliefs and their connection to declining reservation wages.[3]

This paper is also related to job search literature that look at the effect of various interventions on reservation wages. Several papers look at Unemployment Insurance (UI) and reservation wages. For example, two early papers by Fishe (1982) and Feldstein and Poterba (1984). Both papers find a positive relationship between reservation wages and UI. Fishe, who uses data from Florida, does not measure reservation wages directly. The later paper, by Feldstein and Poterba uses Current Population Survey data from the US, which did ask questions regarding the lowest wage a job seeker would accept.

More recently, Le Barbanchon et al. (2019) have looked at an UI reform in France in 2009. They use both a DiD estimator and a regression discontinuity design and find that the reform had no significant effect. Arni and Zylberberg (2020) use data from Switzerland and uses a similar regression discontinuity design to Le Barbanchon et al., but they find that UI has a positive effect on reservation wages. They state these differences could be due to differences between France and Switzerland or due to treatment effect heterogeneity.

Other papers look at different types of interventions. For example, Arni (2015) looks at how active labor market policy affected both reservation and expected wages among other things. He finds that the active labor market policy in Switzerland increased job finding by reducing reservation wages in addition to improving workers effectiveness in search for jobs. Another non-UI paper, by Brown and Taylor (2013), looks at how the WFTC, which I will discuss more in the following section, changed both reservation and expected wages. The authors use BHPS data from 1996 to 2002 and find that WFTC increased expected wages for a subset of non-employed individuals, which in turn increased their reservation wages. The time period examined and the subset of the data used are nearly identical to the data that I use here. Perhaps most noteworthy is the timing of the WFTC introduction in October of 1999, just 6 months after the introduction of the UK NMW. This is something that needs to be considered when estimating the effect that either of these policies has on expected and reservation wages and is something that the authors did not take into account. It seems entirely possible that the NMW is contributing to some of the increases in expected and reservation wages that the authors find. I discuss how I deal with the WFTC in the methodology section below.

3.2 Minimum Wage Literature

The second set of papers related to this project examine the effect of the minimum wage on various outcomes. Many of these papers look at how minimum wage legislation affects employment, for example Card and Krueger (1994), Jardim et al. (2022) and Neumark and

[3]Both Mortensen (1986) and Mortensen and Pissarides (1999) provide a good overview of the job search literature.

Wascher (2000) in the US.[4]

More closely related to this paper is research on the employment effects of the minimum wage in the UK. Several of these papers share a similar identification strategy to this one. This is due to the NMW covering the entire UK. In the US the minimum wage varies across states, but this is not the case in the UK. Instead, researchers often exploit differences in the NMW across age groups or across regions where treatment intensity varies due to differences in income.[5] In the UK, similar to the modern minimum wage research in the US, there is often little to no effect of the minimum wage on employment. See for example Dickens, Machin and Manning (1999), Dolton et al. (2011) and Stewart (2002, 2004).

Even though employment effects are the most commonly analyzed in the minimum wage literature, other outcomes are also looked at. Another common topic of research is how the wage distribution is affected by the introduction of the minimum wage. For example, Dube (2019) in the US and Dickens and Manning (2004), Dolton et al. (2011) and Stewart (2002) in the UK, look at the distributional effects. The findings in these papers are in agreement that the minimum wage increases wages towards the bottom of the income distribution. As I discuss in the methodology section below, I will make a similar assumption to these findings, that people at the top of the reservation wage distribution are unaffected by the introduction of the minimum wage and use this as the additional dimension in the triple DiD.

There is also a small collection of papers investigating the effect that the minimum wage has on search effort. For example, Laws (2018) examines search intensity by constructing several variables using questions in the Labour Force Survey (LFS), something which I aim to replicate using the BHPS, but the data that I use is much less detailed. Laws finds that along the extensive margin the minimum wage increased the number of people looking for a job. Along the intensive margin Laws finds a decrease in search effort. Another paper by Adams et al. (2022) which focuses on the US finds that following a minimum wage increase there is a brief increase in the average time spent searching, but this quickly reverts back to pretreatment levels. These two findings are not necessarily at odds with each other. It is possible that following a minimum wage change, people use certain channels less but spend more time on their preferred channels.

3.3 Minimum Wage and Reservation Wage Literature

More closely related to this chapter, there are at least four papers that look specifically at how minimum wage policy affects reservation wages. Chronologically, the first of these is by Falk et al. (2006). This paper is a clever laboratory experiment conducted with students at two universities in Switzerland. The authors assign students to the role of workers and the firm and explicitly asks workers what their reservation wage is. The authors introduced a

[4]See Manning (2021) for a discussion of the employment effects, or lack of employment effects, for the minimum wage particularly in the US but also in other countries. For a review of the recent literature in the US see Schmitt (2015).

[5]Outside of the UK, Card (1992) and Deere et al. (1995) use a similar strategy that exploits differences in treatment intensity across regions for a federal minimum wage increase. Dolado et al. (1996) does something similar as well in France.

minimum wage into the experiment to see how workers reservation wages changed due to the minimum wage. They found that when the minimum wage was introduced, reservation wages increased. Interestingly, they also found that for some workers reservation wages increased by more than the minimum wage. With the removal of the minimum wage, the authors also note that this did not result in reservation wages returning to the pre-minimum wage levels.

The second paper to look at reservation wages and minimum wages is by Luttmer (2007). This paper uses the US Current Population Survey (CPS) from 1989 to 1992 to investigate the effect that the federal minimum wage increases in 1990 and 1991 had on reservation wages of employed workers. Because reservation wages for these workers are not available in the CPS, the author uses four crude proxies for the reservation wage.[6] Specifically, the author uses an instrumental variable estimator, instrumenting the strength of the minimum wage, in this case the share of workers between the new and old minimum wages, with itself lagged by one year. Luttmer finds no change in the reservation wage.

The third paper on this topic is by Fedorets and Shupe (2021). In this paper, the authors look at the introduction of the German minimum wage in 2015 using data from Socio-Economic Panel. The survey specifically asked questions related to a person's reservation income and hours, which the authors used to construct reservation wages. The authors use a variety of continuous DiD estimators and conclude that the minimum wage increased reservation wages towards the bottom of the reservation wage distribution. Although, they do find evidence that this is only temporary and that eventually the reservation wages return to their earlier levels. They attribute this finding to job seekers learning throughout the search process and adjusting their reservation wages accordingly.

The final related paper that I will discuss, by Sousounis and Lanot (2022), examines reservation wages in the UK. In this paper they also use the BHPS, but to identify reservation wage effects they use a fuzzy regression discontinuity, where the running variable is the difference between the reservation wage in the time period just before treatment and the minimum wage level. Perhaps the most worrisome problem with this identification strategy is the choice of the control group given the potential for spillovers. Individuals with reservation wages above the minimum wage are still low wage workers and there is the possibility that they may also adjust their reservation wages in the presence of a minimum wage. These local treatment effects may not be very informative, particularly if there are spillovers into the comparison group. Sousounis and Lanot are unable to detect any significant effects, largely due to relatively few observations and large standard errors. An additional, and significant problem that the authors do not discuss, is the introduction of the WFTC around the same time as the introduction of the NMW.

Overall, the findings for these papers that analyze the effect of the minimum wage on reservation wages is mixed. Aside from the laboratory experiment, Luttmer (2007) and Sousounis and Lanot (2022) do not find much of an effect, although in the former paper the reservation wage measures are not ideal. In the other paper that I discussed by Fedorets and Shupe (2021) they find a positive effect. Overall, there has been relatively few papers

[6]The proxies for an individual's reservation wage are the wages of their household members, the number of employed people in their household, the number of adults in their household, and finally whether the person is younger than 30.

discussing this topic and there is no clear consensus on the size or direction of the effect. Nevertheless, this is an important area of research that is inherently connected to research on the employment effects of the minimum wage. To illustrate this connection, consider the possibility that workers set their reservation wage too high, perhaps due to biased beliefs, they could potentially reject jobs that they would otherwise accept if they had full information. The converse is also true, they may set their wage too low, and instead accept jobs that they would have otherwise rejected. Because of this, the topic of reservation wages and policy are an important empirical question.

4 Background

In this section I will discuss the history of the minimum wage in the UK. I will also discuss two other policies enacted around the same time as the minimum wage.

4.1 History of the Minimum Wage

The history of the minimum wage in the UK goes back to the Trade Boards Act of 1909, which set industry specific minimum wages for several sectors.[7] Trade Boards were renamed Wage Councils in 1945 and remained until the Wage Councils Act of 1986 and the Trade Union Reform and Employment Rights Act of 1993 which were introduced under the Conservative Party at the time. In September of 1993 all but one Wage Council were abolished.[8]

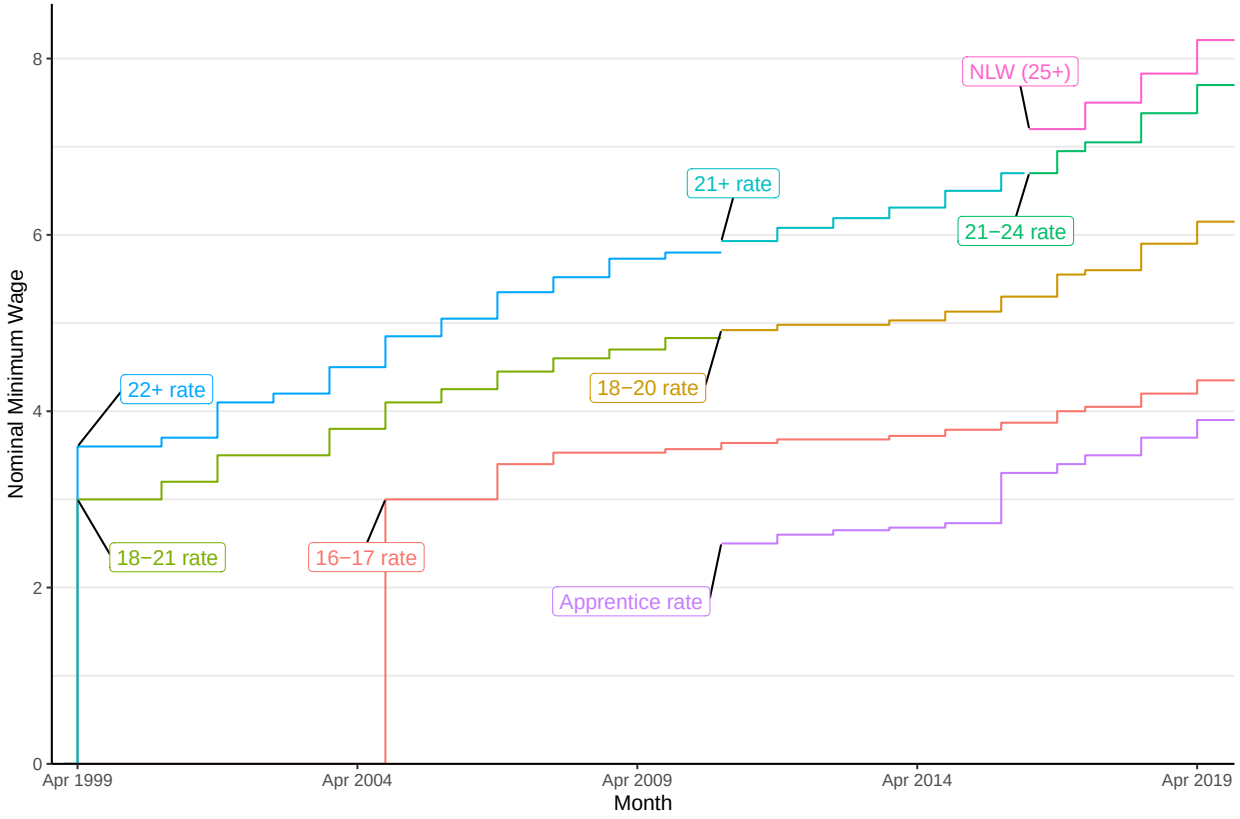
Following the abolition of the Wage Councils there existed a period of several years where the UK was without a minimum wage (aside from the agricultural sector). Then in 1998, with the introduction of the National Minimum Wage Act, a national minimum wage was introduced that covered the entirety of the UK. This became effective on April 1, 1999 and is the NMW that is still in effect today. Initially, there were two separate minimum wages, £3.00 per hour for workers 18 to 21 years old and £3.60 per hour for workers 22 years and older. These two minimum wage rates would stay in effect for two and a half years until they were increased again in October 2001. This can be seen in Figure 1, which plots the nominal minimum wage rates over time between 1999 and 2019.

The y-axis of Figure 1 is the nominal minimum wage rate, and the x-axis is the monthly date. In this figure, the introduction of additional minimum wages can also be seen. For example, expanding the coverage of the minimum wage to 16 and 17-year-olds in October 2004 at £3.00 per hour and the introduction of the apprentice minimum wage in October 2010 at £2.50 per hour. The remaining minimum wages that were introduced redefined the age groups but did not expand coverage to any uncovered groups. This can be seen in April 2016, when the 21+ rate was split into two separate rates, one for 21 to 24-year-olds and the National Living Wage for workers 25 and up.

