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The impact of the National Minimum Wage on employment

A meta-analysis

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Preface

This report presents the findings of a meta-study on the employment effects of the UK national minimum wage. The research project was commissioned by the UK Low Pay Commission (LPC).

The report will be of interest to the LPC, government agencies, and the academic community interested in labour economics and social policy.

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Abstract

This report includes the findings from a meta-analysis of the empirical UK national minimum wage literature. Similar to a previous UK minimum wage study by de Linde Leonard et al. (2014), this study finds no statistically significant aggregate adverse employment effect of the NMW and also no publication bias in the NMW literature. However, estimates for different sub-groups suggest some relatively larger adverse employment effects for some labour market groups, such as part-time employees.

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Executive Summary

Context

The National Minimum Wage Act 1998 established a binding minimum wage across the UK, with the National Minimum Wage (NMW) taking effect on 1 April 1999. In order to advise the government about the NMW, the Low Pay Commission (LPC), an independent body of employers, unions, and experts was established in 1997. The LPC reports annually to the government and provides recommendations on whether and how the NMW rate should be reviewed. To that effect, the LPC, along with other bodies, has conducted and commissioned research on the impact of the NMW to inform its recommendations. Since its introduction, the impact of the NMW on a range of key indicators has been well documented and it has been found to have increased both the real and relative pay of low-income workers and contributed to the narrowing of the gender pay gap (Low Pay Commission, 2014). Furthermore, research finds little effect of the NMW on employment, although some studies suggest some adverse effects for particular labour market sub-groups (e.g. female part-time workers).

Generally, the existing empirical studies on the employment effects of the NMW have adopted different analytical approaches. For instance, some use individual data, others use the geographical variation in the impact of the NMW. Furthermore, different datasets are used for the analysis (e.g. Metcalf 2007). In order to synthesise and evaluate existing primary empirical studies about the UK minimum wage, de Linde Leonard et al. (2014) conducted a meta-analysis of 16 UK studies that were published before 2012. De Linde Leonard et al. (2014) examined the impact of the minimum wage on employment by covering sectoral minimum wages set by the Wage Councils as well as the NMW. The study found no publication bias in the UK minimum wage literature and no evidence for an adverse employment effect of the minimum wage.

Study objectives

The analysis presented in this report builds on the de Linde Leonard et al. (2014) study and complements it in three ways. Firstly, the focus of the current study is exclusively on the NMW, whereas de Linde Leonard et al. (2014) also included the effects of UK Wage Councils and other minimum wage measures. Furthermore, the current study includes the most recent evidence that was published or issued within the last four years, whereas the study by de Linde Leonard et al. (2014) included only studies published up to 2012. Secondly, the current study also includes employment retention effects, that is, the probability of staying in employment after a minimum wage increase. De Linde Leonard et al. (2014) did not include employment retention effects of the NMW, but since a large part of UK minimum wage research estimates these effects, we conduct a separate analysis on them. Thirdly, by exploiting heterogeneity in the design and context of different studies, the analytical approach taken for this study enables a focus on the extent to which effects differ across different labour market sub-groups, or under different economic conditions. From a policy perspective, these effects are as important as the aggregate effect over all sub-groups, but previous meta-studies have not paid particular attention to this aspect.

Analytical approach

This study conducts a meta-regression analysis (MRA) of the UK NMW empirical research on employment and working hours, as well as employment retention probabilities. In essence, a meta-analysis is a form of systematic review employing a range of statistical methods to synthesise and evaluate specific empirical literature. Its purpose is to help researchers and policymakers better understand the existing research on a given phenomenon or policy intervention. MRA is a form of meta-analysis that enables investigation of empirical research in economics and other social sciences. More specifically, MRA is designed to model the influence of observed econometric specifications and heterogeneity in study designs in a specific area of empirical research (e.g. employment effects of minimum wages).

The reported estimates of applied econometric studies are just a sub-set of a large number of different specification choices the researchers made during the research process. Often, there is no reliable way to know which model specification is the 'correct' one. Hence, the research landscape of empirical minimum wage studies and their corresponding estimates is complex and characterised by large heterogeneity. The multidimensional nature of this research makes clear inference and policy advice more difficult. MRA is a tool to address these challenges and synthesise and evaluate research findings and allows the identification of potential publication selection bias in empirical research. Generally, publication bias can arise when researchers, editors or reviewers use statistical significance as a model selection criterion. Publication bias has been documented, and is a widely accepted fact in medical and social science, with a detrimental effect to published empirical findings.

