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Minimum Wages and Firm Value

Brian Bell

Stephen Machin

Abstract

How does the value of a firm change in response to a minimum wage hike? The evidence we have to date is not well-suited to answer this question, principally because events that have been studied are not completely unknown to the stock market or have uncertainty associated with them. This paper exploits the announcement of a sizeable change in the minimum wage in the UK that was both totally unanticipated and free of uncertainty. The stock market response of employers of minimum wage workers is examined in an event study setting, looking at minute-by-minute changes surrounding the announcement and at cumulative abnormal returns on a daily basis before and after the announcement. The analysis uncovers significant falls in the stock market value of low wage firms. The size of the fall in value is compared to the fall in profitability in response to the wage cost shock that will be induced by the announcement and is seen to be of a comparable magnitude.

Keywords: Minimum wages, firm value

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Brian Bell, Department of Economics, University of Oxford and Centre for Economic Performance, London School of Economics. Stephen Machin, Department of Economics, University College London and Centre for Economic Performance, London School of Economics.

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Houghton Street

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“We strongly support the National Minimum Wage and want to see further real-terms increases in the next Parliament. We accept the recommendations of the Low Pay Commission that the National Minimum Wage should rise to £6.70 this autumn, on course for a Minimum Wage that will be over £8 by the end of the decade.”

Conservative Party Manifesto, April 14th 2015.

“I am today introducing a new national living wage. We will set it to reach £9 an hour by 2020. The new national living wage will be compulsory. Working people aged 25 and over will receive it. It will start next April at the rate of £7.20. The Low Pay Commission will recommend future rises that achieve the Government’s objective of reaching 60 percent of median earnings by 2020.”

Budget Speech, July 8th 2015.

“I’ve talked to several chief executives and been surprised by the impact on their profits. In one [big] company, it would wipe out all of their profits”

Paul Drechsler, CBI President, September 2015.

1. Introduction

Ever since minimum wage floors were first introduced to labour markets around the world, a perennial research question of high relevance for labour market policy has been how firms adjust to wage cost increases brought about by increases in the minimum wage. The first port of call for much of the literature has been to study the labour demand response of firms, and this has at various points in time generated research and policy controversies about what minimum wage increases do to employment or unemployment.¹ As evidence of employment losses from minimum wage hikes has proven elusive in a number of settings, a smaller body of research has

¹ Surveying the (mostly US time series) literature that studied data up to the late 1970s, Brown, Gilroy and Kohen (1982) concluded that minimum wages reduced teenage employment, but had less effect on adult employment. The next phase of research were the more micro-based studies of the 1990s, spearheaded by the Card and Krueger (1994) paper on fast food restaurants and Card and Krueger’s (1995) book, which both questioned the earlier findings and found no evidence of disemployment effects. The introduction of the UK National Minimum Wage in April 1999 also generated a number of pieces of research failing to find significant employment effects (see, inter alia, Machin, Manning and Rahman, 2003, Stewart, 2002, 2004, or Dolton, Bondibene and Stops, 2015). In the US there has recently been another revival of research on minimum wage effects, with some focus on geography and differences across state borders. As before this is proving controversial on whether or not minimum wages reduce employment (see, inter alia, Dube, Lester and Reich, 2010 and 2016, Meer and West, 2015, or Neumark, Salas and Wascher, 2014).

placed a focus on looking for other margins of firm adjustment. Whilst there are many such margins, which may differ for firms operating in different sectors, some areas considered in research have been the scope to pass minimum wages on in terms of higher prices (e.g. Aaronson and French, 2007; Lemos, 2008), whether firms cut back on wage increases for other higher paid workers and so reduce wage inequality (e.g. Lee, 1999; DiNardo, Fortin and Lemieux, 1996; Dickens and Manning, 2004) and on whether minimum wage increases squeeze firm profitability (e.g. Draca, Machin and Van Reenen, 2011).

In this paper we study minimum wage effects on firm profitability in a different way from the direct before/after analysis of changes in accounting profitability that result from minimum wage changes. Instead we study the impact of the announcement of a minimum wage change on the stock market value of firms. This approach has been adopted in a couple of studies before, first by Card and Krueger (1995) who studied twenty three events in the US between 1987 and 1989 that eventually led to minimum wage increases in 1990 and 1991, and by Pacheco and Nalker (2006) who undertook an event study looking at changes in shareholder values following a significant reform to the youth minimum wage in New Zealand. Neither of these studies delivers very clear results, primarily because the nature of the ‘events’ that were examined do not allow for a clean event-study. Such a study would require a completely unexpected minimum wage change that had no uncertainty attached to its introduction. To take one example from Card and Krueger, on June 13, 1989 President Bush vetoed a minimum wage rise. The stock market reaction to this event shows no significant effect on firm value. But as Card and Krueger note, it is difficult to know whether this veto conveyed new information to the market, since the White House had promised to veto the bill

when it was first passed by the House three months earlier. And if it did contain new information, how did it change the probability of a minimum wage change?

The event studied in this paper is able to significantly improve upon such concerns. A completely unanticipated and sizable change in the UK minimum wage system was announced in the newly elected Conservative government's emergency budget that was called after its election to power in May 2015. As the quote from the budget speech of July 8 2015 reproduced at the top of the first page of this paper testifies, the Chancellor George Osborne announced that the UK government would introduce a new National Living Wage (NLW) of £7.20 per hour for workers aged 25 and over. Not only was this announcement from a right of centre government that has traditionally been against minimum wages, it was also totally unexpected, with other government ministers and the body which advises the government on minimum wages (the Low Pay Commission) not knowing that it would occur.² Thus the major advantage of our study compared to the other stock market reaction research in this area is that the announcement we study was completely unanticipated.

The event study approach has been very widely used in finance (see Kothari and Warner, 2008, or MacKinlay, 1997), but it has also been used by labour economists in several settings, most notably as a means of studying the effects of unions on firm performance.³ The seminal paper studying union effects on stock market values was by Ruback and Zimmerman (1984) whose event study of union representation elections uncovered evidence of a negative effect of union wins on the equity value of US firms. Subsequently, Bronars and Deere (1990) uncovered similar effects while Lee and Mas

² The BBC News reported that day as follows: "In a surprise announcement at the end of his speech, he said workers aged over 25 would be entitled to a "national living wage" from next April, to soften the impact of in-work benefit cuts." <http://www.bbc.co.uk/news/uk-politics-33437115>

³ Another example of event studies in labour economics is Farber and Hallock's (2009) analysis of the stock market value effects of job loss announcements.

(2012) used a much larger sample and wider time window to find a longer run impact of unions on firm value. These union papers usefully inform the research design we adopt in our event study, but in the different setting of minimum wage changes.

In this paper, the differential stock market response of employers of minimum wage workers is compared to that of employers of higher wage workers in an event study setting looking at minute-by-minute changes surrounding the announcement and at cumulative abnormal returns in the days before and after the announcement. There is evidence of significant falls in the stock market value of low wage firms. Within a day of the budget, firm values were around 1.2 percent lower for the employers of minimum wage labour and ended up stabilizing around 2 to 3 percent lower after five days. Much of this adjustment was rapid and had happened within a couple of days. The size of the fall in firm value is compared to the fall in profitability in response to the wage cost shock that will be induced by the announcement and is seen to be of a comparable magnitude.

The remainder of the paper is structured as follows. In Section 2, the relationship between minimum wages and profitability is first considered, followed by a discussion of the system of minimum wages that operates in the UK and then how this has altered following the introduction of the new National Living Wage. Section 3 describes the data and event study methodology. The results are discussed in Section 4, and Section 5 offers some concluding remarks.

2. Minimum Wages, Profitability and the New National Living Wage

Minimum Wages and Profitability

For a competitive profit maximizing firm employing L workers at wage rate W , using other factors of production at price R and selling its output at price P , profits are

maximized at $\Pi(W, R, P)$. For such a firm, the derivative of the profit function with respect to the wage rate is $\partial\Pi/\partial W = -L(W, R, P)$, the negative of the demand for labour and the second derivative is $\partial^2\Pi/\partial W^2 = -\partial L/\partial W$. The introduction of a minimum wage at a level M , above the prevailing wage W , reduces firm profits by $\Delta\Pi = \Pi(W, R, P) - \Pi(M, R, P)$.

Following Ashenfelter and Smith (1979), this can be approximated as:

$$\Delta\Pi \cong -L\Delta W + \frac{1}{2} \frac{\partial L}{\partial W} (\Delta W)^2 \quad (1)$$

where $\Delta W = M - W$.

The first term on the right-hand side of (1) is the wage bill effect on profits ($-L\Delta W$) and the second can be thought of as the labour demand ($\frac{1}{2} \frac{\partial L}{\partial W} (\Delta W)^2$) effect on profits. Equation (1) can be rewritten as:

$$\Delta\Pi = -WL \left(\frac{\Delta W}{W} + \frac{\eta}{2} \left(\frac{\Delta W}{W} \right)^2 \right) \quad (2)$$

where $\eta = \frac{W}{L} \frac{\partial L}{\partial W} < 0$ is the elasticity of labour demand.

Equation (2) offers a means of thinking about the profit response of a firm to a minimum wage hike. If there is “no behavioural response”, which in this setting means no impact on labour demand, the second order effect in (2), $(\frac{\eta}{2} \left(\frac{\Delta W}{W} \right)^2)$, is zero. The fall of profits that would result from the imposition of a minimum wage M is equal to the proportionate change in the wage multiplied by the wage bill.

If adjustment can occur, then the labour demand effect in the second term is non-zero. This can offset the profit loss to the extent that firms can substitute away from low-wage workers into other factors (e.g. capital). One interesting question is the speed at which such adjustment could occur. In the event study setting of the empirical work in this paper, this is particularly interesting when one attempts to gauge the size of the

profit reduction from a change in market value (which is the present discounted value of firm profits).⁴

Other models focus on the particular mode of adjustment to the wage cost shock from a higher minimum wage. In Aaronson and French (2007), for example, firms have constant marginal costs and thus a horizontal supply curve and so, irrespective of the nature of competition in the product market, the minimum wage increase is passed on entirely to consumers in the form of higher prices. In putty-clay models (like Aaronson, French and Sorkin, 2015) the same is true.⁵ Some other alternatives to adjusting prices that allow the firm to negate the negative impact on profits include compression of the internal wage structure, efficiency wages/productivity improvements and conventional labour demand responses (see, for example, Hirsch, Kaufman and Zelenska, 2015).

Equation (2) also usefully illustrates the inverse relationship between a firm's initial wage and the profit change. It shows that, the lower the initial wage, then the greater the fall in profits associated with the imposition of a minimum wage. This logic underpins what we do in our empirical work where we focus on the stock market response of employers of minimum wage workers in an event study setting. The means by which we define firms that employ minimum wage workers is considered in Section 3 of the paper where we also describe the data that we use.