[7] See Machin and Manning (1994) for a brief overview of the UK Wage Councils or Metcalf (1999) and Pyper (2014) for a more detailed discussion.

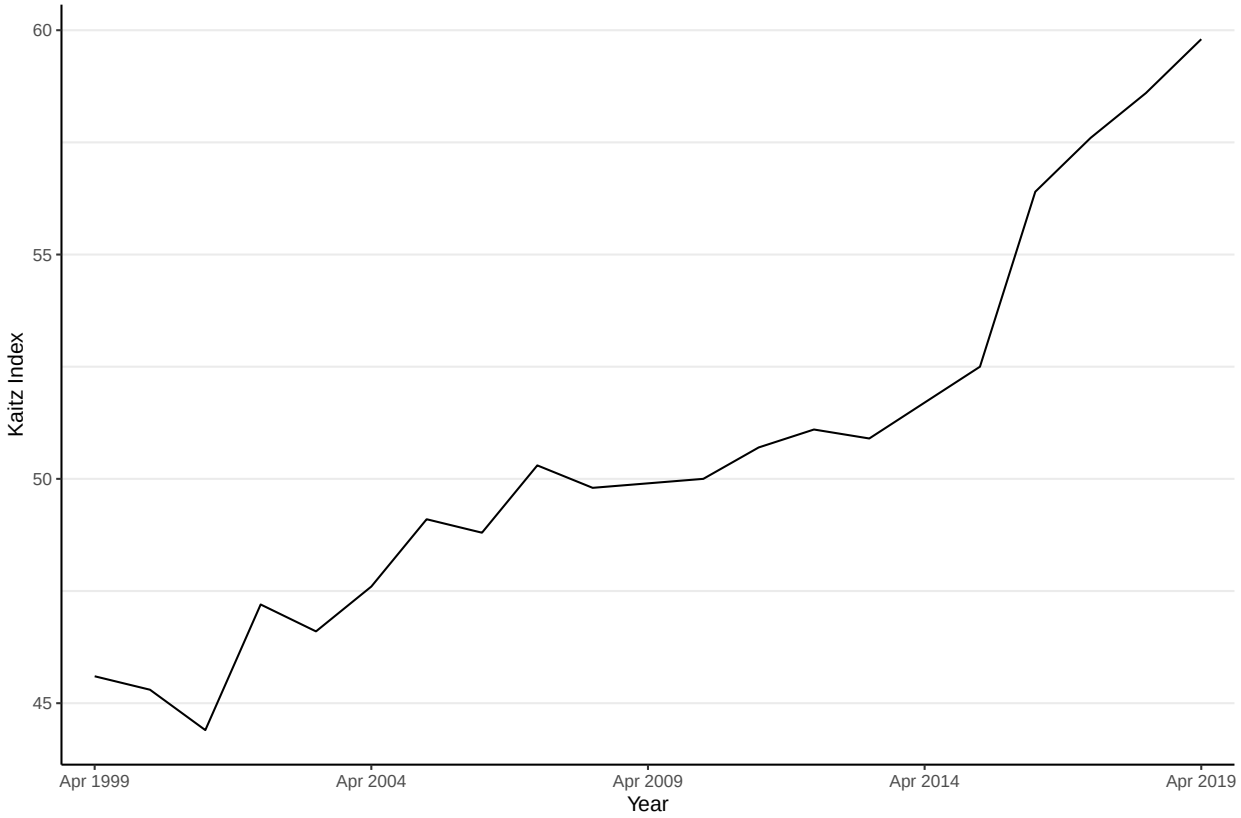
[8] The only surviving Wage Council was in the agricultural sector and would remain until 2013 (Dickens, Machin, Manning et al. 1995).

Figure 1: The National Minimum Wage



[1] This figure plots the nominal minimum wages in the UK by age band from 1999 to 2019.
[2] Data source: Low Pay Commission.

Figure 2: The Kaitz Index Over Time



[1] This figure plots the April Kaitz index, the minimum wage relative to the median wage, from April 1999 to April 2019.
[2] Data source: Low Pay Commission.

Another way to look at the evolution of the NMW over time is the Kaitz index or bite. The Kaitz index is the minimum wage relative to the median wage and it shows the strength of the minimum wage over time. Figure 2 plots the Kaitz index for the UK using data from the Low Pay Commission (LPC).[9] The LPC, which provides guidance on minimum wage rates, discusses four phases of the NMW (Commission 2019), which can be seen clearly in the figure. The introductory phase, from 1999 to 2001, was cautious as they were wary of potential disemployment effects. This can be seen from the initially low level of the bite at introduction followed by it decreasing from 45.6 to 44.4 over this period. The second phase began increasing the minimum wage relative to median earnings between 2001 up to the 2008 recession. Then the third phase, which ran from the 2008 recession to 2015, was cautious again. Finally, the fourth phase, starting in 2016, is when the bite began increasing rapidly again as is evident by the relatively steep slope of the line after 2015.

[9] I use data from the LPC for this figure because they use data from Annual Survey of Hours and Earnings (ASHE) to construct the index. This is likely more accurate than what I would be able to construct using the BHPS.

In this paper, I will focus my analysis on the first phase of the NMW in 1999 and prior to the subsequent increase in the minimum wage in October 2001. I do this for several reasons. First, it provides clear pre- and post-treatment periods. Second, although it would be possible to include more time periods, it seems reasonable to limit the post-treatment window to reduce the time periods that parallel trends must hold for identification. This makes the panel relatively short, but the first post-introduction increase in the minimum wage provides a natural boundary for the panel. It also reduces the complexity of estimating increases in the levels of the minimum wages.

4.2 Other Policies

There were at least two other policies implemented around the same time as the introduction of the NMW. The first of these is the WFTC, which I mentioned briefly in the literature review.[10] Introduced in October 1999, the WFTC replaced the existing family credit system and provided more generous benefits than its predecessor. As the name suggests, WFTC was a refundable tax credit, aimed at helping low-income families and incentivizing them into work. Because this was a fairly large program introduced about six months after the introduction of the minimum wage this is something that I must account for. To avoid capturing the effect of the WFTC on any of the outcomes that I am interested in, I estimate treatment effects separately for parents and non-parents. The latter group, non-parents, should be unaffected by the WFTC so these estimates should be closer to a pure minimum wage effect.

The second policy that was implemented in 1998 is the New Deal. The New Deal was a program aimed at helping people find and keep jobs.[11] This program was comprised of several component programs which targeted different groups of people. The largest component of this was the New Deal for Young People, which focused on individuals between ages 18 and 24. This consisted of two stages and anyone receiving unemployment benefits was automatically enrolled. The first stage was job search help which lasted for 6 months. If the person was still unable to locate a job, several possible options existed. These include enrollment in training, government jobs, or subsidized jobs. Other New Deal programs focused on different groups of people. For example, the New Deal 25+ targeted long-term unemployed people over 25.

The New Deal poses a similar problem to the WFTC, it may potentially affect reservation and expected wages and it was introduced around the same time as the minimum wage. In practice, dealing with the New Deal is more difficult because participation was mandatory for a large proportion of the population if they received unemployment benefits and met certain conditions. As a result, it has the potential to bias estimates depending upon how it may affect reservation and expected wages. As mentioned above, Arni (2015) finds a reduction in reservation wages due to job search help in Switzerland. Based upon my identification strategy, which I discuss in detail below, if the effect of the New Deal is the same in both

[10] See Blundell et al. (2000) for a more detailed discussion of the WFTC.

[11] See Myck (2002) for a brief discussion of the New Deal or Van Reenen (2001) for a discussion of the New Deal for Young People.

high and low wage regions, then it will be differenced out. But this is simply assuming away the problem and is difficult to verify in practice. It is worth bearing in mind that these estimates are potentially negatively biased.

5 Data

In this section I will discuss the data sources that I use for this paper, and I will present some summary statistics.

5.1 Data Sources

In this project I use a secure version of the BHPS Office for National Statistics (ONS) data with Travel to Work Area (TTWA) geographies ("British Household Panel Survey" 2023). As the name suggests, the BHPS is a panel survey consisting of 18 waves of interviews between 1991 and 2009. There are several reasons why I chose to use the BHPS. Foremost, it asks questions directly related to two of the variables of interest for this paper, reservation and expected wages. The survey asks workers about their lowest weekly take home pay and their expected take home pay. It also asks how many hours they would work at both of these weekly rates. There are not many surveys that ask these questions directly, and those that do often have relatively small sample sizes.

There are several drawbacks to using the BHPS, however. Perhaps the largest drawback is that the wage data, which I will use to determine treated (low wage) and untreated (high wage) areas, is likely not as accurate as other surveys such as ASHE because it is self-reported. In addition to this, another issue is the consistency of responses and how well people surveyed understand the questions they are being asked, which may problematically lead to measurement error. Lastly, the sample size is still relatively small. Despite these drawbacks, there are not many other options that directly survey reservation and expected wages.

As stated in the previous subsection, I focus on the introduction of the NMW in April of 1999. The reason for this is that it provides a clear pre- and post-treatment periods for analysis and simplifies estimation in the sections that follow. As a result, I drop waves 1 through 3, which is everything before September 1994, because of the abolition of the Wage Councils in 1993. I also drop all wave 11 observations and all observations after the second minimum wage increase in October 2001. Removing these observations results in 81,492 remaining observations on 20,546 individuals.

In addition to reducing the length of the panel, I also focus solely on people in England. This is because additional households were added to the survey in 1999 for Scotland and Wales, and in 2001 for Northern Ireland. Because of this, I exclude these three countries and focus on the NMW introduction in England. This results in an additional 21,054 observations being removed, leaving 60,438 remaining observations on 12,515 people.

I also focus on working age individuals aged 18 through 65. I exclude 16- and 17-year-olds as they were not covered by a minimum wage at the time. I further remove individuals serving in the armed forces, people missing economic status or that were classified as other, retirees

under the age of 65, and observations missing TTWA information. These observations are removed because they are either missing key variables that will be used to determine treatment status or are not a part of the sample of individuals that are not in the labor force. I also remove any people that received New Deal funding to ensure that any changes in the outcomes of interest are not being driven by other policies implemented at the same time. Lastly, I also remove any observations that moved from between low and high wage regions. This is done to simplify estimation so that I can estimate treatment effects using a DiD estimator. This resulted in a further 17,810 observations being removed so that 42,628 observations on 9,517 people remain across all economic statuses. I then merge Consumer Price Index (CPI) data from the ONS to my main data set and deflate wage and other nominal variables to a base period of April 1999.

At this point, I create two data sets, one for employed workers and one for not employed workers. I use the employed workers data to estimate the actual wage effects of the minimum wage for employed workers as an initial step in my analysis. Additionally, I assign TTWA to high or low impact areas, based upon the median wages that are calculated using employed workers. The sample size for the employed worker data set is 28,276 observations on 6,927 individuals. The other data set, which is the primary data set that I use for my analysis below, conditions on people who were not working when interviewed. This results in 32,284 observations being removed. Additionally, I remove 437 observations with expected wages less than reservation wages and either very low or abnormal reservation wages. The remaining observations that I am left with is 9,907 on 3,963 individuals. Of the 9,907 observations, 4,189 have children and 5,718 have no children.

As mentioned above, the BHPS asks workers about their weekly reservation and expected pay. Using both the weekly rates and their corresponding hours worked, it is then possible to construct hourly rates for reservation and expected wages. Of the full sample, those with and without children, 6,735 observations are missing reservation wage data and 7,131 are missing expected wage data.[12] In addition to these two variables, I also look at several other outcomes of interest. For example, whether the minimum wage caused any change in the number of people looking for work or, in the spirit of Laws (2018), if it changed the effort of those already looking for work.

5.2 Summary Statistics

In this subsection I will present some pre-treatment summary statistics for the main data set that I will use below. Table 1 presents sample averages with standard deviations in parentheses by low wage and high wage region. I define a low wage region as a TTWA with a pre-treatment median wage below the pre-treatment median wage in England. A high wage region is a TTWA with a median wage above the median wage in England. I present summary statistics separately for these groups as this will be one of the dimensions that I difference across with the DiD estimator. The third column presents the summary

[12]This is partially because I include people that are unemployed in addition to people that are not in the labor force. I follow Brown and Taylor (2013) in doing so, as people who are not in the labor force but who report a reservation wage are potentially signaling that they would be willing to work.

statistics for the pooled data and the fourth column presents p-values from a t-test for a difference in means between low and high wage regions. The first five variables in the table are the outcomes of interest that I will look at in the results section that follows. Both Expected and Reservation Wage, stated in real terms, are unsurprisingly lower in low wage regions. Total Annual Benefits, which is also real, is higher in low wage regions as one would expect. The Look for Work variable is the share of observations looking for work in the past four weeks. These averages are fairly similar across the two geographies. Effort, which is a dummy variable equal to one for people who report using 3 or more channels for search and zero otherwise, is essentially the same between low and high wage areas. No children, a dummy variable equal to one if a person reports having no children and zero otherwise, is also similar. The Number of Children, which is the average number of children, is higher in low wage regions. Low wage respondents are typically slightly older, by about 1.25 years. Finally, the share of female respondents between regions is slightly lower in low wage regions. There is a relatively high share of observations that are female, with 64% and 67% respondents being women in low wage and high wage areas, respectively. This is because I focus on non-employed people. If I limit this sample to people without children, the share of women falls to about 55%.