Findings

In line with the previous meta-analysis in the UK (de Linde Leonard et al., 2014), the current study finds no publication selection bias in the UK NMW literature and no overall 'genuine' adverse employment effect, neither on employment and hours nor on employment retention probabilities. The meta-regression approach applied in this research identifies certain research dimensions that affect the magnitude of the reported employment effect. The use of a relative measure of minimum wage (toughness) has relatively large positive consequences for the magnitude of the estimated employment effect. Other study factors may matter as well, but some factors are less robust and have smaller impact on the employment effect. These include: whether the study used differences-in-differences; included a lag of the minimum wage measure; or used the Annual Survey of Hours and Earnings (ASHE) data. In addition, the study findings suggest that estimates that measure the impact of the NMW introduction in 1999 show relatively larger adverse impacts on employment, but the size (and hence economic relevance) of the effect is probably negligible.

Furthermore, specific labour market sub-groups may be more adversely affected by NMW increases than others. This includes for instance part-time employees. This is especially the case when looking at employment retention probabilities, where estimates related to part-time employees show a larger negative impact on employment retention during the introduction of the NMW in 1999 and all periods except during the great recession (2007-2010). What is more, the findings of the current study provide some evidence that the employment retention of young workers may have been relatively more adversely affected during the great recession than other sub-groups.

In light of these findings, it is worth highlighting that the effect sizes for particular labour market groups, such as part-time workers, may need some further investigation. That is, the majority of existing empirical primary studies do not pay specific attention to potentially vulnerable groups. In that regard, the LPC could place special emphasis on these groups in the research it commissions in the future, with the aim of improving the understanding of the heterogeneous impact on these groups.

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Last but not least, we would like to express our thanks to our quality assurance reviewers, Peter Dolton and Joachim Krapels for their thoughtful comments and suggestions on earlier versions of this report.

1. Background

1.1. Introduction

The employment effects of the minimum wage have long been one of the most heavily discussed and studied topics in economics, and has stimulated a rich body of academic literature providing both theoretical and empirical explanations regarding the direction and magnitude of the effect (Schmitt 2013). Until the early 1990s, the neoclassical approach was the dominating theory, and consensus among economists emerged that increases in minimum wages have detrimental impacts on employment. Since then, the influential US studies by Card (1992), Katz and Krueger (1992), Card and Krueger (1994), and Machin and Manning (1994) for the UK heralded the era of 'new minimum research' by reporting quasi-experimental and econometric evidence that minimum wage increases may not harm employment after all. This stream of research triggered a reassessment of the existing underlying minimum wage theory to accommodate the empirical results of no detrimental employment impact (e.g. Metcalf 2007).[1] In addition, many empirical studies have been conducted over the last decades, witnessing the formation of a new generation of research that has attempted to reconcile the contradictory results available thus far (Schmitt 2013). Overall, the majority of the research available to date, and especially since the Card and Krueger (1994) study, shows that there is generally little to zero adverse minimum wage employment effect.

While there is an abundance of US studies published in the last decade on the employment effects of the minimum wage, the contribution of a few stands out and arguably shaped the current debate (Schmitt 2013). For instance, Doucouliagos and Stanley (2009) conducted a meta-analysis of 64 US studies, providing 1,474 estimates of employment elasticity[2] and concluded that the literature was contaminated by publication selection bias. Once publication bias is corrected for, no evidence of an adverse employment effect of the minimum wage remains. Furthermore, Dube et al. (2010) provided a thorough re-examination of both the aforementioned new minimum wage research as well as its critics'. The authors essentially replicated Card and Krueger's (1994) analysis multiple times by comparing the employment levels in contiguous US counties with varying minimum wage levels. The authors reached the conclusion that any differences in the employment rates between the analysed counties were driven by differences in regional employment trends as opposed to minimum wage levels. Building on the study by

[1] E.g. including monopsony and efficiency wage theory.

[2] The employment elasticity measures the percentage change in employment associated with a 1 per cent increase in the minimum wage.