Minimum Wage Setting in the UK

A National Minimum Wage (NMW) was introduced to the UK labour market in April 1999. Prior to that, minimum wages did not play a role in wage determination

⁴ See also Abowd's (1989) classic study of union wage increases and firm performance. Abowd estimates a version of equation (2) examining the effects of unanticipated increases in the wage bill (which he defines as union wealth) on the present discounted value of profits as reflected in changes in stock market values (or shareholder wealth). Interestingly, the findings are unable to reject the simple no behavioural response model where the second order effect is zero.

⁵ See also Sorkin (2015) who emphasises the distinction between modes of adjustment in the short and long run.

as the system that used to operate (the Wages Councils who set sectoral minima in low wage sectors, only covering about 10 percent of UK workers) had been abolished by the Conservative government in 1993 (Dickens, Machin and Manning, 1999).

The rate at which the National Minimum Wage was introduced was determined by a body set up by the Labour government which was elected in May 1997. The Low Pay Commission (LPC) was instituted as an advisory body by the National Minimum Wage Act of 1998. The LPC has nine Commissioners, three of which are from business, three of which are from employee representation groups, and three are members who are independent from the social partners. These last three are the Chair and two academics who are experts in labour economics and industrial relations.

The LPC remit is set by the government each spring, with a main focus on coming up with evidence-based recommendations on the main adult minimum wage rate and the associated age-specific minima. The LPC assesses evidence from a wide range of sources (e.g. academic research, site visits, an annual consultation procedure with oral evidence taken from a wide range of stakeholders). It then makes recommendations in a report submitted to government in February, to which the government responds on acceptance or rejection of the recommendations, and then if accepted (as the main adult rate always has been since introduction) the NMW is updated on October 1st.⁶

Figure 1 shows the rates from 1999 to 2015. In April 1999 the National Minimum Wage was first introduced at a rate of £3.60 per hour for workers aged over 21, together with a youth development rate at £3.00 per hour for 18-21 year olds. Through time more rates have been introduced: in 2004 a minimum wage for 16-17

⁶ For more detail on the functioning of the LPC see Brown (2002), Butcher (2012) and Metcalf (1999, 2002).

year olds was introduced, and an apprentice minimum wage in 2010. Also in 2010 the adult rate was extended to 21 year olds, so that by 2015 there were four rates in place: the adult minimum (now for those aged 21 and over) which had reached £6.70 by October 2015; the youth development rate for 18-20 year olds of £5.30; the rate for 16-17 year olds of £3.87; and the apprentice rate of £3.30.⁷

In many quarters, the operation of the LPC has been deemed a success. The Institute of Government's 2010 polling of 159 members of the Political Studies Association rated the NMW as the most successful government policy of the previous thirty years.⁸ This reflects the evidence-based approach leading to little in the way of employment losses from the NMW, and the independence of the LPC in being able to make its deliberations largely free from political intervention.

The New National Living Wage

After being in a coalition government with the Liberal Democrats as the UK government in power between May 2010 and 2015, the Conservative party was elected outright in the May 2015 election. It called an emergency budget for July 8 2015 and in this budget the Chancellor George Osborne made the completely unexpected announcement of introducing a new National Living Wage that would raise the NMW for age 25 year olds and older workers by 50 pence from April 2016. The main reason for this was to offset the tax credit cuts that the Chancellor introduced in the budget in his strong programme of austerity cuts.

⁷ The UK government has almost always accepted the LPC's recommendations on rates. This has always been true for the recommendations adult, development and 16-17 year old rates. The recommendation on apprentice rates has twice been met with a government instituted change: first in 2011 when the LPC recommended a freeze of the rate but government intervened to increase it by 5 pence; then more markedly in 2015 when the LPC recommended raising the rate by 7 pence from £2.73 to £2.80 as the business secretary pushed the rate a further 50 pence up to £3.30.

⁸ See: <http://www.bbc.co.uk/news/uk-politics-11896971>.

From a political economy perspective, this is a striking and radical intervention. It comes from a political party that has traditionally been strongly against minimum wages and, indeed, which strongly opposed the introduction of the NMW in the first place. The very poor real wage performance of most workers in the UK labour market since 2008 (when median real wages have fallen by around 10 percent, but such falls are seen across most of the wage distribution as well) has altered this standpoint to some extent.⁹ It is true that all of the main UK political parties (including the Conservatives) have recognised that minimum wages are both popular amongst the general public and that they can play a role in raising wages (and by association living standards).¹⁰

The surprise of the budget announcement and the size of the wage shock is what we exploit in our event study of the impact on the stock market value of firms.¹¹ The 50 pence NLW supplement on adult minimum wages came as a complete surprise to the market. The Chancellor also introduced a target level for the adult minimum wage of £9 per hour to be reached by 2020. This was also news to the stock market, as the Conservative Manifesto before the May 2015 election (quoted at the start of the paper) was clear in the aspiration of reaching £8 per hour by that date.

The introduction of the NLW also alters the role of the LPC in its future deliberations, as it now has a target to work to. In practical terms the government intervention has also effectively introduced a new age band into the structure of minimum wages that operate for low wage workers in the UK. This is shown in Table

⁹ See Blundell, Crawford and Jin (2014) and Gregg, Machin and Fernandez-Salgado (2014) for more detail on the nature of real wage falls in the UK labour market.

¹⁰ On the popularity of the UK minimum wage, a 2014 Gallup poll reported that 66 percent of those polled were in favour of increasing the minimum wage.

¹¹ In addition to being unanticipated, we noted earlier that a key additional requirement for a successful event study, particularly when trying to evaluate the size of any estimated effect, is that there be no uncertainty over the introduction of the new minimum wage. The announcement considered in this paper satisfies that requirement because the 1998 National Minimum Wage Act gives Government Ministers the power to set the minimum wage without reference to the LPC. The Government confirmed in writing to the LPC on Budget Day that such an order would be made.

2 where the new structure of minimum wage rates that will apply from 2016 is compared to those of 2014 and 2015.

The new NLW also offers an ‘experiment’ not made possible by previous increases in the minimum wage coming from the LPC recommendations. In due course, it will be interesting to study the employment and other economic effects of this big increase, of 10.8 percent compared to the £6.50 rate at the time of the announcement, or of 7.5 percent compared to the already accepted LPC rate of £6.70 that was made effective after the budget in October 2015. By 2020, the targeted minimum wage of £9 is 12.5 percent higher than the £8 level that had previously been suggested.

As a result of the minimum wage changes and 2020 target, the number of workers in the UK labour market who are covered by the minimum is expected to rise significantly. Figure 2 shows actual coverage from 1999 to 2014 and expected coverage from 2015 onwards (defined as the number of workers paid at or below the relevant minimum and up to 5 pence above). There is a significant increase resulting from the change. In 2015 before the change the number of covered workers had risen gradually to reach 1.6 million by 2015. Afterwards, due to the new NLW of April 2016 and the 2020 target, there is a sharp increase, straight away jumping to over 2.5 million, and reaching 3.8 million by 2020.

3. Data and Modelling Approach

Data

The equity price data come from Datastream and Bloomberg. The principal sample frame is made up of the constituents of the FTSE All-Share Index. This index comprises eligible companies listed on the London Stock Exchange main market that pass screenings for liquidity and investability. The index captures 98 percent of the UK’s

market capitalization. There are 643 constituents of the index, with a mean (median) market capitalization of £3.1bn (£599mn).

We exclude from our analysis all investment trusts and private equity funds, giving a final sample of 442 firms. We have daily prices, total returns and volume. We also extract daily data on market capitalization, dividend yield and the price-book ratio. Trade-level data for the announcement date are taken from Bloomberg. These data contain the price, volume and exact time of every trade during the official trading day (8am to 4.30pm). We use this data to compute the volume-weighted price for each stock by minute of the trading day.

Treatment Firms

To estimate the effect of the increase of the minimum wage on firm market values, we need to construct a sample of firms that are exposed to the treatment. We first follow the approach of Draca, Machin and Van Reenen (2011) by using accounting information on the average wage of the firm to sort firms. The annual accounts report the total wage and salary costs for the firm and the average number of employees. This gives us a measure of the average annual wage per employee. Since the new minimum wage is set at £7.20, a worker who is employed full-year full-time would earn £14,976.

We therefore identify the quoted firms in our sample who are expected to be affected by the minimum wage announcement on the basis of their average wage per employee being less than £15,000 per year. The strength of this identification approach depends on the extent to which minimum wage workers are concentrated in firms at the lower end of the wage distribution. Unfortunately, firms are not required to report any information on the distribution of wages within the firm, only the average wage.

To therefore assess the usefulness of the approach we adopt, we study a different data source looking at the segregation of wages across firms in the UK using the 2013

cross-section of the Annual Survey of Hours and Earnings (ASHE) and the Annual Business Survey (ABS). These are matched worker-firm level data that allows us to look at within-firm wage distributions and explore the association between average wages and the intensity of low-wage workers. We have a sample of 62,594 workers (and 7,795 firms) employed in the private sector who can be matched to firm-level data that includes the average wage per employee.

We follow the Low Pay Commission procedure of defining a minimum wage worker as any worker who receives an hourly wage (excluding overtime) that is up to five pence above the minimum wage effective at the time of the survey (April 2013). Overall, 6.2 percent of our sample are minimum wage workers. This is very similar to the 7 percent figure reported for all private sector workers in the UK in the 2014 Low Pay Commission report (page 22). Our final restriction is that firms must employ at least 100 workers and have an average wage of at least £5,000. These two sample restrictions reduce our sample to 59,535 workers (and 5,853 firms), but the share of minimum-wage jobs remains at 6.2 percent.

In Figure 3, we plot the proportion of minimum-wage workers in a firm against the firm's average annual wage for those firms with an average wage below £30,000 (40,046 workers in 3,684 firms). We split the sample into vigtiles of the average wage, with a sample of 186 firms in each bin. There is clearly a strong decline in the proportion of minimum-wage workers as the average wage rises. Only for those bins to the left of the £15,000 cutoff are at least 10 percent of the workforce on the minimum wage. On average, 21 percent of workers in firms with an average wage of less than £15,000 are minimum-wage workers. Alternatively, one can note that 75 percent of minimum-wage workers work in firms that have average annual wages of less than £15,000.

These figures underestimate the impact of the minimum wage on our equity sample, because they reflect the average share of minimum-wage workers across all industries. Our equity sample however is heavily focused on two particular industries (see the list of firms and their sectors in the Appendix), namely non-specialised Retail Trade (47190) and Beverage Serving activities (56302). As Table 2 shows, if we further restrict the ASHE/ABS sample to only include these two industries, we have a sample of 2,924 workers (and 84 firms). In these industries, 30.3 percent of workers in firms with an average wage of less than £15,000 are minimum-wage workers.