In Table 2 I report average real reservation wages by tercile of the reservation wage distribution and by low and high wage regions. I use terciles as this will be an additional dimension of the triple DiD, with the upper tercile of the reservation wage distribution serving as the reference group. Further, to assign observations to terciles, I use four distributions. Two for high and two for low wage regions so that the distributions can vary pre- and post-treatment. Due to a relatively small number of observations, I use terciles instead of smaller bins. This table uses pre-treatment distributions to calculate the summary statistics. The rows denote the region type and the columns denote the tercile of the distribution. Like the previous table, this table contains sample averages with standard deviations in parentheses. I also include the number of observations in brackets. As can be seen from this table, the average reservation wage is always lower in the low wage region. This difference starts out relatively small, £0.21 for the bottom tercile. It gets larger in the middle tercile, and the difference becomes the largest at the top, approximately £1.44.

Table 3 is similar to the previous table. Instead of average reservation wages it shows average real expected wages, still by tercile of the reservation wage distribution. As can be seen in the table, similar to the previous table the average expected wage for each tercile of the distribution is lower in low wage areas than in high wage areas. The difference here is also growing. It starts off relatively small at the bottom of the distribution at £0.40. At the top of the distribution, it increases to £1.69.

To conclude this section, Figure 3 plots the number of times an individual is observed in the not employed data set. I first condition on having nonmissing reservation wage data as this is the primary variable of interest. The x-axis is the number of times that a person appears in the main data and the y-axis is the number of observations with that many appearances. I combine six or more appearances to protect confidentiality. As can be seen from the figure, a majority of the observations come from a person appearing only once in the data set.

Table 1: Pre-Treatment Summary Statistics

	Sample			
	Low Wage	High Wage	All	p
Expected Wage	4.68	5.56	5.07	0.000
	(2.46)	(3.33)	(2.91)	
Reservation Wage	3.98	4.69	4.30	0.000
	(1.69)	(2.71)	(2.23)	
Total Annual Benefits	2,640.90	2,393.99	2,520.59	0.007
	(2,903.14)	(4,676.04)	(3,797.48)	
Look for Work	0.19	0.20	0.19	0.137
	(0.39)	(0.40)	(0.40)	
Effort	0.23	0.22	0.23	0.457
	(0.81)	(0.77)	(0.79)	
No Children	0.57	0.59	0.58	0.184
	(0.49)	(0.49)	(0.49)	
Number of Children	0.86	0.81	0.84	0.076
	(1.21)	(1.23)	(1.22)	
Age	37.60	36.36	37.02	0.000
	(13.92)	(13.84)	(13.90)	
Female	0.64	0.67	0.66	0.015
	(0.48)	(0.47)	(0.48)	
Observations	3,950	3,242	7,229	7,192

This table contains pre-treatment sample averages with standard deviations in parentheses for the main variables in the British Household Panel Survey that I use in this paper. The columns indicate the sample used to calculate the summary statistics, with low wage regions being defined as a TTWA with below median average pay. The third column pools both low and high wage regions together and the final column is the p-value for a t-test between low wage and high wage regions. The Expected and Reservation Wage variables are hourly rates constructed using the data. Both of these variables, in addition to Total Annual Benefits, are in real terms. Looking for Work is the share of the main data set that report they have searched for a job in the past four weeks. Effort is a dummy variable equal to one if the respondent reported using three or more channels to search for a job. No Children is a dummy variable equal to one if the individual had no children and zero otherwise. Number of Children is the average number of children each respondent has, including people without children. Age is the age of the respondent and Female is a dummy variable equal to one if the respondent is female and zero otherwise.

Table 2: Average Pre-Treatment Reservation Wage by Tercile of Reservation Wage Distribution

	Tercile		
	1	2	3
High Wage Region	2.90	4.11	7.06
	(0.49)	(0.34)	(3.55)
	[366]	[366]	[366]
Low Wage Region	2.69	3.67	5.62
	(0.46)	(0.28)	(1.96)
	[454]	[444]	[443]

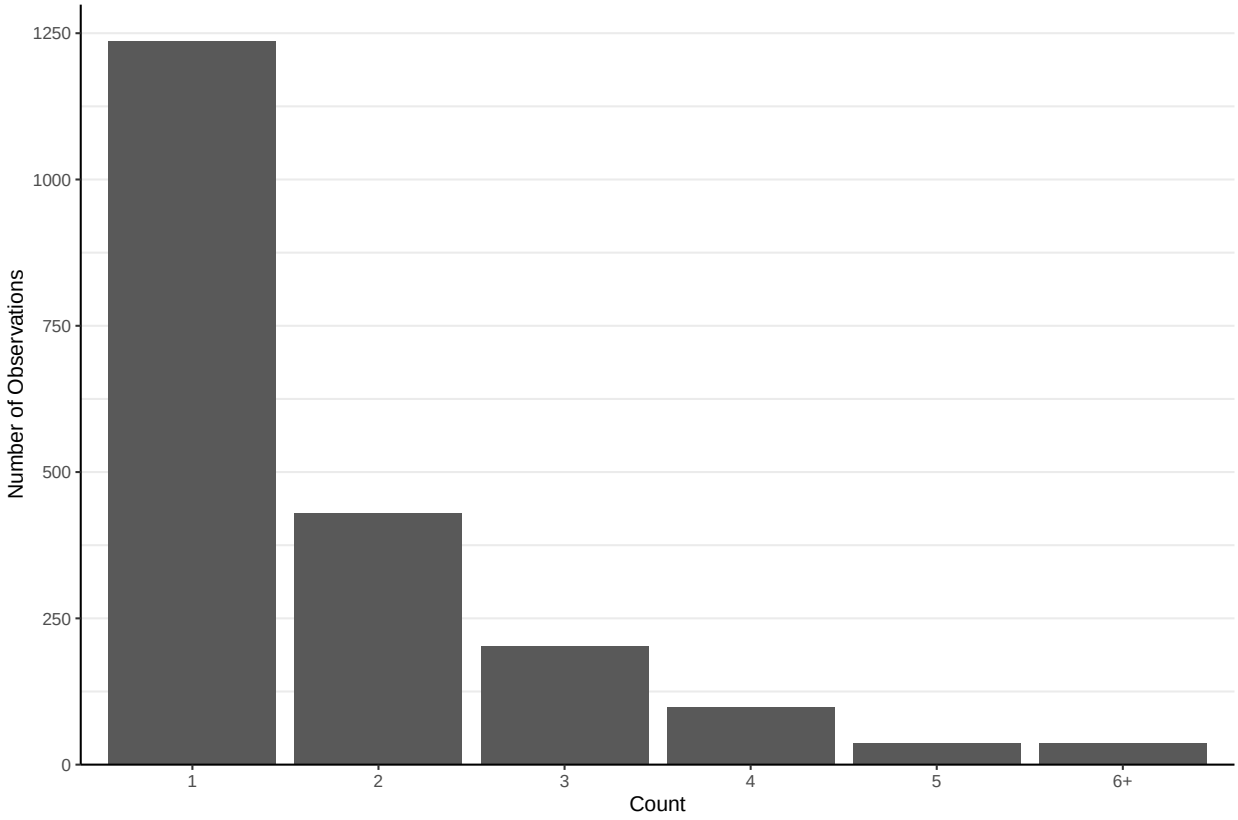
This table contains the sample averages for real reservation wages along with standard deviations in parentheses and the number of observations in brackets. The columns denote which tercile of the reservation wage the averages are being taken over and the rows denote which region, high or low wage.

Table 3: Average Pre-Treatment Expected Wage by Tercile of Reservation Wage Distribution

	Tercile		
	1	2	3
High Wage Region	3.69	4.80	8.36
	(0.88)	(1.23)	(4.47)
	[325]	[318]	[304]
Low Wage Region	3.29	4.22	6.67
	(0.74)	(0.92)	(3.35)
	[407]	[393]	[376]

This table contains the sample averages for real expected wages along with standard deviations in parentheses and the number of observations in brackets. The columns denote which tercile of the reservation wage the averages are being taken over and the rows denote which region, high or low wage.

Figure 3: Count of Appearances in Panel



This figure plots the number of times an individual was observed in the data set with the y-axis being the number of observations in the data for a given number of appearances on the x-axis. I limit the data set to observations with nonmissing reservation wage data, as this is the primary variable of interest for this project. Six or more observations are binned together to protect confidentiality.

6 Methodology

In this section I will present the main model that I will use to estimate the effect of the introduction of the NMW on reservation wages, expected wages, and several other outcomes related to search. A DiD estimator seems like a logical choice in this situation, using high and low wage regions as control and treated groups, respectively. In doing so, one assumes that parallel trends between low and high wage regions holds. However, if there are labor market shock that affects either low or high wage regions, the resulting estimates may be biased.

Because of this, I will use a triple DiD estimator, where I difference across geography and time as usual. The additional dimension that I difference across is the reservation wage distribution. I use the reservation wage distribution as my sample consists of non-employed workers who do not have a wage. People in the upper tercile of the reservation wage distribution are unlikely to be affected by the minimum wage, therefore I will use them as the additional comparison group. This additional difference will remove any labor market shocks that similarly affect the three terciles of the reservation wage distribution within a high or low wage region.

To estimate the effect that the minimum wage has on reservation wages, I will use a triple DiD estimator by estimating the model:

$$Y_{it} = \lambda_t + \theta L_i + \delta L_i P_t + \sum_{\tau \neq 3} \left[\gamma_\tau R_\tau + \kappa_\tau L_i R_\tau + \eta_\tau P_t R_\tau + \beta_\tau L_i P_t R_\tau \right] + \varepsilon_{it}, \tag{4}$$

where Y_{it} is the outcome of interest for person i in wave t, λ_t is a set of wave fixed effects, L_i is a low wage region dummy variable, P_t is a post-treatment dummy variable, R_τ is a reservation wage tercile dummy variable for terciles $\tau = 1, 2$, and ε_{it} is the error term. I define a low wage region as a TTWA with below median average wages. The parameters of interest are the two β coefficients on the triple interaction term, $\beta_{\tau=1}$ and $\beta_{\tau=2}$.

This contrasts the average outcome evolution of both the bottom and middle of the reservation wage distribution with the top of the reservation wage distribution for low and high wage regions and differences it across these regions. Using low and high wage regions is similar to comparing low and high bite regions, something that is well established in the minimum wage literature in the UK (Stewart 2002). The reason that this is similar is because the minimum wage in the UK is national, so the primary element of the bite that varies across geographies is the median income component. In practice, the additional difference in this estimator, which is intended to capture labor market shocks that affect everybody in the region, does not have much of an effect on the estimates. I report additional estimates from a simple DiD across regions by tercile of the reservation wage in the appendix. Estimates for the top tercile of the distribution are typically close to zero, so the additional difference does not change the findings much.

One may be worried about whether the median wage is the correct wage to use when defining treatment. There are two main reasons why I choose to do so. First, setting this wage threshold too low limits spillovers into other regions that may also be highly affected by the minimum wage. There is also the converse problem of setting the wage threshold too

high. In this case, units who should be classified as untreated low impact areas would be included in the treated group. This is also problematic. Perhaps the best solution would be to define treatment as TTWAs at the very bottom of the wage distribution and compare them to TTWAs at the very top. Unfortunately, removing all observations from TTWAs in the middle of the wage distribution would further reduce an already relatively small sample size. As a result, defining treatment in this way serves these two purposes: it allows for some spillovers, and it retains as many observations as possible.

There are several points worth mentioning about this identification strategy. First, there is no pure control group as everyone over the age of 18 is subject to a NMW after its introduction and before its subsequent uprating. Because of this, identification relies on comparing low dosage areas (i.e., areas with low bite and high wages) to high dosage areas (areas with high bite and low wages). This affects the interpretation of the estimates as they are not relative to no minimum wage, but rather relative to a lower dosage group. Related to this and as I've mentioned above, I only focus on the introduction of the minimum wage. So, what I am estimating is the effect of the introduction of the minimum wage on high bite areas relative to low bite areas.

It is also worth mentioning again that, as I discussed above, I only estimate effects for England due to changes in the composition of the sample for other countries. Further, to deal with the WFTC I estimate separate effects for people with and without children. The treatment effect estimates for the subsample without children are preferred because they should not capture any of the changes due to the WFTC, but I include both, along with pooled estimates, for comparison purposes.

7 Results

In this section I will present estimates from the triple DiD estimator that I discussed in the previous section. In the first subsection I will estimate the effect of the NMW introduction on actual wages using the employed data set that I discussed above. Then in the second subsection I will present the estimates for the search variables using the non-employed data set.

7.1 Wage Effects

Prior to estimating the effect of the NMW introduction on reservation wages and the other search related variables, I will present estimates for the effect on actual wages. This is to establish that the minimum wage did affect actual wages. Additionally, it acts as a sort of validity check for the identification strategy. There is evidence that workers may anchor their reservation wages to their past wages (Krueger and Mueller 2016, see). This connection between actual wages and reservation wages is the basis for this validity check, testing to see if the results from a wage regression on the model I proposed in the previous section produce sensible results. If it does not, there would be grounds for concern about the validity of the results for the other variables that I use as well.

To estimate the effect of the minimum wage on actual wages I estimate a similar model to Equation 4, but I estimate separate effects by decile instead of by tercile. The sample of employed workers that I use to estimate these effects is much larger than the sample that I use in the figures that follow to estimate the effects on search behavior. This allows me to estimate treatment effects by decile.

Figure 4 plots the point estimates and the 95% confidence intervals for the wage effects of the NMW introduction by decile of the wage distribution. Standard errors used to construct confidence intervals in this figure are clustered at the TTWA level. As can be seen from the plot, there is a relatively large and positive effect at the bottom of the wage distribution. This estimate implies that the minimum wage introduction increase wages in the bottom decile on average by about 16.16%. The second through fourth deciles are all positive, significant, and similar in size, about half the size of the point estimate for the first decile. In the fifth and sixth deciles the point estimates are even smaller and are significant at the 5% level. In the seventh trough ninth deciles the point estimates are relatively small and insignificant, albeit still positive.

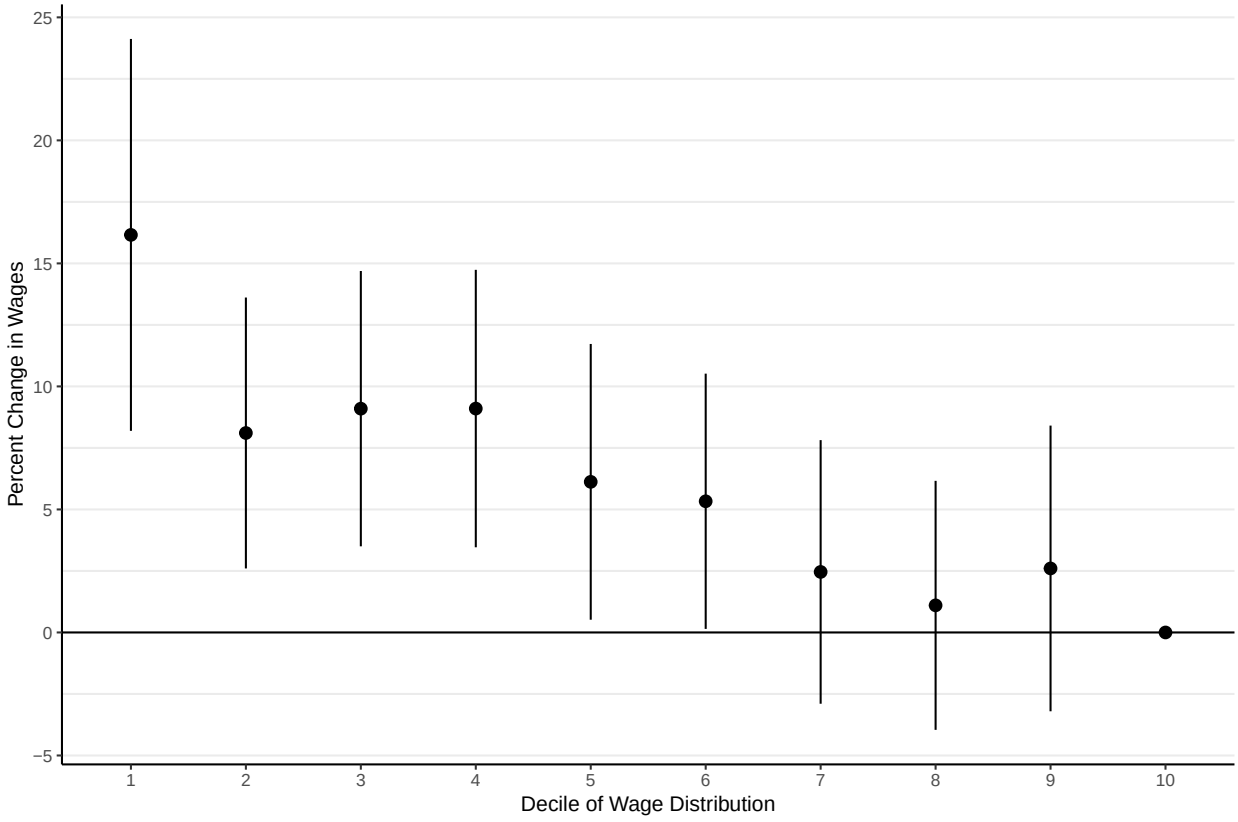
These estimates are similar in sign to the other literature for the UK, but they are larger than the estimates reported by Stewart (2002). They also appear to be larger than the estimates reported by Dickens and Manning (2004), although they present estimates by percentile of the wage distribution. I also find more evidence of a spillover; the point estimates are significant higher into the wage distribution. Differences in these estimates and those found in other papers could potentially arise due to the quality of the underlying data. Dickens and Manning use ASHE data, which is almost certainly more accurate than the self-reported earnings data that I use here. Similarly, Stewart uses New Earnings Survey data, a predecessor to ASHE. Overall, given the quality of the underlying wage data that I use, I would conclude that these results are sensible.

7.2 Main Results

Figure 5 plots point estimates and confidence intervals for the effect of the NMW on reservation wages by tercile of the reservation wage distribution. Standard errors are clustered by TTWA and the estimates for the top tercile of the distribution are mechanically zero. The different colors show which sample is used to estimate the treatment effects. Red circles are estimates from the full sample, green triangles are for the sample with children, and blue squares are for the sample without children. The estimates without children on the right are probably the closest to a pure minimum wage effect as they should be unaffected by the WFTC. The remaining figures in this section will follow a similar layout and tables of these results can be seen in the appendix Table 4 through to Table 6. As can be seen from the figure, all the estimates are insignificant at conventional levels. Point estimates for the sample with children are positive and at the bottom of the distribution they are relatively large. They then become smaller but remain positive in the middle of the distribution. For the sample without children, point estimates are much smaller in magnitude. The point estimates for the bottom tercile are negative, for the middle tercile they are positive.

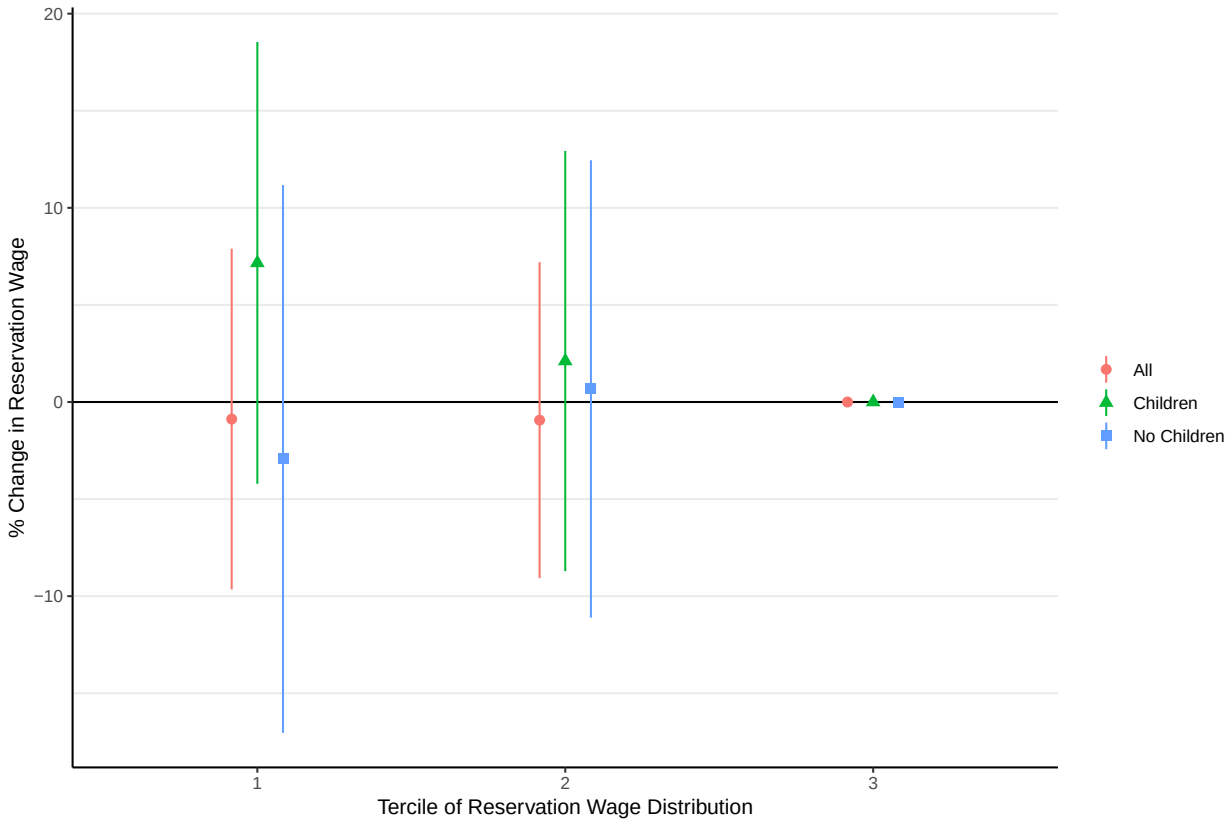
In Figure 6 I plot the effect estimates with expected wages as the outcome variable by

Figure 4: Triple DiD Wage Effect Estimates Following National Minimum Wage Introduction



This figure plots the percent change in real wages by decile of the actual wage distribution following the introduction of the NMW. It is important to note that the sample here is employed people, different from the remaining figures in this section. Each point is a treatment effect estimate and the vertical bars are the estimates corresponding 95% confidence intervals. Standard errors are clustered at the TTWA level. I estimate wage effects similar to Equation 4, the only difference being the summation over terciles changes to a summation over deciles, with the tenth decile now serving as the omitted reference category and is mechanically zero.

Figure 5: Triple DiD Reservation Wage Effect Estimates Following National Minimum Wage Introduction



This figure plots the percent change in real reservation wages by tercile of the reservation wage distribution following the introduction of the NMW. Each point is a treatment effect estimate and the vertical bars are the estimates corresponding 95% confidence intervals. Standard errors are clustered at the TTWA level. The red circles and bars on the left of each grouping of three estimates corresponds to the pooled sample, the green triangles and bars in the middle to the sample with children, and the blue squares and bars on the right to the sample without children. Effects are estimated as discussed in Equation 4 in the previous section. The third tercile is omitted as the reference category and is mechanically zero. Figure 11 in the appendix plots similar estimates from a simple DiD that only takes differences between low and high wage regions. Table 4 to Table 6 in the appendix contains the point estimates and standard errors in table format.

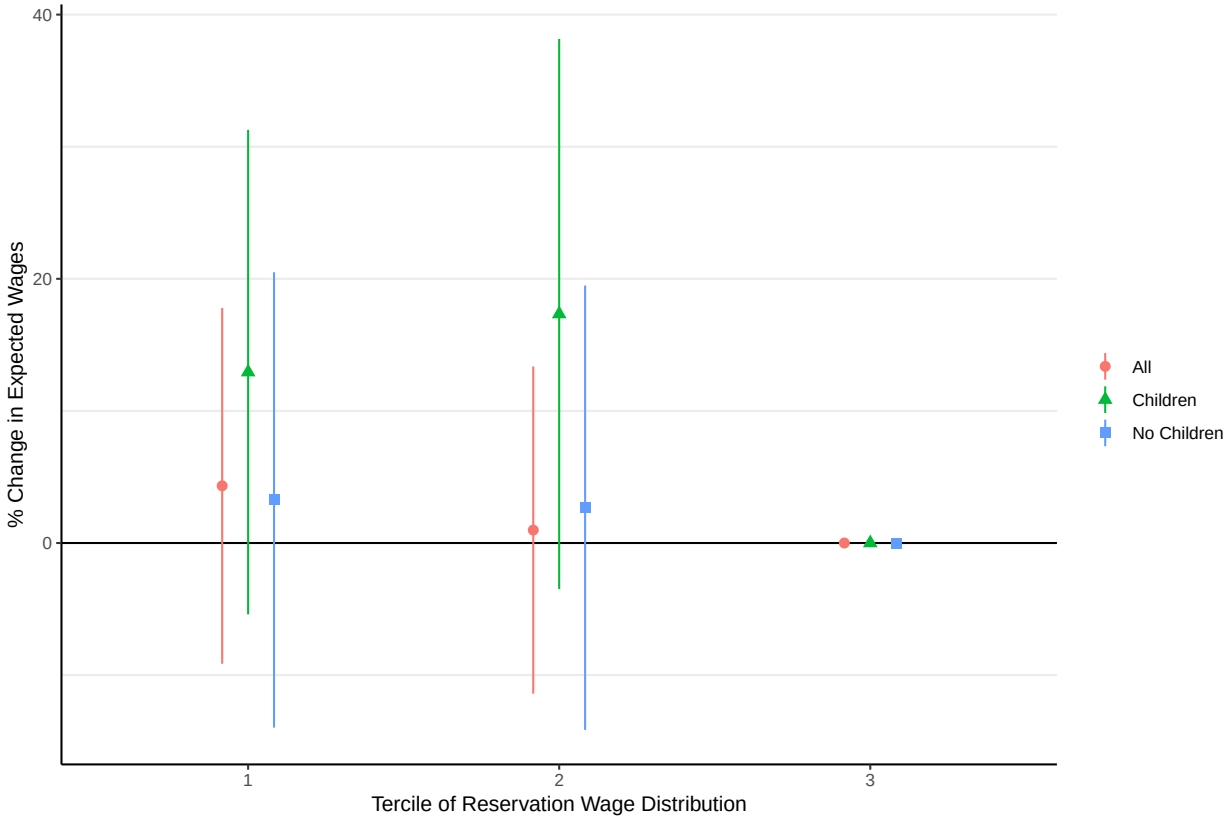
tercile of the reservation wage distribution. The sign of the estimates are all positive and all the point estimates are insignificant. Like the results for reservation wages, the estimates for expected wages are much larger for the sample with children, potentially because of the WFTC. For the sample without children the estimates are all close to zero.