We also require that the firm has a majority of its employees based in the UK. Some of the low average wage firms are predominantly operating in low-wage economies, but have chosen to list on the London stock exchange. Clearly these firms are not affected by the UK minimum wage. Our final sample of NMW firms comprises the twenty companies that are listed (grouped by sector) in the Appendix. Together, these 20 firms employ over 600,000 workers.

Event Study Method

We follow the by now standard approach in the finance literature to estimate the effect of the minimum wage change on a firm's equity value. We compute the abnormal return as the difference between a stock's actual return and the expected return. For firm i at time t , the abnormal return is simply:

$$AR_{it} = r_{it} - E[r_{it}|X_t]$$

where r_{it} is the actual realized return and $E[r_{it}|X_t]$ is the expected return, with X_t denoting the information set at time t .

We consider a number of alternative specifications for $E[r_{it}|X_t]$. Perhaps the most common approach is to use the Capital Asset Pricing Model (CAPM) to estimate the sensitivity of the i th firm's return to a market index (i.e. X_t is the market return) and

use the predicted values as an estimate of the expected return. This approach is adopted by Ruback and Zimmerman (1984), Card and Krueger (1995) and Lee and Mas (2012).

To implement this, we estimate a daily return model of the form:

$$r_{it} = \alpha_i + \beta_i r_{mt} + \epsilon_{it}$$

where r_{mt} is the return on the equal-weighted FTSE All Share index. The market model is estimated over a twelve-month period up to the 15th April 2015, which is 60 days prior to the minimum wage announcement. The abnormal return from the CAPM model is then simply:

$$AR_{it} = r_{it} - (\hat{\alpha}_i + \hat{\beta}_i r_{mt})$$

It is well-known however that the cross-section of stock returns can be predicted by more than simply the market return (Fama and French, 1992). We therefore also present results using a four-factor model for expected returns that includes the market return, a size return based on market capitalization, a value return based on dividend yield and a momentum return.¹²

One further factor that could affect our results is that firms with sizeable minimum wage exposure tend to be heavily distributed in certain industries that employ more low wage workers such as retail, hotels, restaurants and bars. Evidence suggests that stock returns have an important industry component (Moskowitz and Grinblatt, 1999; Fama and French, 1997) and if, by chance, these particular industries experienced abnormal returns relative to the market since the announcement date for reasons unrelated to the minimum wage, we would ascribe those returns to the minimum wage

¹² For the four-factor model, we estimate each factor return by allocating all stocks in the FTSE All-Share index into (a) a large, medium and small-cap portfolio based on the 30th and 70th percentile rank on the previous trading day, (b) a high, medium and low dividend yield portfolio based on the 30th and 70th percentile rank on the previous trading day and (c) a high, medium and low momentum portfolio based on the 30th and 70th percentile rank on the previous trading day of returns over the period 126-21 days prior to the ranking. We then generate daily factor returns by taking the difference between the two extreme portfolios for each factor. See Dube, Kaplan and Naidu (2011) for another example of an event study using factor models.

announcement. The expected return definition used above will not account for this. We therefore also construct two-digit SIC industry returns (excluding the minimum wage firms themselves) and use these as our measure of expected returns. So in our main results we consider estimates of abnormal returns from three alternative models: (1) the CAPM, (2) a four-factor model and (3) a 2-digit industry model.

4. Results

In this section we discuss the results of our analysis. We begin by presenting minute-by-minute evidence to demonstrate the strong reaction of our minimum wage sample to the exact announcement time of the minimum wage increase. We then examine the subsequent daily abnormal returns. Finally we present evidence from a regression model that suggests a significant ability of the market to isolate minimum wage firms from other, arguably similar, firms.

Intra-day Announcement Effect

The Chancellor of the Exchequer began the Budget statement at 12.33 on July 8th. At 13.35, he announced the decision to raise the minimum wage, one hour and two minutes into the speech. He concluded the speech four minutes later, at 13.39. We can therefore exploit the intra-day price change in our sample to examine whether there was any difference in returns between the NMW firms and the non-NMW firms prior to the announcement time (13.35) and whether there was a subsequent divergence. We have minute-by-minute data on the trade price and volume traded of each stock. We present results for both the equal-weighted index of NMW firms and a value-weighted index that accounts for the very different trading volumes that are present in the intra-day data.

To motivate the analysis, Figure 4 shows minute-by-minute share price moves for three low wage firms from the market open on budget day to 24 hours after the NLW announcement. The three firms are a retail firm Home Retail Group, a pub JD Wetherspoon and a hospitality firm The Restaurant Group. In all three cases, there is a marked dramatic drop in their share prices at the precise time that the minimum wage announcement was made. The initial drop within half an hour was of the order of 2-3 percent and was broadly sustained for the rest of the trading day. On market opening at 8:00 AM the next day, the pub JD Wetherspoon took another hit dropping a further 2 percent, presumably as the market had more time overnight to absorb and assess the information contained in the announcement.

Analysis of the whole sample of NMW firms is provided in Table 3. Panel A gives the minute-by-minute cumulative abnormal returns ($CAR(X, Y)$) for the NMW stocks from the time of announcement ($X = A$) over the subsequent Y minutes. In Panel B we report the pre-announcement returns. The abnormal returns are calculated for a market model (i.e. adjusting returns for the overall market return over the same period) and for the two-digit industry model. The first two columns of results use equal-weighting, whilst the final two columns are value-weighted. Figure 5 displays the cumulative raw returns to the NMW and non-NMW stocks from the beginning of the trading day to 24-hours after the announcement, while Figure 6 shows the equal-weighted abnormal return for the NMW stocks. The 95 percent confidence interval around the mean abnormal return is also shown for the latter.

For the pre-announcement effects, there are two key points. First, there was essentially no trend in the market in the hours prior to the Budget and no significant difference between the NMW and non-NMW stocks. Second, all of the Budget announcements prior to the minimum wage announcement had very little effect on

market prices and almost no effect on the relative performance of the two groups of firms.

From 13.35 onward, the picture is very different. There was a sharp fall in the price of NMW stocks. One hour on from the announcement, the NMW firms on average experienced a fall of as much as 69bp relative to the market on an equal-weighted basis, and 176bp on a value-weighted basis.¹³ Although these effects weaken as the trading day finished, all observations on the average abnormal returns of the NMW firms are negative from the announcement time. Moreover, on market opening the day after budget day, the gap significantly widens again as Figures 5 and 6 make very clear, so that 24 hours after the NLW announcement the fall in cumulative abnormal returns is around 1.2 percent. Overall, we take this as strong evidence that the decline in NMW prices relative to non-NMW prices occurred as a direct result of the minimum wage announcement and was not as a consequence of other Budget changes (or indeed other events in the market).

Before we move on to consider the results on the evolution of daily cumulative returns, it is interesting to look at the minute-by-minute pattern for the day before (7th July) and up to minimum wage announcement. We do this so as to both undertake a placebo-type experiment and to see whether there was any general pre-announcement trend in the NMW abnormal returns. Figure 7 plots the equal-weighted abnormal returns for the NMW firms, together with 95 percent confidence intervals. The Figure makes it very clear that at no point were the pre-announcement day abnormal returns significantly different from zero (relative to the same time of day as the announcement on the 8th).

¹³ Note that the smaller equal-weighted as compared to value-weighted returns simply reflect the fact that stocks that were traded less actively had more positive returns than the more actively traded stocks.

Cumulative Abnormal Returns

Having demonstrated an intra-day response to the minimum wage announcement, we now turn to consider daily cumulative abnormal returns from the announcement day onward. We compute these equal-weighted cumulative abnormal returns from day X to day Y as $(CAR(X, Y) = \sum_{t=X}^{t=Y} AR_{it})$. So for example denoting $X=A$ as announcement time, $CAR(A, 10)$ measures the cumulative abnormal return on the NMW stocks for the post-announcement part of Budget day and the first ten trading days from then. We use three expected return models: (1) the CAPM model, (2) a 4-factor model and (3) a two-digit industry-matched model.

Table 4 presents the key results for the mean CARs, whilst Figure 8 plots the CAR (using the industry-matched model for returns) with associated 95 percent confidence intervals for the 10 days either side of the announcement. Panel A of the table gives post-announcement returns for a one-, two-, three-, four-, five-, and ten-day horizon, while Panel B reports the pre-announcement returns for corresponding horizons in the pre-Budget period. We study daily returns for a 10-day window since the announcement is clear and public, so we would expect the market to re-price reasonably fast. Longer horizons are increasingly likely to bring in other events not related to the NLW that may shift abnormal returns differentially for treatment and control firms. We do however comment below on estimated CARs for up to three months after the announcement.

The decline over the announcement day and the following day, $CAR(A, 1)$, is in the range -1.4 to -1.7 percent, depending on the expected return model we adopt. Over the five-day period, the decline is between -2.1 percent and -3.0 percent. At this point, the decline seems to have stabilized, since there is at most an additional 20bp decline over the subsequent five days. This suggests that the market reacted quickly to

the announcement, with around one-half to three-quarters of the adjustment occurring by the end of the first-day after the Budget. All the estimated negative cumulative returns are statistically significant at the 5 percent level or better.

Panel B shows weak evidence that the NMW firms outperformed over the pre-announcement period, though none of the CARs are statistically significant. This suggests that if anything the results may slightly underestimate the effect of the minimum wage announcement, since we know that stocks tend to have momentum over these holding-period horizons (see Jegadeesh and Titman, 1993).

As already noted, other events may start to impact the estimated CARs as the time window is extended further. That said, when we did widen the window and estimate a twenty- and sixty-day CAR, we obtained estimates (and associated standard errors) of -2.919 (1.884) and -3.968 (3.755) for the industry-matched model. The significantly reduced precision of these estimates is not at all surprising, but the magnitude does show that the significant fall experienced within the first few days of the announcement appears to be permanent.

Possible Small Sample Issues

As with other event studies, small sample issues may lead to possible biases. The first concerns the relatively small number of firms in the treatment group and the volatility of returns for some of the less traded firms. To consider this, we have therefore also estimated CARs for the median firm at each horizon and by trimming the two highest and lowest CARs within the sample of twenty firms in the same way as the mean regressions in Table 4. The results for the five-day horizon are reported in Table A1 in the Appendix. All these alternative approaches continue to show significantly negative effects – though the point estimates are somewhat less negative in general. We also find that 15 of the 20 firms in the NMW portfolio have a negative abnormal return

five-days after the announcement (regardless of expected return model). Using 18 months of pre-announcement data, we find that for this sample of 20 firms, such a large number of negative returns across the portfolio lies outside the 95 percent confidence interval.

A second issue is that the distribution of cumulative abnormal returns may not be normally distributed as assumed. We therefore also undertook a non-parametric analysis where we estimated CARs in an estimation window that predates the NLW announcement. As one example of this, we estimated five-day industry-matched CARs based on daily data from September 2013 through April 2015 and considered their distributions. The 5th percentile CAR was -1.59 and the 95th percentile CAR was +1.73; the 1st percentile was -2.67 and the 99th percentile +2.34. We can then ask, given how this specific portfolio of stocks moved over the last two years, how likely is it that over a five-day window they would decline by the size of our estimated CAR of -3.047. This has an empirical p -value of 0.002. In general, these empirical confidence intervals broadly matched the standard confidence intervals used in Table 4.