Figure 7 plots estimates by tercile of the reservation wage distribution where the outcome is total annual benefits. This figure is not intended to be causal, but rather a test to see if there was any change in benefits around the same time as the minimum wage was introduced as these could be driving some of the findings, or lack of findings, above. For the sample without children, the point estimates are all relatively close to zero and insignificant, albeit positive in sign. For the sample with children, the point estimates are also insignificant, but they are negative in sign. The first tercile is relatively large as well, but the standard error is also large. This could potentially indicate that there were some changes in benefits, however, for the subset of the data with children particularly towards the bottom of the distribution.

In the two figures that follow, I look at whether there was any change in actual search behavior. Figure 8 plots the estimates from a regression where the outcome is whether a person has looked for work in the past four weeks. In this figure, all point estimates are positive. For estimates in the first tercile, the estimates and confidence intervals from the samples with and without children are large. Only the estimate for the sample with children is significant at the 10% level, the estimate for the sample without children is insignificant. These estimates imply that there is an approximately 25 percentage point increase in the probability of searching in high dose areas relative to low dose areas for the sample without children. For the second tercile, the estimates are also large and positive. For this tercile, the estimate with children is slightly smaller in magnitude than the first tercile and has become insignificant. For the estimate without children, it has become larger and significant at the 10% level. Estimates for the second tercile imply a 28 percentage point increase in the probability of search for the high dose group. Overall, there does appear to be some evidence that search behavior was affected by the introduction of the minimum wage, although the size of these estimates is likely overstated. These estimates are similar in sign to the findings of Laws (2018), but the magnitude is much larger here. This is likely at least partially due to differences in data, where Laws uses the LFS with many more observations than I have available in the BHPS. Laws also focuses primarily on a large increase in the minimum wage rather than the introduction as I focus on here.

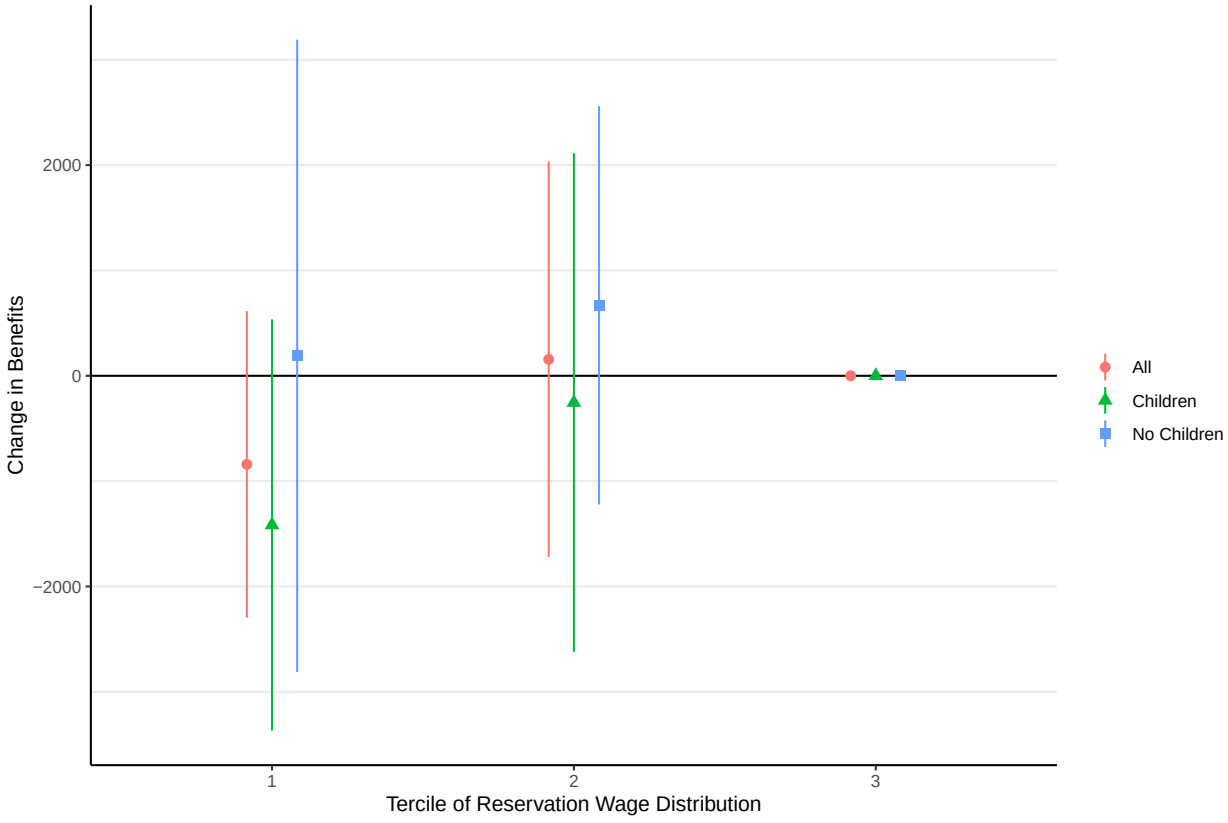
In the final figure of this section, I present estimates for how the introduction of the NMW affected search effort, also similar to Laws. Figure 9 plots these estimates by tercile of the reservation wage distribution. The variable that I use here is a dummy variable equal to one if a person reported using three or more channels for search and zero otherwise. For the bottom tercile the estimates are negative and imply a reduction in search effort, similar to Laws, and are significant at the 10% level for the sample without children. Similar to the previous figure, the point estimates are much larger in magnitude than Laws finds. The confidence intervals around the point estimates that I present here are also large. For the sample with children, estimates are positive and large but insignificant. Again, the confidence intervals are relatively large here too. For the middle tercile of the distribution, effect estimates shrink in magnitude and become insignificant, but the sign of the estimates

Figure 6: Triple DiD Expected Wage Effect Estimates Following National Minimum Wage Introduction



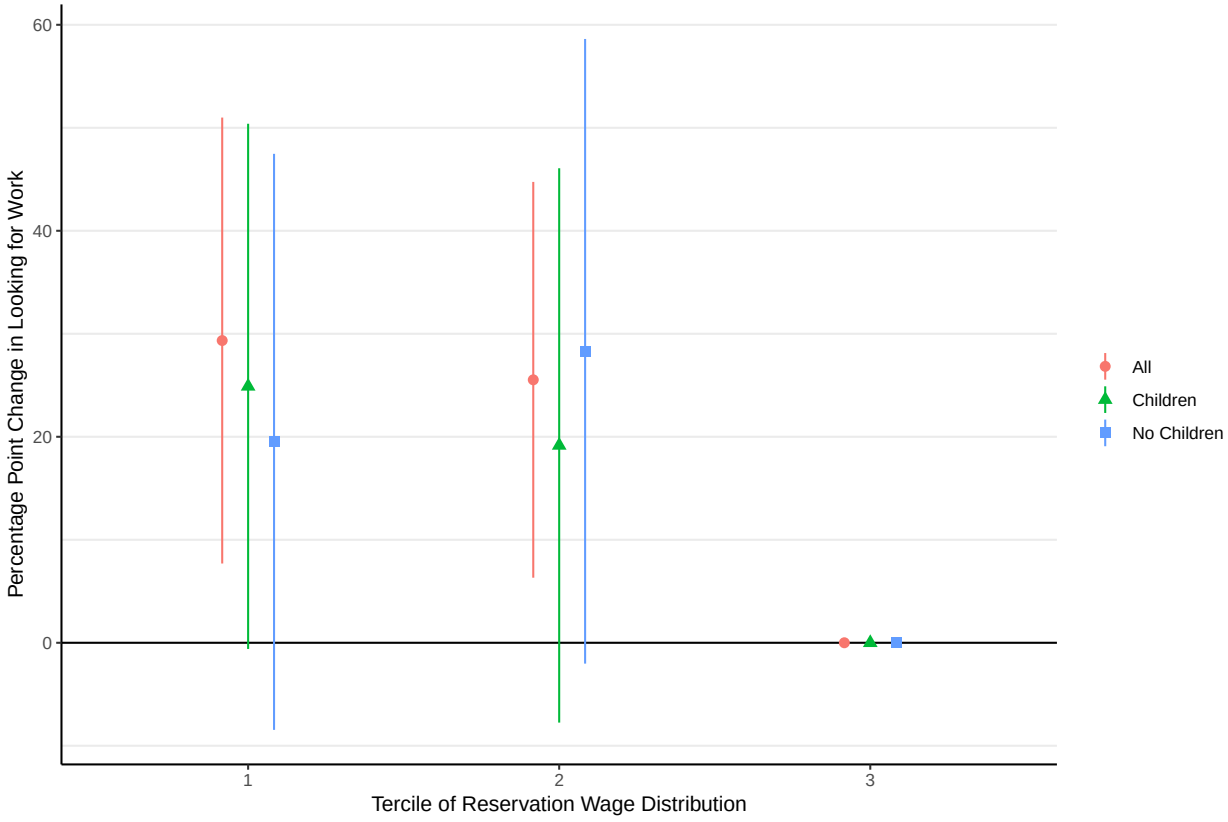
This figure plots the percent change in real expected wages by tercile of the reservation wage distribution following the introduction of the NMW. Each point is a treatment effect estimate and the vertical bars are the estimates corresponding 95% confidence intervals. Standard errors are clustered at the TTWA level. The red circles and bars on the left of each grouping of three estimates corresponds to the pooled sample, the green triangles and bars in the middle to the sample with children, and the blue squares and bars on the right to the sample without children. Effects are estimated as discussed in Equation 4 in the previous section. The third tercile is omitted as the reference category and is mechanically zero. Figure 12 in the appendix plots similar estimates from a simple DiD that only takes differences between low and high wage regions. Table 4 to Table 6 in the appendix contains the point estimates and standard errors in table format.

Figure 7: Triple DiD Change in Benefits Following National Minimum Wage Introduction



This figure plots the change in real total annual benefits by tercile of the reservation wage distribution following the introduction of the NMW. Each point is the triple interaction parameter estimate and the vertical bars are the estimates corresponding 95% confidence intervals. Standard errors are clustered at the TTWA level. The red circles and bars on the left of each grouping of three estimates corresponds to the pooled sample, the green triangles and bars in the middle to the sample with children, and the blue squares and bars on the right to the sample without children. Parameters are estimated as discussed in Equation 4 in the previous section. The third tercile is omitted as the reference category and is mechanically zero. Figure 13 in the appendix plots similar estimates from a simple DiD that only takes differences between low and high wage regions. Table 4 to Table 6 in the appendix contains the point estimates and standard errors in table format.

Figure 8: Triple DiD Searching for Work Estimates Following National Minimum Wage Introduction



This figure plots the percentage point change in people looking for work by tercile of the reservation wage distribution following the introduction of the NMW. Each point is a treatment effect estimate and the vertical bars are the estimates corresponding 95% confidence intervals. Standard errors are clustered at the TTWA level. The red circles and bars on the left of each grouping of three estimates corresponds to the pooled sample, the green triangles and bars in the middle to the sample with children, and the blue squares and bars on the right to the sample without children. Effects are estimated as discussed in Equation 4 in the previous section. The third tercile is omitted as the reference category and is mechanically zero. Figure 14 in the appendix plots similar estimates from a simple DiD that only takes differences between low and high wage regions. Table 4 to Table 6 in the appendix contains the point estimates and standard errors in table format.

stays the same. Taking both of these findings together, although the point estimate is likely overstated, the direction of the effects in the bottom tercile imply that search effort may have been affected differently by the minimum wage introduction and the WFTC.

7.3 Discussion

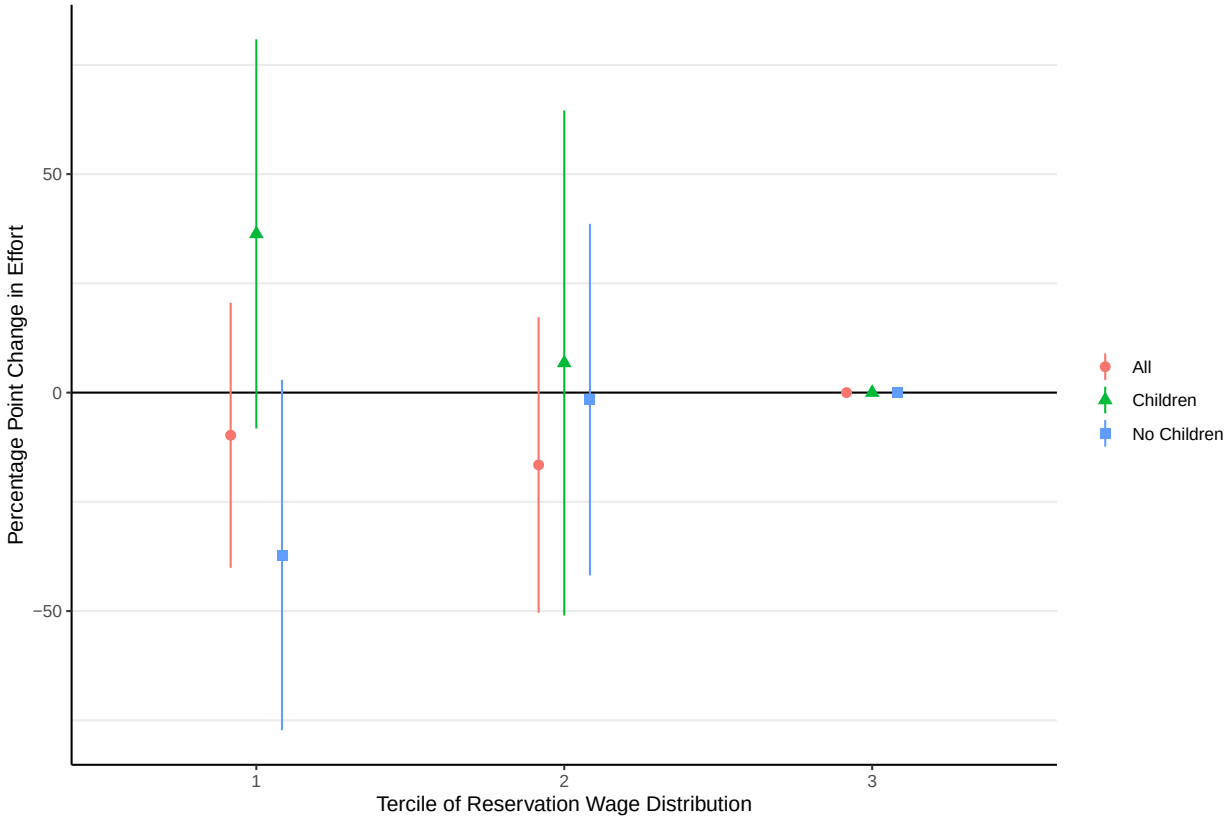
In Section 2 I presented a brief conceptual framework based upon Mortensen (1986) to show the determinants of reservation wages for unemployed people. In the previous subsection I presented estimates for the effect that the NMW introduction had on the reservation wage and its various components in Equation 2 to determine the channels through which the reservation wage was changing. Unfortunately, because of the size of the standard errors surrounding the estimates it is difficult to determine whether there was any change in reservation wages because of the minimum wage. Further, from these results I cannot conclude whether any of the components of the reservation wage significantly changed due to the introduction of the minimum wage. As a result, it is not possible to determine whether the absence of a significant change in the reservation wage is due to a lack of power, the absence of an effect due to the low bite at the introduction of the NMW, or some other policy such as the New Deal offsetting any changes that would have happened if the minimum wage were introduced alone.

For the sample without children, which should be closest to a pure minimum wage effect because they are unlikely to be affected by the WFTC, the point estimate indicates a decrease in the reservation wage by approximately 2.93% but the standard error is very large. Comparing this to the other literature, Sousounis and Lanot (2022) also reach a similar conclusion. They determine that the effect is too small to estimate using the same data but a different identification strategy. This paper does not, however explicitly deal with the introduction of the WFTC. Fedorets and Shupe (2021) found a roughly 16% increase in reservation wages for people at the tenth percentile of the reservation wage distribution. Because of the very large standard errors associated with the estimates in this paper, I cannot rule out relatively large positive effects of the minimum wage on reservation wages. Additionally, the potentially negative bias introduced by the introduction of the New Deal around the same time may partially explain the negative point estimates found here relative to the other literature on reservation wages and minimum wages in other countries.

The other main outcome that I have examined in this paper is expected wages. There is not much in the literature regarding changes in expected wages due to a minimum wage introduction. Brown and Taylor (2013) who look at expected wage changes, among other things, due to the WFTC introduction in the UK estimates a roughly 5 percent increase in expected wages.[13] For the full sample estimates that I present in this paper, where I include both people with and without children, the point estimates suggest a roughly 4.3% increase in expected wages. It is important to note that the estimates I reported in this paper are insignificant, but the point estimates here and in Brown and Taylor (ibid.) appear to be

[13]They report this as a 5 percentage point increase, but they use the log of reservation wages as their outcome variable.

Figure 9: Triple DiD Change in Effort Estimates Following National Minimum Wage Introduction



This figure plots the percentage point change in search effort by tercile of the reservation wage distribution following the introduction of the NMW. I estimate these on a subsample of the data used in other figures, those that are looking for work. Each point is a treatment effect estimate and the vertical bars are the estimates corresponding 95% confidence intervals. Standard errors are clustered at the TTWA level. The red circles and bars on the left of each grouping of three estimates corresponds to the pooled sample, the green triangles and bars in the middle to the sample with children, and the blue squares and bars on the right to the sample without children. Effects are estimated as discussed in Equation 4 in the previous section. The third tercile is omitted as the reference category and is mechanically zero. Figure 15 in the appendix plots similar estimates from a simple DiD that only takes differences between low and high wage regions. Table 4 to Table 6 in the appendix contains the point estimates and standard errors in table format.

similar. It is unclear, however, whether the minimum wage, WFTC, or some interaction of the two policies are driving their results.

8 Conclusion

In this chapter I have looked at how reservation wages, expected wages, and several other search behavior outcomes were affected by the introduction of the NMW in England. To do so, I have used data from the ONS BHPS combined with minimum wage data from the LPC. Because the minimum wage covered everyone over the age of 18 in England, I estimated the effect of the minimum wage on a high dosage group relative to a lower dosage group. Specifically, I used a triple DiD estimator that differences across geographies, time, and the reservation wage distribution. The final difference is included to remove any shocks that affected the entire distribution within a high or low wage region.

I find no evidence that the minimum wage introduction affected reservation or expected wages in England for the high dosage group relative to the low dosage group. This is a similar conclusion to Sousounis and Lanot (2022) who also looked at the UK using BHPS data and concludes that the effect is likely too small to identify given the data. There are several potential explanations for this. The first is that the data does not contain enough observations to be able to identify potentially small treatment effects. Related to this, terciles may be too large to capture any effects at the very bottom of the distribution. With more observations it would be possible to say more about this. A second possibility is that there was not much of an effect because the minimum wage was introduced at such a low level as a cautionary measure. Second, it could be that there is little difference in treatment intensity between the high and low dosage groups. Third, even if the minimum wage changed individuals' actual wage offer distributions, biased beliefs may cause individuals' perceived wage offer distributions to remain unchanged. Finally, there may be other policies affecting the findings, such as the New Deal.

The contribution of this project is using a better subsample of the data to attempt to identify treatment effects. Particularly, estimating treatment effects separately for people with and without children to deal with the start of the WFTC around the same time. I believe that there are several key takeaways from this paper despite the absence of any significant findings. First and perhaps most importantly is that other policies introduced at the same time need to be considered as they may affect the results. This is particularly true for the introduction of the NMW in the UK as the change in government introduced many new policies around the same time that could potentially affect outcomes of interest. I also believe that this paper highlights the need for high quality data, particularly for unemployed people. Despite being such an important topic in economies throughout the world, there are very few large surveys that ask questions about unemployed people's expectations and beliefs. Overall, further research on the topic is needed, perhaps when better data containing peoples' beliefs and expectations becomes available.

References

Adams, C., J. Meer and C. Sloan (2022). "The minimum wage and search effort". *Economics Letters* 212, p. 110288.

Arni, P. (2015). "Opening the Blackbox: How Does Labor Market Policy Affect the Job Seekers' Behavior? A Field Experiment". *IZA Discussion Paper* 9617.

Arni, P. and Y. Zylberberg (2020). "Unemployment Insurance and Learning: Evidence from Reservation Wages". *Working Paper*.

Blundell, R., A. Duncan, J. McCrae and C. Meghir (2000). "The labour market impact of the working families' tax credit". *Fiscal studies* 21.1, pp. 75–104.

"British Household Panel Survey" (2023). *Waves 1-18, 1991-2009: Special Licence Access, Travel to Work Areas. University Of Essex, Institute For Social and Economic Research.*

Brown, S. and K. Taylor (2013). "Reservation wages, expected wages and unemployment". *Economics Letters* 119.3, pp. 276–279.

Burdett, K. and T. Vishwanath (1988). "Declining Reservation Wages and Learning". *The Review of Economic Studies* 55.4, p. 655.

Card, D. (1992). "Using Regional Variation in Wages to Measure the Effects of the Federal Minimum Wage". *Industrial and Labor Relations Review* 46.1, p. 22.

Card, D. and A. B. Krueger (1994). "Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania". *The American Economic Review* 84.4, pp. 772–793.

Commission, L. P. (2019). "20 years of the National Minimum Wage: A history of the UK minimum wage and its effects".

Deere, D., K. M. Murphy and F. Welch (1995). "Employment and the 1990-1991 minimum-wage hike". *The American Economic Review* 85.2, pp. 232–237.

Dickens, R., S. Machin and A. Manning (1999). "The Effects of Minimum Wages on Employment: Theory and Evidence from Britain". *Journal of Labor Economics* 17.1, pp. 1–22.

Dickens, R., S. Machin, A. Manning, D. Metcalf, J. Wadsworth and S. Woodland (1995). "The Effect of Minimum Wages on UK Agriculture". *Journal of Agricultural Economics* 46.1, pp. 1–19.

Dickens, R. and A. Manning (2004). "Has the national minimum wage reduced UK wage inequality?" *Journal of the Royal Statistical Society Series A: Statistics in Society* 167.4, pp. 613–626.

Dolado, J., F. Kramarz, S. Machin, A. Manning, D. Margolis, C. Teulings, G. Saint-Paul and M. Keen (1996). "The Economic Impact of Minimum Wages in Europe". *Economic Policy* 11.23, p. 317.

Dolton, P., C. R. Bondibene and J. Wadsworth (2011). "Employment, Inequality and the UK National Minimum Wage over the Medium-Term". *Oxford Bulletin of Economics and Statistics* 74.1, pp. 78–106.

Dube, A. (2019). "Minimum Wages and the Distribution of Family Incomes". *American Economic Journal: Applied Economics* 11.4, pp. 268–304.

Falk, A., E. Fehr and C. Zehnder (2006). "Fairness Perceptions and Reservation Wages–the Behavioral Effects of Minimum Wage Laws". *The Quarterly Journal of Economics* 121.4, pp. 1347–1381.

Fedorets, A. and C. Shupe (2021). "Great expectations: Reservation wages and minimum wage reform". *Journal of Economic Behavior & Organization* 183, pp. 397–419.

Feldstein, M. and J. Poterba (1984). "Unemployment insurance and reservation wages". *Journal of Public Economics* 23.1–2, pp. 141–167.

Fishe, R. P. H. (1982). "Unemployment Insurance and the Reservation Wage of the Unemployed". *The Review of Economics and Statistics* 64.1, p. 12.

Jardim, E., M. C. Long, R. Plotnick, E. van Inwegen, J. Vigdor and H. Wething (2022). "Minimum-Wage Increases and Low-Wage Employment: Evidence from Seattle". *American Economic Journal: Economic Policy* 14.2, pp. 263–314.

Krueger, A. B. and A. I. Mueller (2016). "A Contribution to the Empirics of Reservation Wages". *American Economic Journal: Economic Policy* 8.1, pp. 142–179.

Laws, A. (2018). "Do minimum wages increase search effort?" *Cambridge-INET Working Paper Series* 2018/14.

Le Barbanchon, T., R. Rathelot and A. Roulet (2019). "Unemployment insurance and reservation wages: Evidence from administrative data". *Journal of Public Economics* 171, pp. 1–17.

Luttmer, E. F. (2007). "Does the minimum wage cause inefficient rationing?" *The BE Journal of Economic Analysis & Policy* 7.1.

Machin, S. and A. Manning (1994). "The Effects of Minimum Wages on Wage Dispersion and Employment: Evidence from the U.K. Wages Councils". *Industrial and Labor Relations Review* 47.2, p. 319.

Manning, A. (2021). "The Elusive Employment Effect of the Minimum Wage". *Journal of Economic Perspectives* 35.1, pp. 3–26.

McCall, J. J. (1970). "Economics of Information and Job Search". *The Quarterly Journal of Economics* 84.1, p. 113.