Regression Based Analysis

In a final analysis of the returns data, we examine the cross-section of all post-announcement abnormal returns for the full sample of 442 firms. We are interested primarily here in whether there is evidence to suggest that the market was able to accurately identify the firms most at risk from the minimum wage rise and whether our identification approach to minimum-wage firms is plausible given the market response.

Table 5 reports some regression results for this cross-section of returns for the five-days following the announcement (results that prove qualitatively similar for ten-day returns are given in Appendix Table A2). We use the CAPM model to estimate expected returns, but the results are robust to using any of the alternative return models

considered before. In column (1) we simply report the coefficient on a dummy if the firm was in our NMW sample. The coefficient of -2.131 on this dummy is of course equal to the mean abnormal return after five-days reported in the first column of Table 4. In column (2) we additionally add controls for 2-digit industry, market-capitalization size quintile and pre-announcement returns. These controls marginally increase the size of the estimated negative effect for the NMW firms to -2.331.

In column (3) we consider whether the negative cumulative returns for the NMW sample are merely a result of a more general decline for lower-wage firms. Since we use the cutoff of less than £15,000 average wage to identify the NMW firms, we consider whether firms in the £15-20k, £20-25k and £25-30k average wage bracket experienced any similar pattern (with £30k+ being the omitted group). There is no evidence to support this idea, suggesting that the market focused closely on the lowest-wage firms.

In column (4) we divide the NMW sample into two equal-sized groups of 10 firms. One group, NMW High π Impact, are those firms in which the mechanical percentage reduction in pretax profits from a 4 percent rise in the wage bill (the estimated effect of the minimum wage hike for the average firm in our sample – see below) is above the median, and the second group, NMW Low π Impact, are those for which it is below the median. We would expect the cumulative abnormal returns to be more negative for the NMW High π Impact group, and this is exactly what we find. Indeed one cannot reject that the entire abnormal return decline is a result of the declines for these firms, though the point estimate is negative for the NMW Low π Impact firms as well.

Table 6 further refines the analysis, looking at a minimum wage exposure variable that we were able to match to our firms from the ASHE and ABS data described

above. This measures the actual proportion of workers paid the National Minimum Wage in April 2013, and is defined for 275 of the original 442 firms (and 19,441 workers). We lose firms for two key reasons. First, some firms are listed on the London Stock Exchange but the holding company is not UK-domiciled. These firms do not appear in the ABS as the sampling frame is only UK-registered companies. We lose 99 companies as a result. Second, as the ASHE wage data is only a 1 percent sample, some firms do not have any workers recorded in the data. For each firm that we can match, we compute the minimum wage exposure (NMW Exposure) by calculating the percentage of workers that had an hourly wage no more than 5p higher than the October 2012 minimum wage rate of £6.19. The advantage of this measure is that it captures the full range of minimum-wage exposure for all firms, rather than just focusing on 20 firms.

Columns (1) and (2) of Table 6 report the regression of 5-day abnormal returns after the national living wage announcement on this exposure variable (Table A3 in the Appendix reports results for 10-day returns). It should be noted that the results in Table 5 are replicated almost exactly if we re-estimated on the reduced sample of 275 firms. The exposure variable is significantly negative, so that firms with a higher proportion of minimum wage workers experience a larger decline in value following the announcement. Taking the coefficient in column (2), the results suggest that firms with a 10 percentage point higher fraction of the workforce employed on the minimum wage experienced a 62bp additional decline in stock price following the announcement.

We also define a dummy variable equal to 1 if the firm is one of the 20 firms with the largest estimated minimum wage exposure. Columns (3) and (4) show

regression results for this dummy variable.¹⁴ The estimates are very similar to those in Table 5, which suggests that the results we have established are robust to reasonable alternative definitions of the particular constituents of the portfolio of NMW stocks.

Impact on Profitability

Consider the sample of firms that have an average wage of less than £15,000 in the matched worker-firm data discussed in Section 3. We noted above that for the two principal industries in our equity sample, 30 percent of workers in these firms are minimum-wage workers. To evaluate the impact of a minimum-wage hike for these firms, we start by noting that for the low-wage firms in these industries, minimum-wage workers account for 21 percent of the wage bill. This of course is lower than their share of employment since they are by definition the lowest paid workers in the firm. So the simple direct effect of increasing the minimum wage by 10 percent for these workers would generate a wage bill rise of 2.1 percent.

But this calculation ignores two additional effects. First, all workers currently above the minimum wage but who would fall below the new minimum wage, must have their wages raised to at least the new minimum. 27 percent of workers are in this group, and to raise their wages at least to the new minimum adds an additional 1.3 percent to the wage bill, giving an overall increase of 3.4 percent. Second, it is usually assumed that workers seek to protect their relativities following a minimum wage increase. A simple method of capturing this is to assume that workers on the old minimum wage get the full 10 percent increase and that all workers within 20 percent of the old minimum receive some wage increase on a smoothly-sliding scale that maintains wage rank order, places everyone at least at the new minimum and tapers the minimum wage

¹⁴ This sample of 20 firms therefore differs somewhat from that used in the results in Table 5 which are based on the average wage in the firm (from the company annual report).

effect to vanish for all workers with wages already above 10 percent of the new minimum. This gives a total wage bill increase of 4.1 percent. We would argue that this suggests a fairly tight bound on the wage bill effect of the increase, for the average firm in our sample, to be between 3 and 4 percent.

How reasonable is this calculation? Perhaps the best evidence comes directly from one of the firms in our NMW sample. Next plc (a large clothes retailer) released its half-yearly report in September 2015. They provided a detailed calculation of the impact of the NLW on their wage bill. By 2020, the firm estimated that the wage bill would be £27m higher as a result of paying the NLW (including the associated costs of maintaining relativities) on a total wage bill of £720m, or 3.8 percent.

Table 7 calibrates the impact of this scale of wage bill shock on firm profits. We use data from the last three Annual Reports of the 20 firms in our equity sample. All these reports predate the minimum wage announcement. We normalize sales to be 100 and compute the average for each firm of the wage bill and pre-tax profits. The figures in column (1) report the baseline. On average, the wage bill is equal to 18.6 percent of total sales and the pre-tax profit equals 6.0 percent. This is a relatively low profit margin, though is common for firms in these sectors. We focus on pre-tax profits because we assume that any hit to the wage bill feeds through all the profit measures e.g. firms cannot for example alter their financing costs to offset the wage bill rise. With a real interest rate of 3 percent, a pre-tax profit of 6 gives a present value of 200.

Now consider a rise in the minimum wage of 10 percent (the average rise over the next four years) that raises the wage bill by 4 percent (column (2)). Assuming no offsetting effects, pre-tax profits fall by 12 percent. If this rise in the wage bill is permanent (i.e. no subsequent reduction in the minimum wage) and there are no offsetting effects, the present value of the firm drops by 12.4 percent to 175.2.

Alternatively, suppose that the firm takes the hit in full for five years but then successfully generates fully offsetting effects elsewhere on the income statement. Then firm value declines by 1.6 percent.

We can also evaluate the size of the response in terms of variable exposure to the minimum wage. We reported in Table 6, that a firm with a 10 percent higher share of minimum-wage workers experienced an additional estimated 62bp fall in value. In the final column of Table 7, we show that a firm employing 40 percent minimum wages workers (10 percentage points above the baseline), would experience a decline in present value of 17 percent. Again assuming full offset in the medium-run, the drop in firm value is predicted to be 2.3 percent, 70bp more than for the baseline firm. This very closely matches the estimate from our empirical analysis.

Whilst these numbers are inevitably somewhat back-of-the-envelope, they do suggest that the size of the effect we have estimated in our empirical work (a 2-3 percent decline) is consistent with the market believing that firms will be able to significantly offset the costs of the minimum wage, at least in the medium term. Crucially, our estimates are inconsistent with there being a large, permanent effect on firm profits where employers are unable to adjust to respond to the additional wage costs induced by the minimum wage increase.

How will firms achieve this offset in practice? Again, we can look at corporate reports issued since the announcement that have commented on the NLW introduction. At the time of writing, four firms in our sample have released reports that discuss the NLW. To varying degrees, they all expect to be able to significantly mitigate the effects of the rise in the wage bill. Factors mentioned include increasing prices, raising productivity and increasing cost efficiency. Interestingly, none of the firms mentioned an employment response. For example, Next plc (whose half-yearly report we have

referred to above) say that a 1 percent increase in product price over the next four years would completely offset their additional wage costs from the National Living Wage.

5. Conclusions

Based on a stock market event study, the empirical research presented in this paper describes what happened to the market value of firms employing minimum wage workers when a completely unexpected announcement of raising the minimum wage occurred. The setting is an emergency budget that was called promptly after the new election of a right of centre government in the UK. The UK Chancellor of the Exchequer made a surprise announcement on budget day (July 8 2015) that he would introduce a new National Living Wage some 11 percent higher than the prevailing National Minimum Wage for workers aged 25 and above.

The impact of the announcement is studied both intra-day and for up to ten days either side of the announcement. Unlike the work on stock market responses to minimum wages in other settings, where the unanticipated nature and certainty of the announced rises are much less precise than in our setting, we find there to be a strong and lasting impact on stock market values. The size of this reduction in firm value resulting from the NLW announcement is compared to the fall in profitability in response to the wage cost shock that will be induced by the announcement and is seen to be of a comparable magnitude, assuming that firms can adjust over time. Thus the announcement of NLW introduction seems to have had the impact of significantly reducing the expected profits of UK firms when it is to be implemented in April 2016.