Metcalf, D. (1999). "The British national minimum wage". *British Journal of Industrial Relations* 37.2, pp. 171–201.

Mortensen, D. T. (1986). "Chapter 15 Job search and labor market analysis". *Handbook of Labor Economics*. Elsevier, pp. 849–919.

Mortensen, D. T. and C. A. Pissarides (1999). "Chapter 39 New developments in models of search in the labor market". *Handbook of Labor Economics*. Elsevier, pp. 2567–2627.

Myck, M. (2002). "How the New Deal works".

Neumark, D. and W. Wascher (2000). "Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania: Comment". *American Economic Review* 90.5, pp. 1362–1396.

Pyper, D. (2014). "House of Commons Research Briefing. The National Minimum Wage: Historical Background". Standard Note: SN06897.

Schmitt, J. (2015). "Explaining the Small Employment Effects of the Minimum Wage in the United States". *Industrial Relations: A Journal of Economy and Society* 54.4, pp. 547–581.

Sousounis, P. and G. Lanot (2022). "Minimum Wage Effects on Reservation Wages". *Journal of Labor Research* 43.3-4, pp. 415–439.

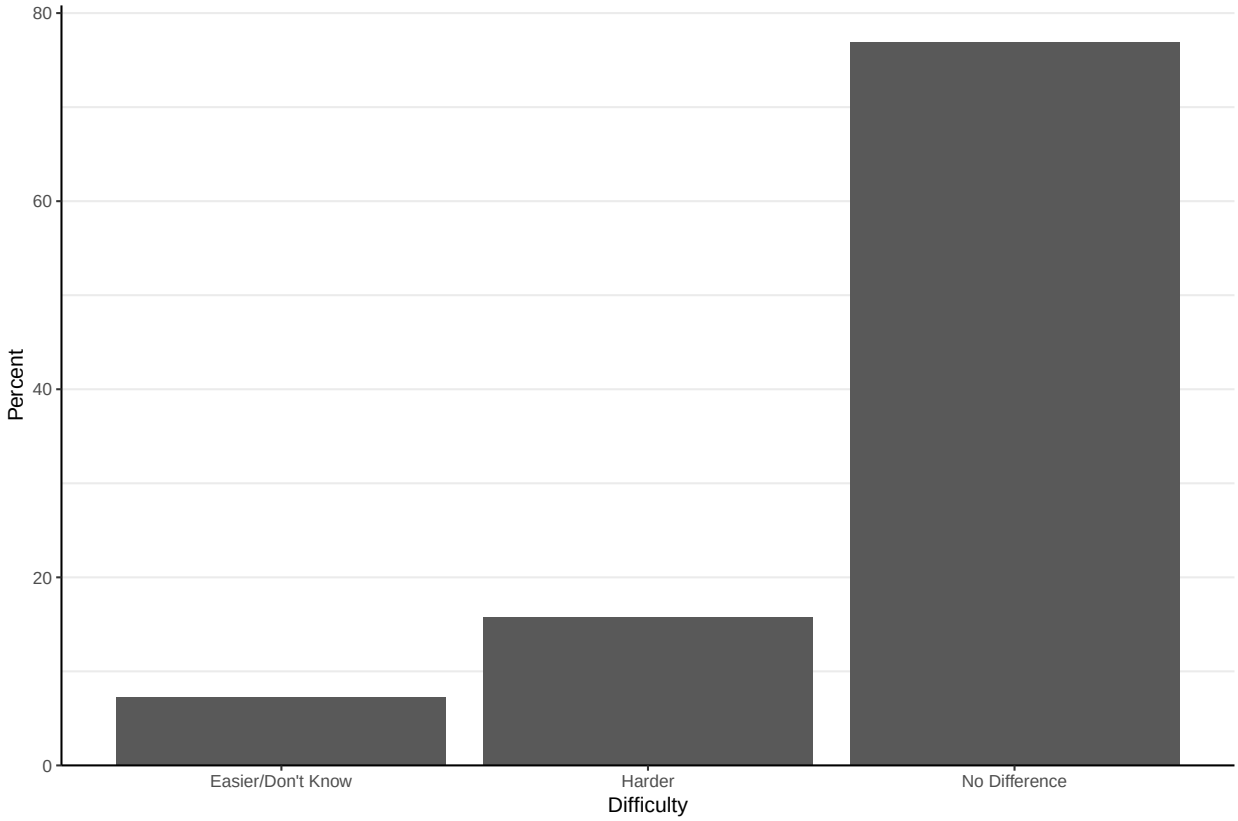
Stewart, M. B. (2002). "Estimating the Impact of the Minimum Wage Using Geographical Wage Variation". *Oxford Bulletin of Economics and Statistics* 64.supplement, pp. 583–605.

— (2004). "The Employment Effects of the National Minimum Wage". *The Economic Journal* 114.494, pp. C110–C116.

Van Reenen, J. (2001). *No more skivvy schemes? Active labour market policies and the British New Deal for the young unemployed in context.*

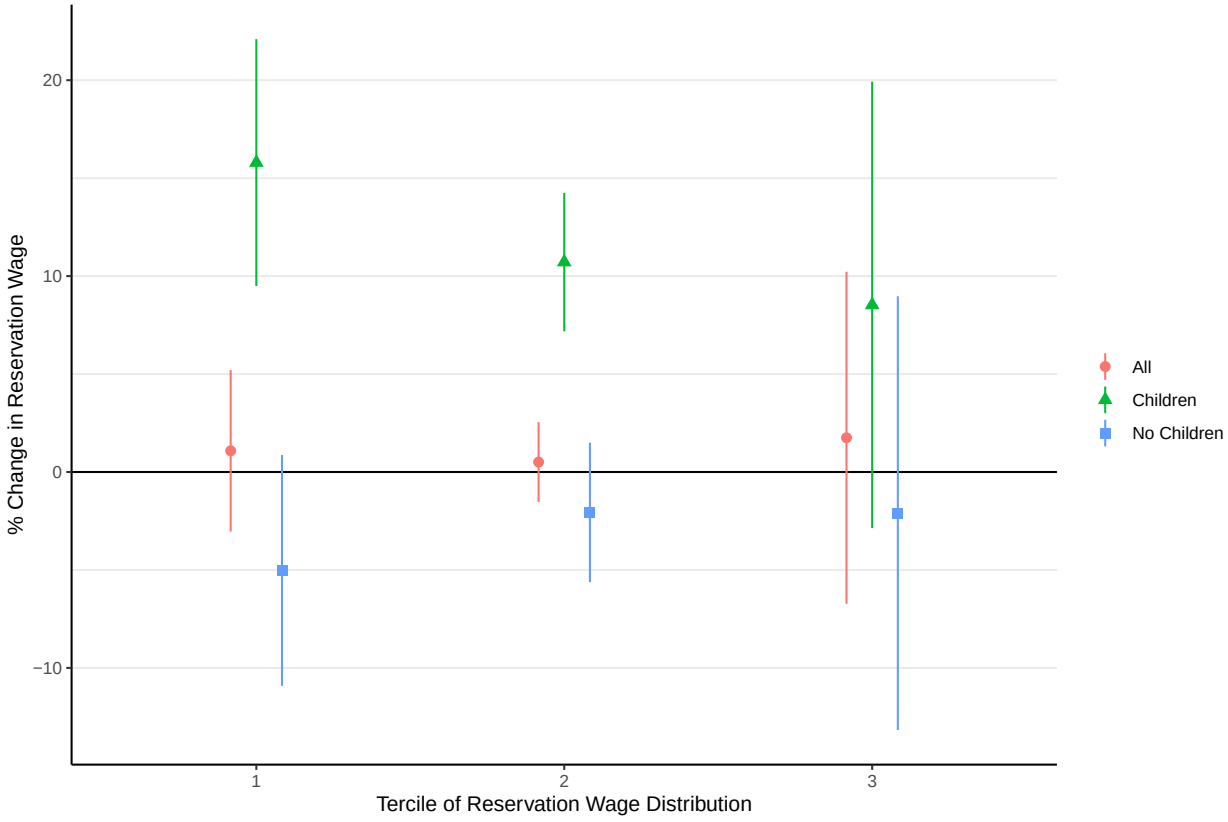
9 Chapter 3 Appendix

Figure 10: Beliefs About NMW Effect on Job Finding



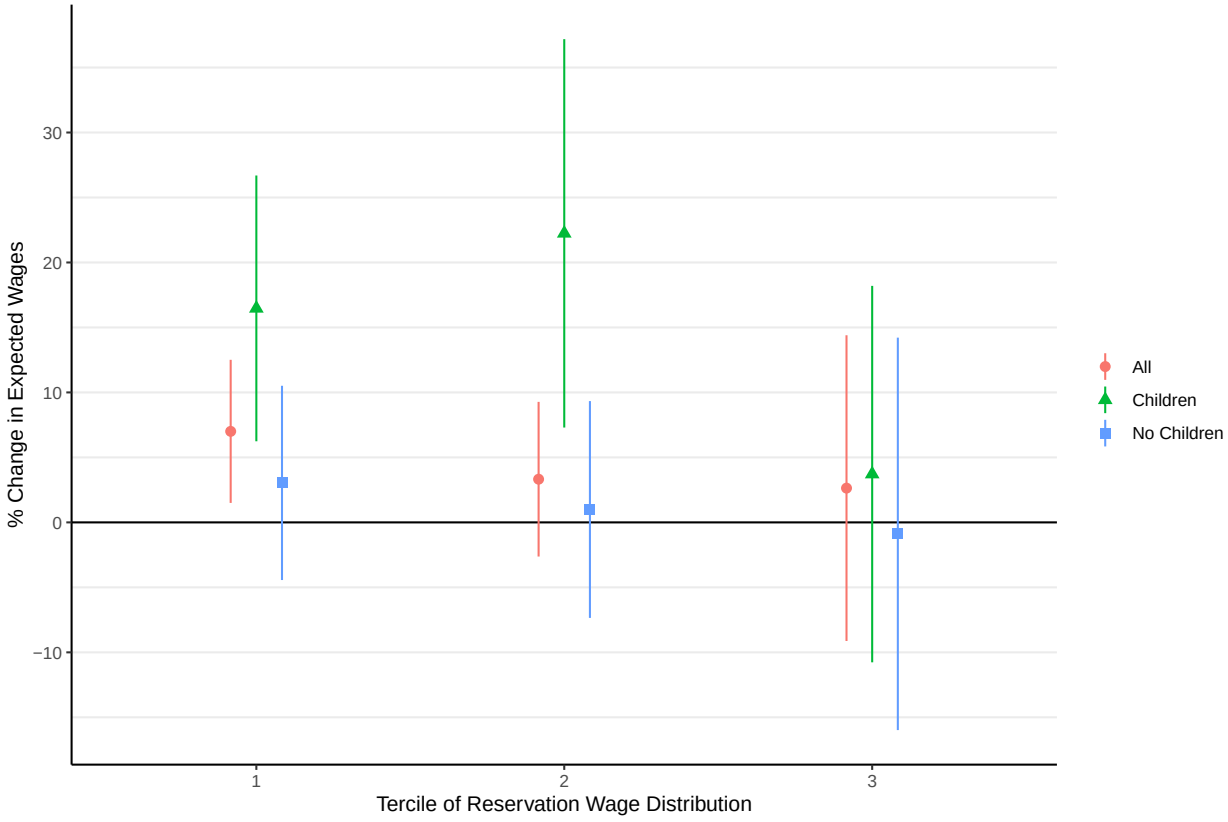
This figure plots unemployed people's beliefs about job availability following the introduction of the NMW in 1999. I group together the two smallest categories, easier and don't know, into a single category for confidentiality. This question was only asked in one wave of the BHPS.

Figure 11: Simple DiD Reservation Wage Effect Estimates Following National Minimum Wage Introduction



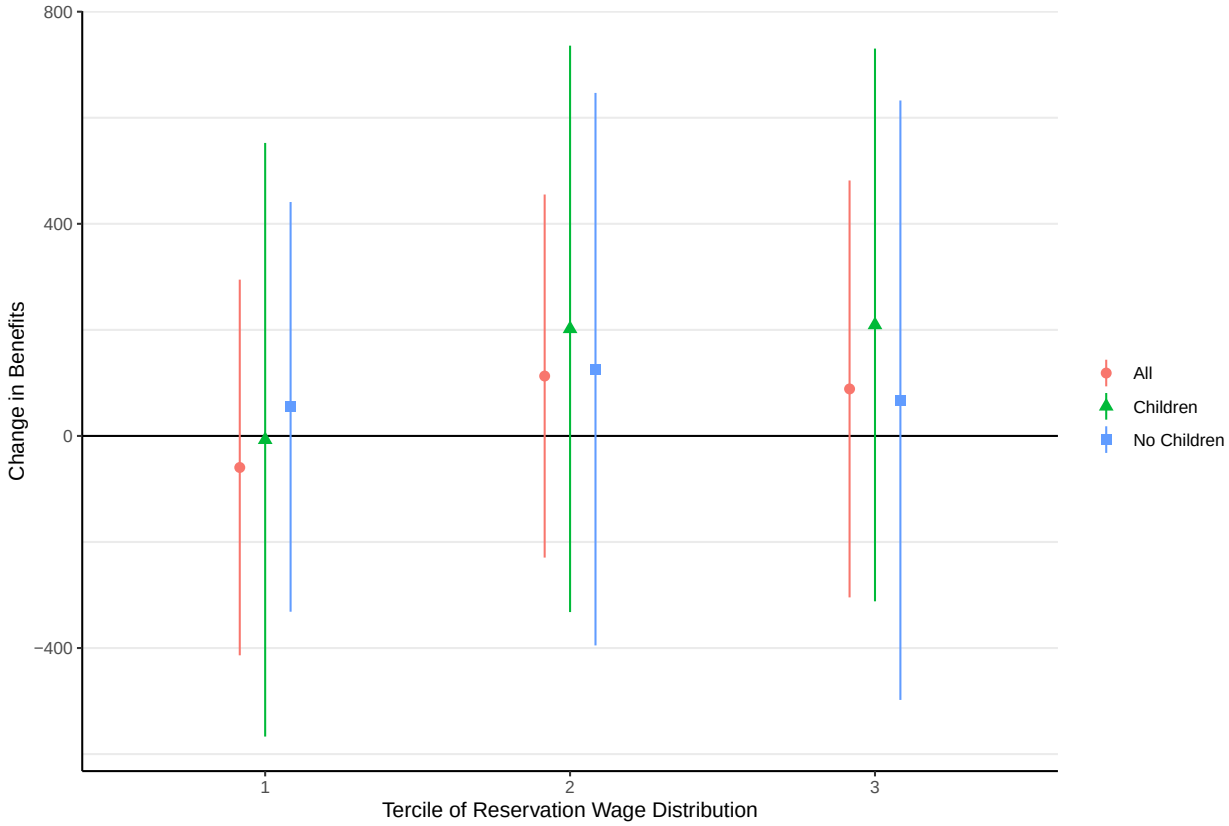
This figure plots the percent change in real reservation wages by tercile of the reservation wage distribution following the introduction of the NMW. Each point is a treatment effect estimate and the vertical bars are the estimates corresponding 95% confidence intervals. Standard errors are clustered at the TTWA level. The red circles and bars on the left of each grouping of three estimates corresponds to the pooled sample, the green triangles and bars in the middle to the sample with children, and the blue squares and bars on the right to the sample without children. Effects are estimated using a simple DiD, with one difference being across time and the other being across low and high wage regions.

Figure 12: Simple DiD Expected Wage Effect Estimates Following National Minimum Wage Introduction



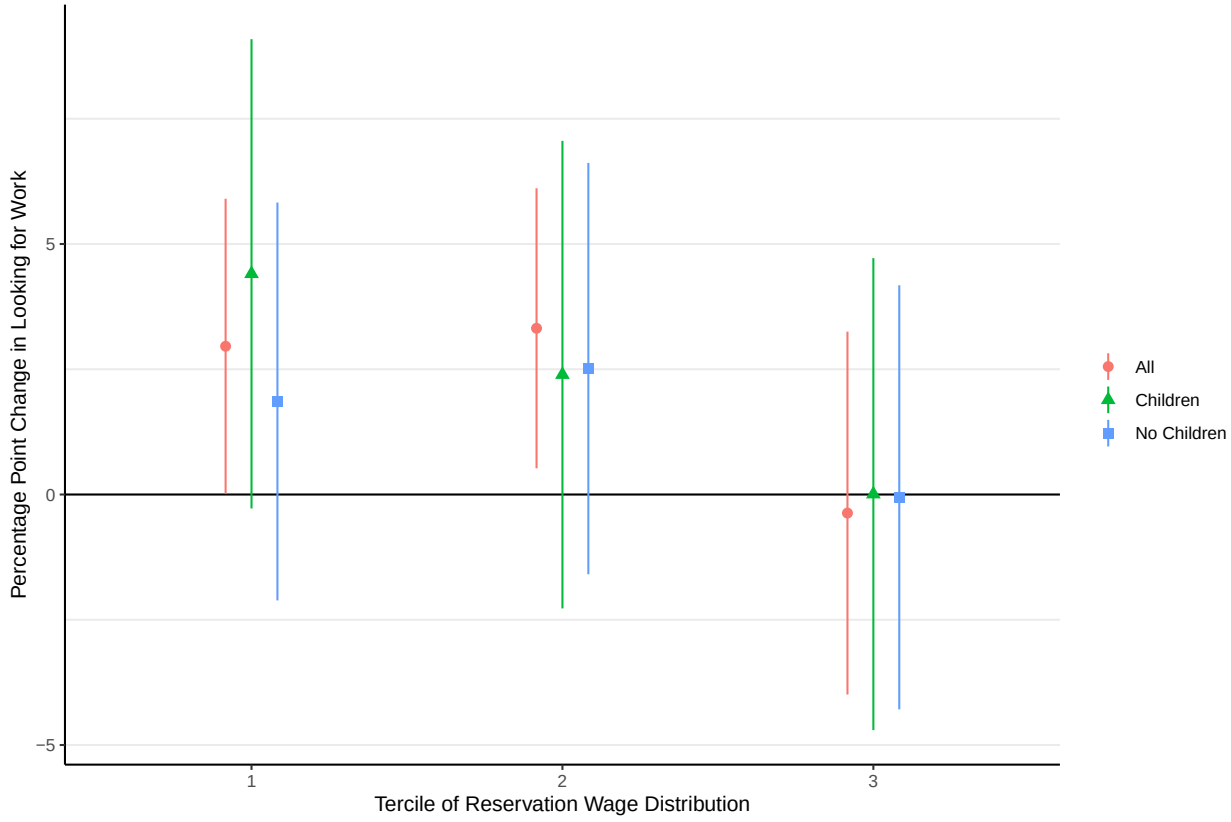
This figure plots the percent change in real expected wages by tercile of the reservation wage distribution following the introduction of the NMW. Each point is a treatment effect estimate and the vertical bars are the estimates corresponding 95% confidence intervals. Standard errors are clustered at the TTWA level. The red circles and bars on the left of each grouping of three estimates corresponds to the pooled sample, the green triangles and bars in the middle to the sample with children, and the blue squares and bars on the right to the sample without children. Effects are estimated using a simple DiD, with one difference being across time and the other being across low and high wage regions.

Figure 13: Simple DiD Change in Benefits Following National Minimum Wage Introduction



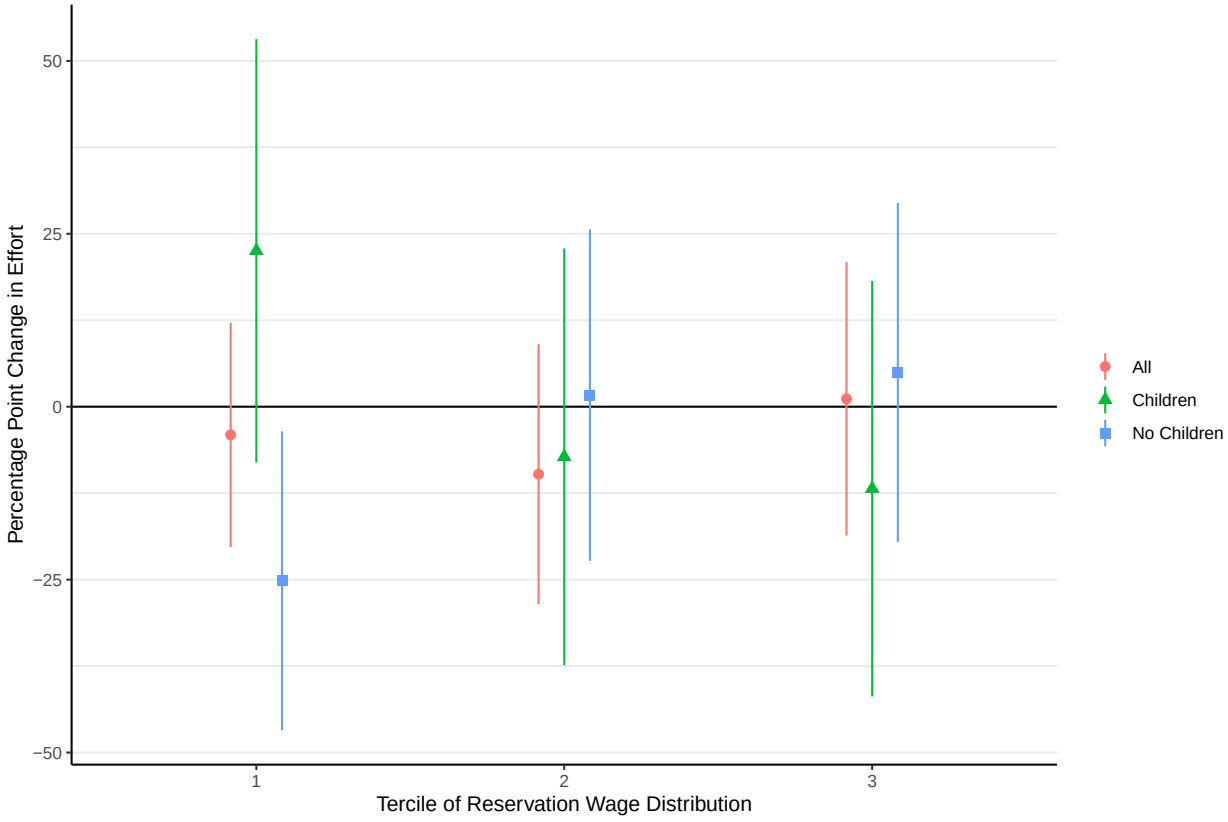
This figure plots the change in real total annual benefits by tercile of the reservation wage distribution following the introduction of the NMW. Each point is the interaction parameter estimate from a DiD and the vertical bars are the estimates corresponding 95% confidence intervals. Standard errors are clustered at the TTWA level. The red circles and bars on the left of each grouping of three estimates corresponds to the pooled sample, the green triangles and bars in the middle to the sample with children, and the blue squares and bars on the right to the sample without children. Parameters are estimated using a simple DiD, with one difference being across time and the other being across low and high wage regions.

Figure 14: Simple DiD Searching for Work Estimates Following National Minimum Wage Introduction



This figure plots the percentage point change in people looking for work tercile of the reservation wage distribution following the introduction of the NMW. Each point is a treatment effect estimate and the vertical bars are the estimates corresponding 95% confidence intervals. Standard errors are clustered at the TTWA level. The red circles and bars on the left of each grouping of three estimates corresponds to the pooled sample, the green triangles and bars in the middle to the sample with children, and the blue squares and bars on the right to the sample without children. Effects are estimated using a simple DiD, with one difference being across time and the other being across low and high wage regions.

Figure 15: Simple DiD Change in Effort Estimates Following National Minimum Wage Introduction



This figure plots the percentage point change in search effort by tercile of the reservation wage distribution following the introduction of the NMW. Each point is a treatment effect estimate and the vertical bars are the estimates corresponding 95% confidence intervals. Standard errors are clustered at the TTWA level. The red circles and bars on the left of each grouping of three estimates corresponds to the pooled sample, the green triangles and bars in the middle to the sample with children, and the blue squares and bars on the right to the sample without children. Effects are estimated using a simple DiD, with one difference being across time and the other being across low and high wage regions.

Table 4: Triple Difference-in-Differences Estimates for Main Data

	Reservation	Expected	Benefits	Search	Effort
Tercile 1	-0.880	4.330	-841.044	29.344***	-9.757
	(4.478)	(6.871)	(742.295)	(11.045)	(15.480)
Tercile 2	-0.935	0.980	155.913	25.531***	-16.551
	(4.150)	(6.318)	(957.801)	(9.803)	(17.257)
Observations	3,153	2,761	3,152	3,153	1,408

[1] This table contains point estimates and standard errors for the coefficient estimates in Figure 5 through Figure 9. This table is for the full sample, including both people with and without children.
[2] * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 5: Triple Difference-in-Differences Estimates for Sample with Children

	Reservation	Expected	Benefits	Search	Effort
Tercile 1	7.165	12.938	-1,416.542	24.896*	36.318
	(5.805)	(9.357)	(996.103)	(13.008)	(22.720)
Tercile 2	2.111	17.335	-254.363	19.160	6.787
	(5.520)	(10.624)	(1,207.799)	(13.730)	(29.489)
Observations	1,515	1,304	1,514	1,515	544

[1] This table contains point estimates and standard errors for the coefficient estimates in Figure 5 through Figure 9. This table is for the sample of people with children.
[2] * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 6: Triple Difference-in-Differences Estimates for Sample Without Children

	Reservation	Expected	Benefits	Search	Effort
Tercile 1	-2.933	3.262	189.630	19.507	-37.170*
	(7.198)	(8.793)	(1,531.283)	(14.268)	(20.462)
Tercile 2	0.673	2.673	669.540	28.300*	-1.607
	(6.009)	(8.581)	(964.747)	(15.472)	(20.522)
Observations	1,638	1,457	1,638	1,638	864

[1] This table contains point estimates and standard errors for the coefficient estimates in Figure 5 through Figure 9. This table is for the sample of people without children.
[2] * significant at 10%, ** significant at 5%, *** significant at 1%.