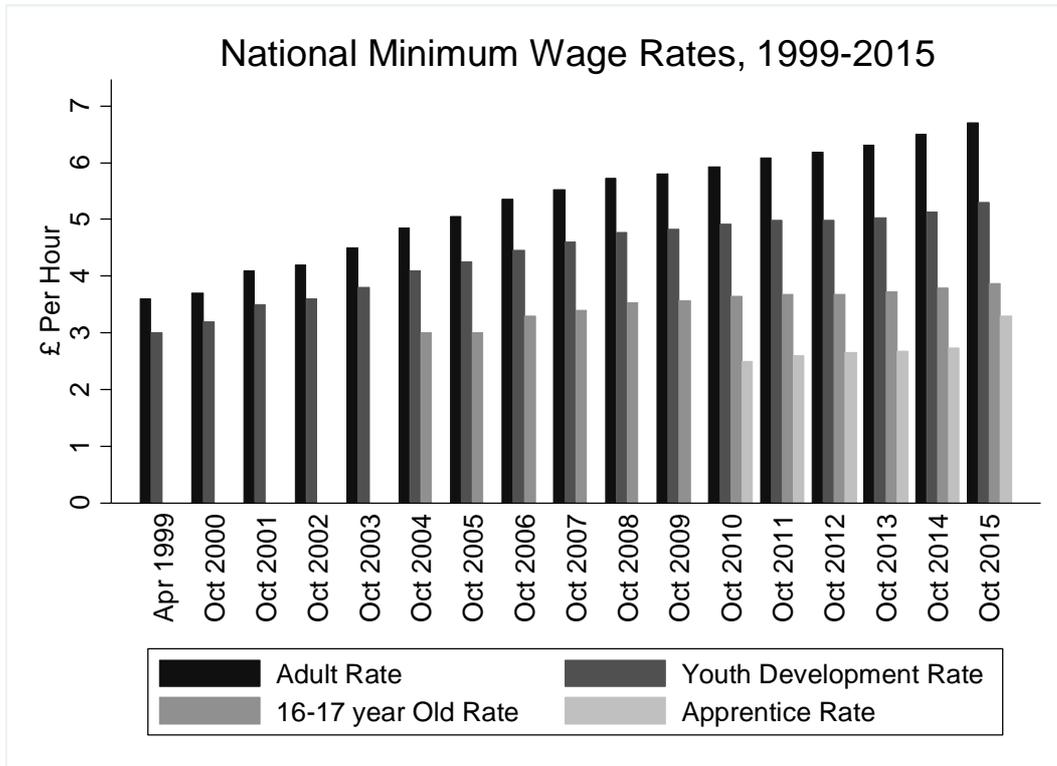
References

- Aaronson, D. and E. French (2007) Product Market Evidence on the Employment Effects of the Minimum Wage, Journal of Labor Economics, 25, 167-200.
- Aaronson, D., E. French, and I. Sorkin (2015) Industry Dynamics and the Minimum Wage: A Putty-Clay Approach, University College London mimeo.
- Abowd, J. (1989) The Effect of Wage Bargains on the Stock Market Value of the Firm, American Economic Review, 79, 774-800.
- Ashenfelter, O. and R. Smith (1979) Compliance with the Minimum Wage Law, Journal of Political Economy, 87, 333-50.
- Blundell, R., C. Crawford and W. Jin (2014) Employment Composition, Hourly Wages and the Productivity Puzzle, Economic Journal, 124, 377-407.
- Bronars, S. and D. Deere (1990) Union Representation Elections and Firm Profitability, Industrial Relations, 29, 15–37.
- Brown, C., C. Gilroy and A. Kohen (1982) The Effect of the Minimum Wage on Employment and Unemployment, Journal of Economic Literature, 20, 487-528.
- Brown, W. (2002) The Operation of the Low Pay Commission, Employee Relations, 24, 595–605.
- Butcher, T. (2012) Still Evidence Based? The Role of Policy Evaluation in the Recession and Beyond: The Case of the National Minimum Wage, National Institute Economic Review, 219, R26-R40.
- Card, D. and A. Krueger (1994) Minimum Wages and Employment: A Case Study of the Fast-food Industry in New Jersey, American Economic Review, 84, 772-93.
- Card, D. and A. Krueger (1995) Myth and Measurement: The New Economics of the Minimum Wage, Princeton: Princeton University Press.
- 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, 1-22.
- Dickens, R. and A. Manning (2004) Spikes and Spillovers: The Impact of the National Minimum Wage on the Wage Distribution in a Low-Wage Sector, Economic Journal, 114, C95-C101.
- DiNardo, J., N. Fortin and T. Lemieux (1996) Labor Market Institutions and the Distribution of Wages, 1973–1992, Econometrica, 64, 1001–1044.
- Dolton, P., C. Bondibene and M. Stops (2015) Identifying the Employment Effect of Invoking and Changing the Minimum Wage: A Spatial Analysis of the UK, Labour Economics, 37, 54-76.

- Draca, M., S. Machin and J. Van Reenen (2011) Minimum Wages and Firm Profitability, American Economic Journal: Applied, 3, 129-51
- Dube, A., E. Kaplan and S. Naidu (2011) Coups, Corporations and Classified Information, Quarterly Journal of Economics, 126, 1-35.
- Dube, A., T. Lester and M. Reich (2010) Minimum Wage Effects Across State Borders: Estimates Using Contiguous Counties, Review of Economics and Statistics, 92, 945-64.
- Dube, A., T. Lester and M. Reich (2016) Minimum Wage Shocks, Employment Flows, and Labor Market Frictions, Journal of Labor Economics, forthcoming.
- Fama, E. and K. French (1992) The Cross-Section of Expected Stock Returns, Journal of Finance, 47, 427-65.
- Fama, E. and K. French (1997) Industry Costs of Equity, Journal of Financial Economics, 43, 153-93.
- Farber, H. and K. Hallock (2009) The Changing Relationship Between Job Loss Announcements and Stock Prices: 1970-1999, Labour Economics, 16, 1-11.
- Gregg, P., S. Machin and M. Fernández-Salgado (2014) Real Wages and the Big Squeeze, Economic Journal, 124, 408-32.
- Hirsch, B., B. Kaufman and T. Zelenska (2015) Minimum Wage Channels of Adjustment, Industrial Relations, 54, 199-239.
- Jegadeesh, N. and S. Titman (1993) Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency, Journal of Finance, 48, 65-91.
- Kothari, S. and J. Warner (2008) Econometrics of Event Studies, in B. Eckbo (Ed.) Handbook of Empirical Corporate Finance, Elsevier.
- Lee, D. (1999) Wage Inequality in the United States During the 1980s: Rising Dispersion or Falling Minimum Wage?, Quarterly Journal of Economics, 114, 941-1023.
- Lee, D. and A. Mas (2012) Long-Run Impacts of Unions on Firms: New Evidence From Financial Markets, 1961-1999, Quarterly Journal of Economics, 127, 333-78.
- Lemos, S. (2008) A Survey of the Effects of the Minimum Wage on Prices, Journal of Economic Surveys, 22, 187-212.
- Machin, S., A. Manning and L. Rahman (2003) Where the Minimum Wage Bites Hard: The Introduction of the UK National Minimum Wage to a Low Wage Sector, Journal of the European Economic Association, 1, 154-80.

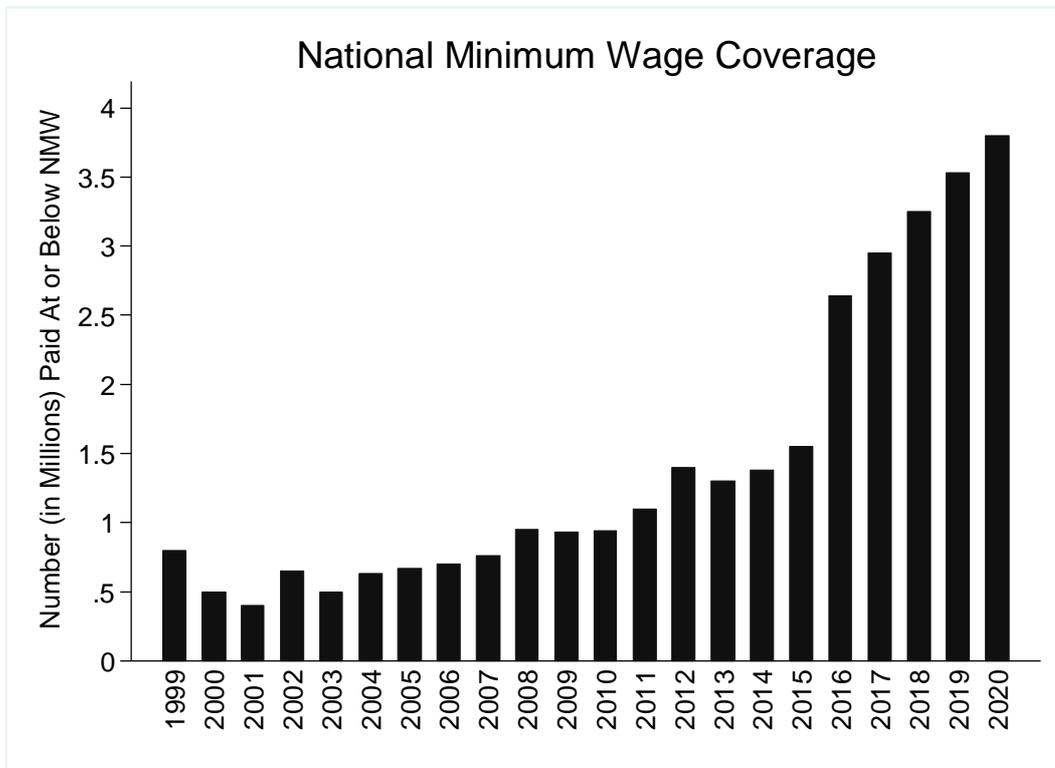
- MacKinlay, A. (1997) Event Studies in Economics and Finance, Journal of Economic Literature, 35, 13-39.
- Meer, J. and J. West (2015) Effects of the Minimum Wage on Employment Dynamics, Journal of Human Resources, forthcoming.
- Metcalf, D. (1999) The Low Pay Commission and the National Minimum Wage, Economic Journal, 109, F46-F66.
- Metcalf, D. (2002) The National Minimum Wage: Coverage, Impact and Future, Oxford Bulletin of Economics and Statistics, 64, 567-82.
- Moskowitz, T. and M. Grinblatt (1999) Do Industries Explain Momentum?, Journal of Finance, 54, 1249-90.
- Neumark, D., J. Salas and W. Wascher (2014) Revisiting the Minimum Wage and Employment Debate: Throwing out the Baby with the Bathwater?, Industrial and Labor Relations Review, 67, 608-48.
- Pacheco, G. and V. Nalker (2006) Impact of the Minimum Wage on Expected Profits, International Review of Applied Economics, 20, 469-90.
- Ruback, R. and M. Zimmerman (1984) Unionization and Profitability: Evidence from the Capital Market, Journal of Political Economy, 92, 1134-57.
- Sorkin, I. (2015) Are There Long Run Effects of the Minimum Wage?, Review of Economic Dynamics, 18, 306-33.
- Stewart, M. (2002) Estimating the Impact of the Minimum Wage Using Geographical Wage Variation, Oxford Bulletin of Economics and Statistics, 64, 583-605.
- Stewart, M. (2004) The Impact of the Introduction of the UK Minimum Wage on the Employment Probabilities of Low Wage Workers, Journal of the European Economic Association, 2, 67-97.

**Figure 1:
UK National Minimum Wages, 1999-2015**



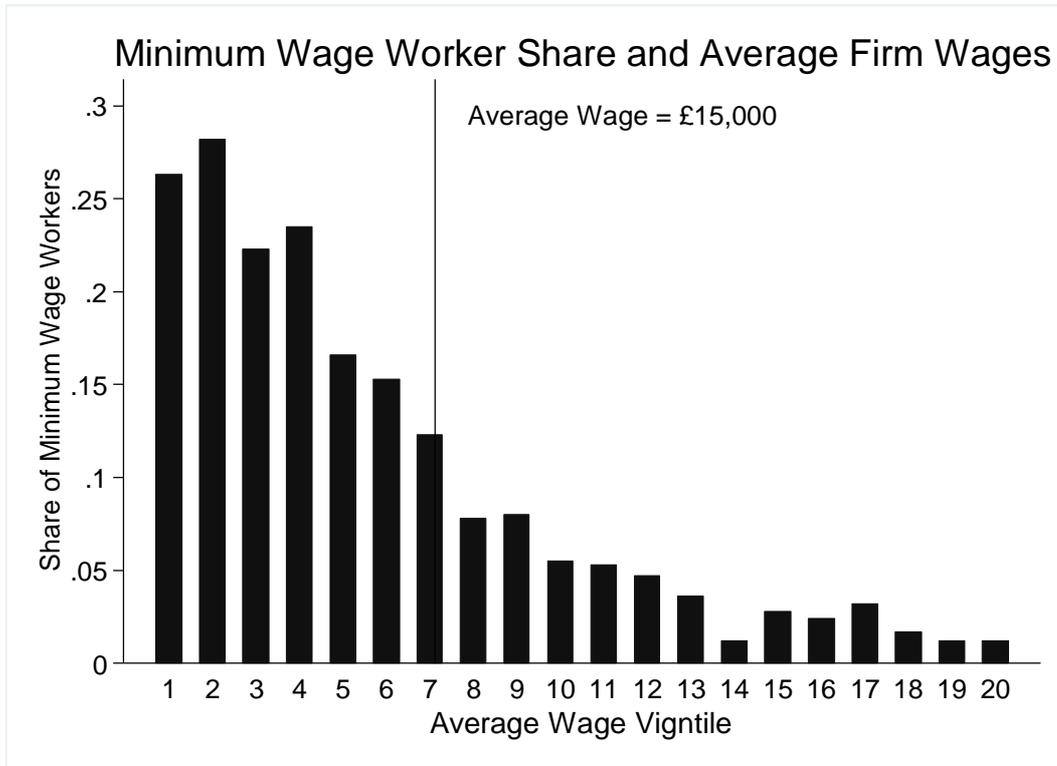
Notes: From Low Pay Commission annual reports.

**Figure 2:
Actual and Estimated Minimum Wage Coverage, 1999-2020**



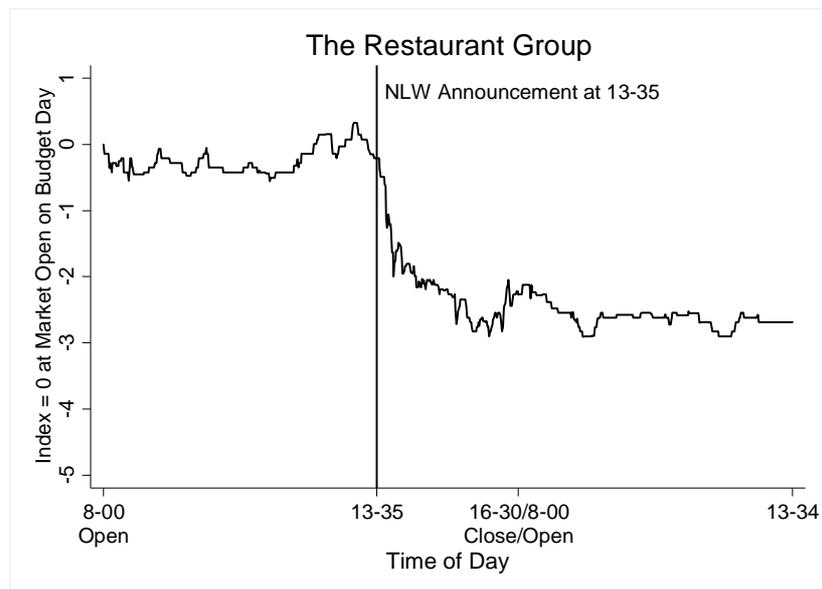
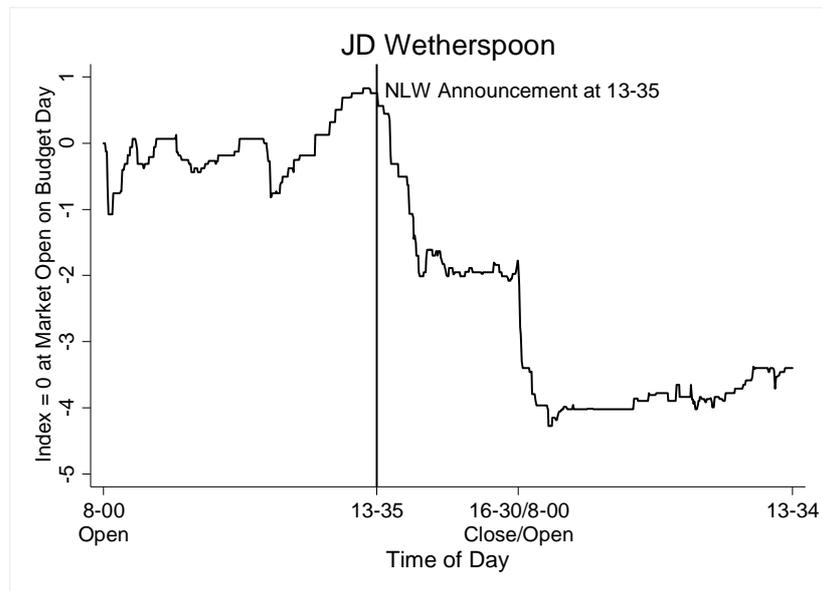
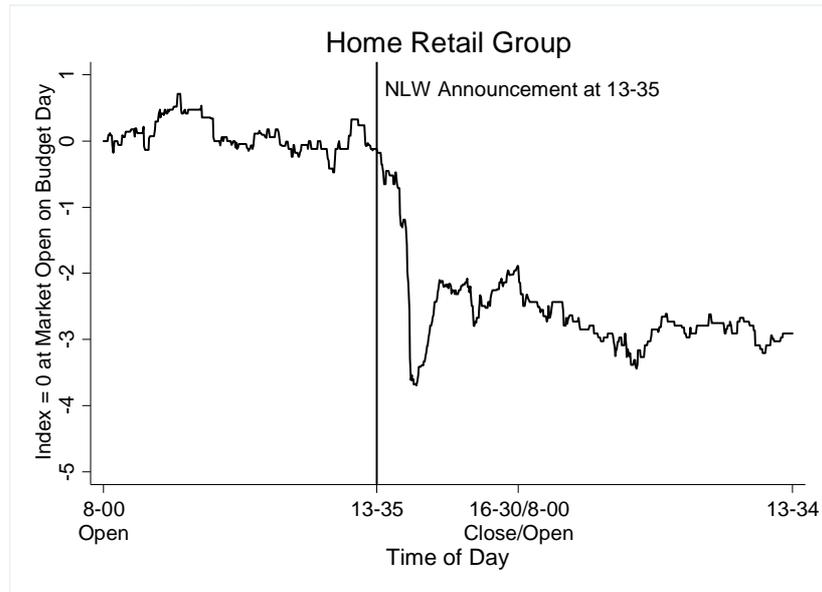
Notes: Low Pay Commission calculations from Annual Survey of Hours and Earnings (ASHE) from 1999 to 2014 and from 2015 onwards using wage forecasts from ASHE 2014. Paid at or below the minimum is based upon the Low Pay Commission procedure of defining a minimum-wage worker as any worker who receives an hourly wage (excluding overtime) that is up to five pence above the minimum wage effective at the time of the survey

**Figure 3:
Minimum Wage Shares and Firm Average Wages**

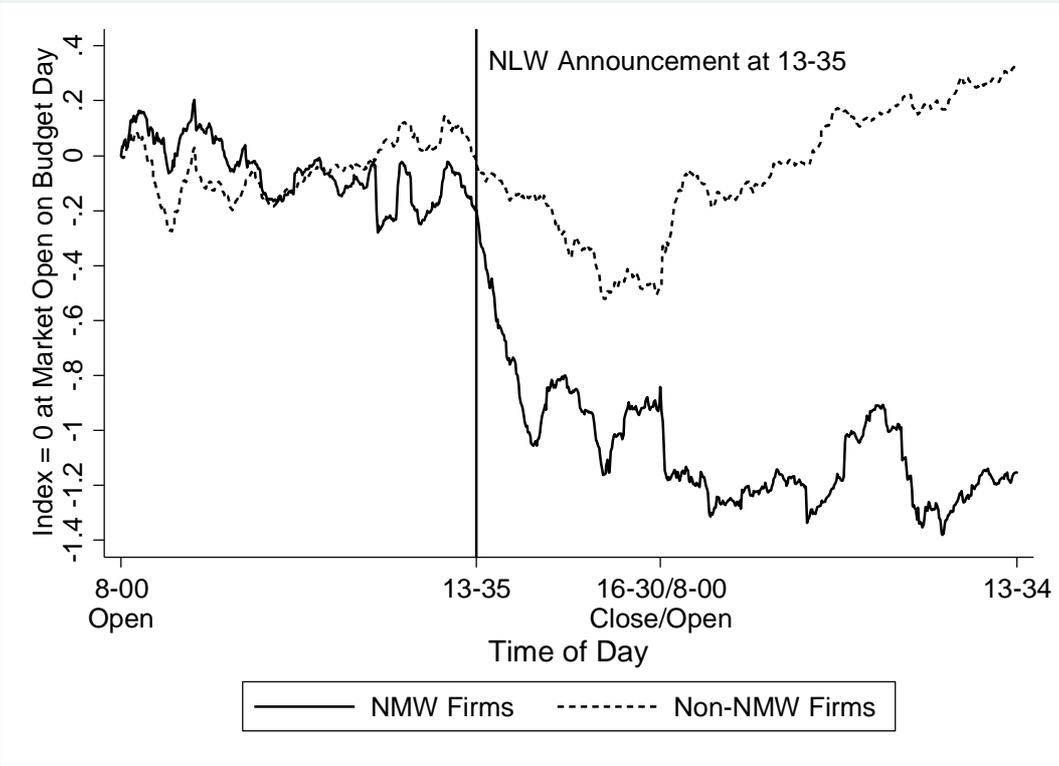


Notes: The y-axis shows the proportion of minimum-wage workers in the firm. The x-axis shows the average annual wage in the firm divided into bins for 5 percentiles from lowest (left) to highest (right) – a total of 20 bins for annual wages from £5,000 to £30,000. Derived from matched worker-firm data (40,046 workers in 3,684 firms) from the 2013 Annual Survey of Hours and Earnings (ASHE) and the Annual Business Survey (ABS).

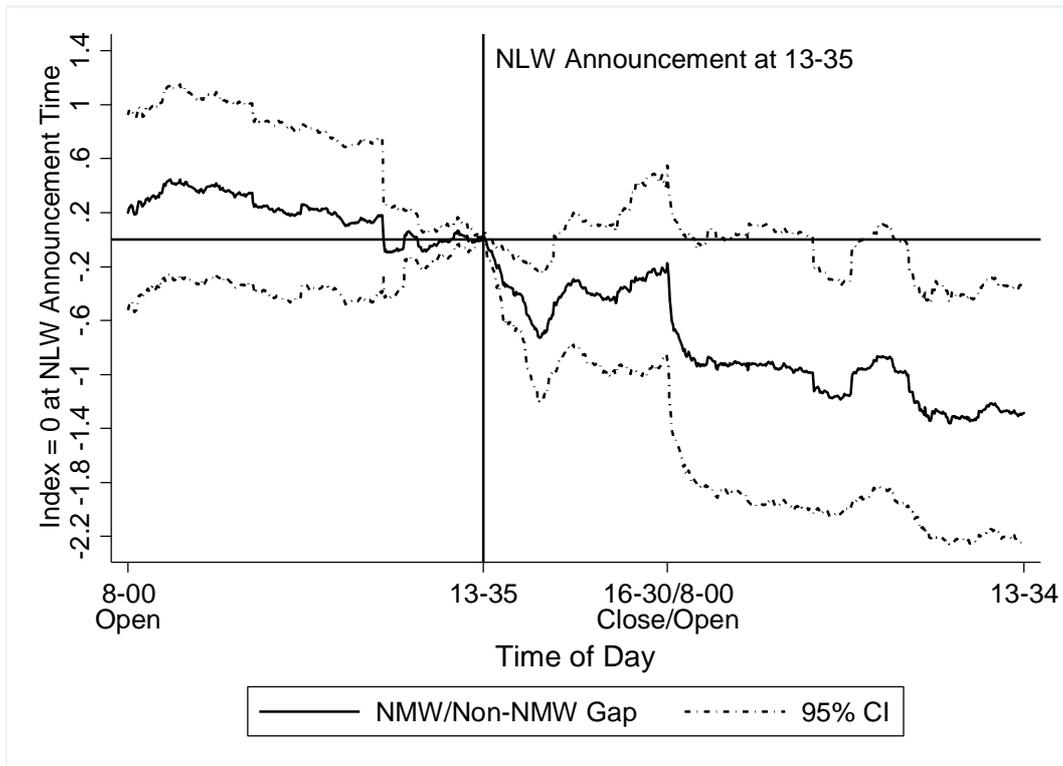
Figure 4: Examples of Share Price Movements of NMW Firms



**Figure 5:
Returns On Budget Day and 24 Hours After The NLW Announcement**

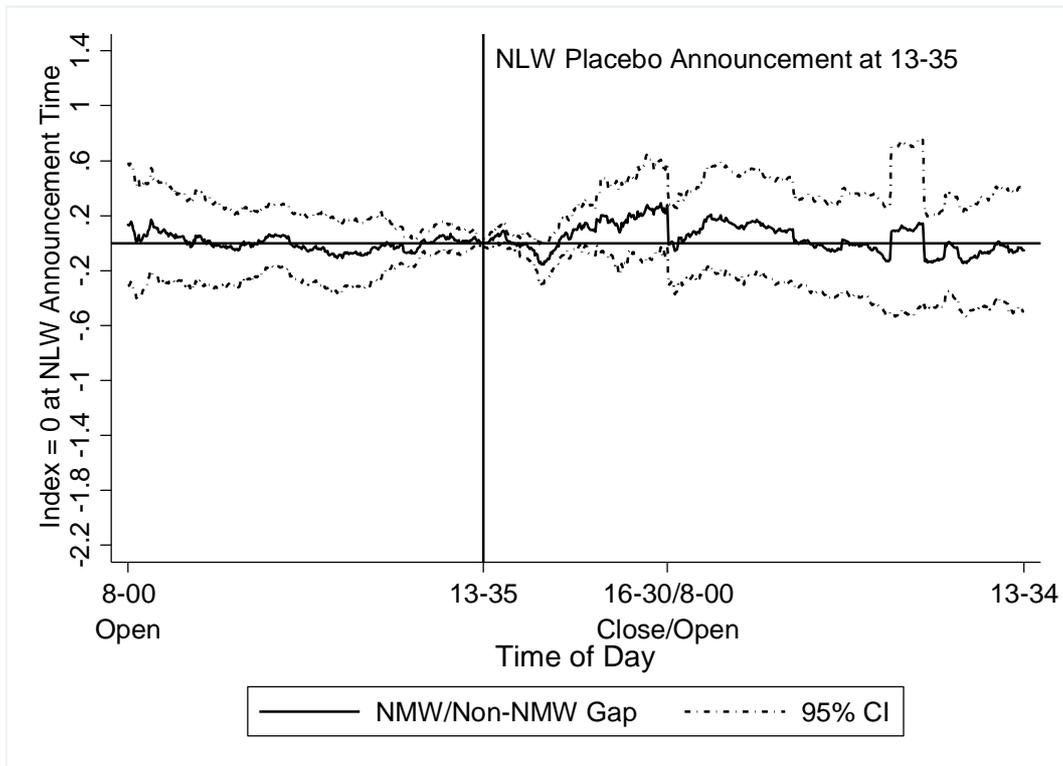


**Figure 6:
Gap in Returns On Budget Day and 24 Hours After The NLW Announcement**



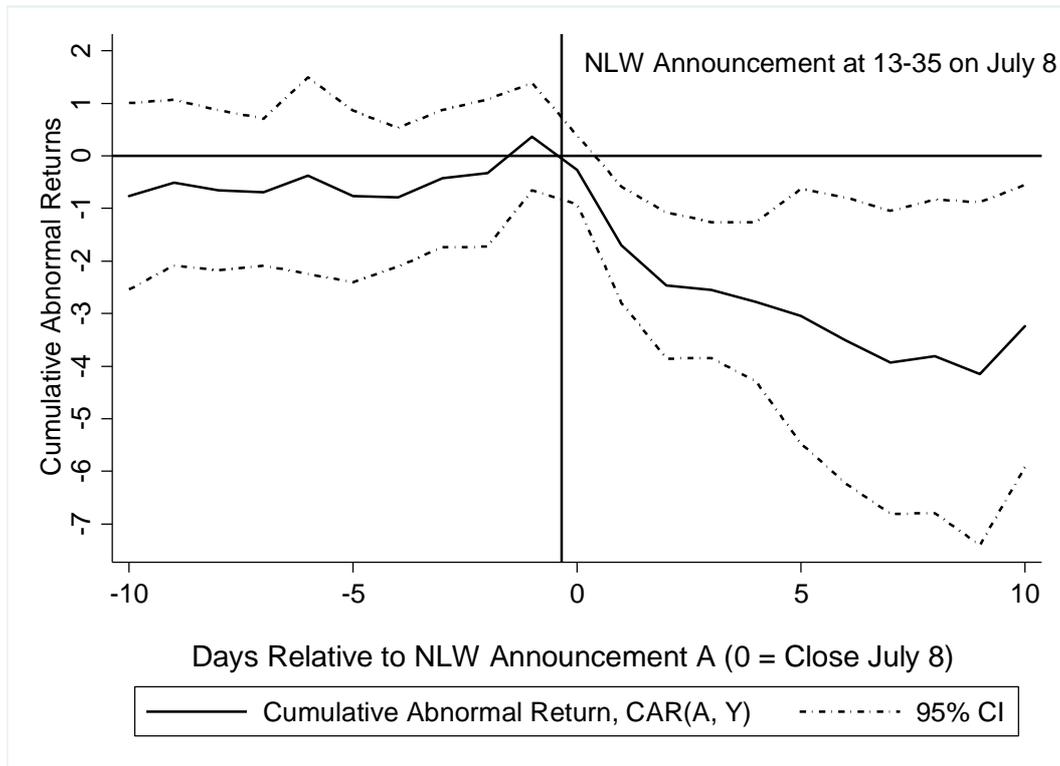
Notes: Based on 442 FTSE All-Share Index quoted firms, comprising 20 NMW firms and 422 Non-NMW firms. The 20 NMW firms are listed in the Appendix.

**Figure 7:
Placebo Test – Day Before Budget Day, July 7 2015**



Notes: Based on 442 FTSE All-Share Index quoted firms, comprising 20 NMW firms and 422 Non-NMW firms. The 20 NMW firms are listed in the Appendix.

**Figure 8:
Daily Cumulative Abnormal Returns**



Notes: Based on 442 FTSE All-Share Index quoted firms, comprising 20 NMW firms and 422 Non-NMW firms. The 20 NMW firms are listed in the Appendix. Cumulative abnormal returns for the NMW firms are measured using a 2-digit industry return index as the expected return measure. The announcement date (Day 0) was budget day on July 8 2015, with the announcement A occurring at 13-35, two-thirds of the way through the trading day.

TABLE 1. AGE VARIATIONS IN MINIMUM WAGES, 2014-2016

Uprating Date	October 2014	October 2015	April 2016
Decision Process and Date	Government Accepted Low Pay Commission Recommendations in March 2014	Government Accepted Low Pay Commission Recommendations in March 2015	Chancellor Introduced National Living Wage For 25+ Workers in July 2015 Budget
Adult NMW, Age 21+	6.50	6.70	
Adult NMW, Age 21-24			6.70
Adult NLW, Age 25+			7.20
Youth NMW, Age 18-20	5.13	5.30	5.30
Youth NMW, Age 16-17	3.79	3.87	3.87

Notes: From Low Pay Commission annual reports and July 2015 budget.

TABLE 2. MINIMUM WAGE SHARES AND FIRM AVERAGE WAGES

	All Firms			Firms With Average Wage <£15,000		
	Number of Firms	Mean Wage	Share of Minimum Wage Workers	Number of Firms	Mean Wage	Share of Minimum Wage Workers
All	3684	16943	0.096	1259	11878	0.210
NMW Firms	84	14046	0.247	58	11736	0.303
Non-NMW Firms	3600	17170	0.093	1201	11894	0.206

Notes: Derived from matched worker-firm data (40,046 workers in 3,684 firms) from the 2013 Annual Survey of Hours and Earnings (ASHE) and the Annual Business Survey (ABS). The NMW firms are those in the two particular industries that dominate our equity sample, non-specialised Retail Trade and Beverage Serving activities.

TABLE 3. ESTIMATES OF INTRA-DAY CUMULATIVE ABNORMAL RETURNS

	Equal-Weighted		Value-Weighted	
	(1) Market Model	(2) Industry- Matched Model	(3) Market Model	(4) Industry- Matched Model
Panel A: NMW Firms – Post-Announcement				
CAR(A,20)	-0.342** (0.131)	-0.271* (0.125)	-1.419** (0.551)	-1.246** (0.537)
CAR(A,60)	-0.694** (0.238)	-0.638** (0.242)	-1.759** (0.681)	-1.564** (0.662)
CAR(A,120)	-0.469 (0.288)	-0.575 (0.312)	-1.495** (0.447)	-1.408** (0.425)
CAR(A, Market Close)	-0.280 (0.323)	-0.262 (0.334)	-0.996* (0.495)	-0.815 (0.491)
Panel B: NMW Firms – Pre-Announcement				
CAR(-20,A)	-0.040 (0.045)	-0.121* (0.054)	0.034 (0.038)	-0.080 (0.040)
CAR(Budget Start, A)	-0.023 (0.089)	-0.054 (0.093)	0.149 (0.086)	0.086 (0.075)
CAR(Market Open, A)	-0.183 (0.368)	0.038 (0.363)	-0.164 (0.159)	0.298 (0.139)

Notes: CAR(A, Y) denotes the cumulative abnormal return from announcement t time A (13:35) to minute Y relative to the announcement time. There are 20 firms in the NMW sample. Panel A reports results for the post-announcement period and Panel B reports results for the pre-announcement period. The market closed 175 minutes after the announcement, it opened 334 minutes before the announcement and the budget began 62 minutes before the announcement. The cumulative abnormal return for each firm is equal-weighted in columns (1) and (2) and weighted by their share of the total value of all trades in NMW stocks over the relevant period in columns (3) and (4). ** denotes significance at 1 percent level; * denotes significance at 5 percent level.

TABLE 4. ESTIMATES OF MEAN DAILY CUMULATIVE ABNORMAL RETURNS

	(1) CAPM Model	(2) 4-Factor Model	(3) Industry-Matched Model
Panel A: NMW Firms – Post-Announcement			
CAR(A,1)	-1.428** (0.523)	-1.516** (0.542)	-1.693** (0.564)
CAR(A,2)	-1.799** (0.608)	-1.967** (0.620)	-2.465** (0.709)
CAR(A,3)	-1.661** (0.617)	-1.823** (0.612)	-2.553** (0.660)
CAR(A,4)	-1.533* (0.656)	-1.639* (0.656)	-2.774** (0.773)
CAR(A,5)	-2.131* (0.917)	-2.231* (0.910)	-3.047** (1.235)
CAR(A,10)	-2.268* (1.128)	-2.464* (1.165)	-3.241** (1.370)
Panel B: NMW Firms – Pre-Announcement			
CAR(-1,A)	-0.327 (0.512)	-0.357 (0.533)	-0.368 (0.520)
CAR(-5,A)	0.500 (0.800)	0.402 (0.805)	0.767 (0.832)
CAR(-10,A)	1.647 (0.934)	1.523 (0.963)	0.768 (0.904)

Notes: CAR(A, Y) denotes the cumulative abnormal return from announcement time on July 8th (A) to close on day Y, where Y is relative to 8th July. There are 20 firms in the NMW sample. Panel A reports results for the post-announcement period and Panel B reports results for the pre-announcement period. ** denotes significance at 1 percent level; * denotes significance at 5 percent level.

TABLE 5. REGRESSION ESTIMATES OF FIVE-DAY ABNORMAL RETURNS

	(1)	(2)	(3)	(4)
NMW	-2.131* (0.894)	-2.331* (0.943)	-2.266* (1.032)	
NMW High π Impact				-3.318* (1.607)
NMW Low π Impact				-1.071 (1.044)
Average Wage £15-20k			-0.196 (0.909)	-0.146 (0.912)
Average Wage £20-25k			0.262 (0.568)	0.295 (0.565)
Average Wage £25-30k			0.291 (0.899)	0.297 (0.902)
Sample Size	442	442	442	442
2-Digit Industry	N	Y	Y	Y
5-Day Prior Return	N	Y	Y	Y
Size Quintiles	N	Y	Y	Y

Notes: The dependent variable is the five-day cumulative abnormal return, $CAR(A,5)$, using the CAPM model. NMW are our sample of 20 firms with average wage less than £15,000. NMW High π Impact are the 10 NMW firms for which a 4 percent rise in the wage bill would generate the largest percentage decline in pre-tax profits. NMW Low π Impact are the other ten firms in the NMW sample. Robust standard errors in parentheses. We also control for foreign exposure with a dummy equal to one if the majority of firm employment (or sales) is outside the UK. ** denotes significance at 1 percent level; * denotes significance at 5 percent level.

**TABLE 6. REGRESSION ESTIMATES OF FIVE-DAY ABNORMAL RETURN
USING ACTUAL EXPOSURE**

	(1)	(2)	(3)	(4)
NMW Exposure	-5.020* (2.422)	-6.208* (2.964)		
NMW Sample			-2.123* (0.920)	-2.185* (1.041)
Sample Size	275	275	275	275
2-Digit Industry	N	Y	N	Y
5-Day Prior Return	N	Y	N	Y
Size Quintiles	N	Y	N	Y

Notes: The dependent variable is the five-day excess return using the CAPM model. NMW Exposure is the percentage of workers in the firm that earn within 5p on the National Minimum Wage in the ASHE sample for the firm. NMW Sample is a dummy variable equal to 1 if the firm is one of the 20 firms with the largest value for NMW Exposure and where the measure of exposure is based on at least 30 observations in ASHE. We also control for foreign exposure with a dummy equal to one if the majority of firm employment (or sales) is outside the UK. Robust standard errors in parentheses.

** denotes significance at 1 percent level; * denotes significance at 5 percent level.

TABLE 7. THE NATIONAL LIVING WAGE EFFECT ON FIRM PROFITS

	Baseline Firm	10 Percent Increase in Minimum Wage (30 Percent Minimum Wage Workers)	10 Percent Increase in Minimum Wage (40 Percent Minimum Wage Workers)
Sales	100	100	100
Wage Bill	18.6	19.3	19.6
Other Costs	53.9	53.9	53.9
Gross Profit	27.5	26.8	26.5
Operating Profit	8.7	8.0	7.7
Pre-Tax Profit	6.0	5.3	5.0
Present Value of Pre-Tax Profits	200	175.2	165.9
Percent Decline in Firm Value (Permanent)		-12.4	-17.1
Decline in Firm Value (Hit to 2020, Thereafter No Effect)		-1.6	-2.3

Notes: Column 2 assumes a 3 percent real interest rate, 4 percent rise in wage bill (resulting from a 10 percent minimum wage increase, assuming 30 percent of workers are NMW workers). Column 3 assumes a 5.5 percent rise in the wage bill (resulting from a 10 percent minimum wage increase, assuming 40 percent of workers are NMW workers). If, rather a 10 percent increase, the minimum wage increase is graduated as a path of 7 percent, 9 percent, 11 percent and 12 percent increases to get to the £9.00 per hour target in 2020 the calculation turns out to be almost identical.

Appendix

List of National Minimum Wage Firms By Sector

Bars and Restaurants

Greene King plc
J D Wetherspoon plc
Marston's plc
Mitchells & Butlers plc
The Restaurant Group plc

Retail

Apparel
Next plc

Broadline
B&M European Value Retail
Debenhams plc
Marks and Spencer Group plc
Home Retail Group plc

Food
McColl's Retail Group plc
WM Morrison Supermarkets plc
Greggs plc

Home Improvement
Dunelm Group plc

Specialty
Card Factory plc
Game Digital plc
Poundland Group plc
WH Smith plc

Services

Business Support
Mitie Group plc

Recreational
Cineworld Group plc

Additional Tables

TABLE A1. ALTERNATIVE ESTIMATES OF DAILY CUMULATIVE ABNORMAL RETURNS

	(1) CAPM Model	(2) 4-Factor Model	(3) Industry-matched Model
Mean	-2.131* (0.917)	-2.231* (0.910)	-3.047** (1.235)
Median	-1.148* (0.563)	-1.358** (0.510)	-2.213* (1.125)
Trimmed Mean	-1.343** (0.394)	-1.392** (0.395)	-2.444** (0.658)
Negative Return Count	15* (5, 14)	15* (5, 14)	15* (4, 14)

Notes: Estimates are for the five-day cumulative abnormal return, CAR(A,5) for the NMW stocks. The trimmed mean excludes the two largest and two smallest returns. Negative Return Count is the number of stocks (out of 20) that have a negative five-day CAR (with the empirical 95 percent confidence interval below). ** denotes significance at 1 percent level; * denotes significance at 5 percent level.

TABLE A2. REGRESSION ESTIMATES OF TEN-DAY ABNORMAL RETURNS

	(1)	(2)	(3)	(4)
NMW	-2.268* (1.101)	-2.540* (1.136)	-2.676* (1.220)	
NMW High π Impact				-4.089* (1.765)
NMW Low π Impact				-1.080 (1.383)
Average Wage £15-20k			-0.321 (1.012)	-0.259 (1.107)
Average Wage £20-25k			-0.934 (0.751)	-0.894 (0.749)
Average Wage £25-30k			0.615 (1.115)	0.619 (1.117)
Sample Size	442	442	442	442
2-Digit Industry	N	Y	Y	Y
10-Day Prior Return	N	Y	Y	Y
Size Quintiles	N	Y	Y	Y

Notes: The dependent variable is the ten-day cumulative abnormal return, $CAR(A,10)$, using the CAPM model. NMW are our sample of 20 firms with average wage less than £15,000. NMW High π Impact are the 10 NMW firms for which a 4 percent rise in the wage bill would generate the largest percentage decline in pre-tax profits. NMW Low π Impact are the other ten firms in the NMW sample. We also control for foreign exposure with a dummy equal to one if the majority of firm employment (or sales) is outside the UK. Robust standard errors in parentheses. ** denotes significance at 1 percent level; * denotes significance at 5 percent level.

**TABLE A3. REGRESSION ESTIMATES OF TEN-DAY ABNORMAL RETURN
USING ACTUAL EXPOSURE**

	(1)	(2)	(3)	(4)
NMW Exposure	-6.850* (2.920)	-7.816* (3.319)		
NMW Sample			-2.537* (1.025)	-2.428* (1.149)
Sample Size	275	275	275	275
2-Digit Industry	N	Y	N	Y
10-Day Prior Return	N	Y	N	Y
Size Quintiles	N	Y	N	Y

Notes: The dependent variable is the ten-day excess return using the CAPM model. NMW Exposure is the percentage of workers in the firm that earn within 5p on the National Minimum Wage in the ASHE sample for the firm. NMW Sample is a dummy variable equal to 1 if the firm is one of the 20 firms with the largest value for NMW Exposure and where the measure of exposure is based on at least 30 observations in ASHE. We also control for foreign exposure with a dummy equal to one if the majority of firm employment (or sales) is outside the UK. Robust standard errors in parentheses. ** denotes significance at 1 percent level; * denotes significance at 5 percent level.

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