Dube et al. (2010), Allegretto et al. (2011) focused on youth employment, as opposed to industry specific employment, in the period between 1990 and 2009. The analysis was conducted at the state level and found that, after controlling for regional factors, increases in minimum wages had no significant impact on employment levels. This impact was consistently insignificant in times of economic recessions. Sabia et al. (2012) ran a similar analysis also focusing on a young employment group (i.e. workers 16 to 29 years old) but limited their study to low-skilled workers. The analysis compared the levels of employment in New York, which experienced a minimum wage raise, to those in Pennsylvania, Ohio and New Hampshire, which did not. The authors concluded, unlike the previous studies, that the employment levels of younger and less-educated workers did decrease as a consequence of the minimum wage increase (Schmitt 2013). Another study that made significant contributions to the way in which the employment impact of minimum wages is understood is that of Hirsch, Kaufman, and Zelenska (2011). The authors analysed the impact of changes in the federal minimum wage between 2007 and 2009 on fast-food restaurants in Georgia and, more importantly, conducted a thorough empirical examination of a range of probable 'channels of adjustment' to the changes in the minimum wage. They concluded that the employment impact was insignificant due to the fact that minimum wage changes were absorbed by numerous different adjustment channels.

In addition to the US, one of the countries in which the effects of increases in the minimum wage have been extensively analysed and debated is the UK. The National Minimum Wage Act 1998 established a binding minimum wage across the UK, with the National Minimum Wage (NMW) taking effect on 1 April 1999. In order to advise the government about the NMW, the Low Pay Commission (LPC), an independent body of employers, unions, and experts was established in 1997. The LPC reports annually to the government and provides recommendations on whether and how the NMW rate should be reviewed. To that effect, the LPC, along with other bodies, has conducted and commissioned research on the impact of the NMW to inform its recommendations (Brown 2009). Since its introduction, the impact of the NMW on a range of key indicators has been well documented and as the NMW has gained wide political support, it has evolved into an uncontroversial policy tool (Plunkett and Hurrell 2013). The NMW has been found to have increased both the real and relative pay of low-income workers and contributed to the narrowing of the gender pay gap (Low Pay Commission 2014).

There are a number of empirical studies that investigate the employment effect of the NMW, including many commissioned by the LPC. Generally, the studies adopted different approaches, for instance some used individual data, others used the geographic variation in the impact of the NMW, and some used different datasets (e.g. Metcalf 2007). Existing studies also examined the effect of the NMW on employment and working hours before and amid the great recession (e.g. 2007-2010), and in the years after the economic downturn (e.g. Bryan et al. 2013, Dickens et al. 2012 or Dolton et al. 2011, to name a few). Generally, the conducted research finds little to zero adverse employment effects of the NMW, with the exception of some studies reporting some adverse effects for particular labour market sub-groups (e.g. female part-time workers).

In addition to the empirical analyses described above, several meta-analyses exist that examine the employment effect using pooled data from numerous separate primary studies. For instance, Card and Kruger (1995b) analysed fifteen US time-series studies and found publication selection bias in favour of studies providing statistically significant adverse employment effects. The meta-analysis by Doucouliagos and Stanley (2009) of 64 US studies investigated 1,474 estimates of the employment elasticity and corroborated prevalence of a publication bias described by Card and Kruger (1995b). Once this publication bias was corrected for, no adverse employment effect remained. Focusing on several industrial countries, Boockmann (2010) conducted a meta-analysis on 55 studies since 1995 and concluded that almost two-thirds of the estimates in the meta-sample have a negative sign and hence that traditional neoclassical theory may still affect the literature. Furthermore, the studies by Belman and Wolfson (2014) and Giotis and Chletsos (2015) included also empirical minimum wage studies from different countries. Overall, these two studies also found little evidence of an adverse employment effect. Looking at low-income countries, Nataraj et al. (2014) analysed a meta-sample of sixteen studies and found a positive impact on informal employment and a negative effect on formal employment. The meta-study by de Linde Leonard et al. (2014) focused solely on the UK minimum wage and echoed the findings from the US meta-analyses by finding little significant adverse employment effects for the UK. However, in contrast to the US, de Linde Leonard et al. (2014) concluded that the UK empirical minimum wage literature seems not to be affected by publication bias.

1.2. Objectives of the study

The objective of this study was to conduct a meta-analysis of the employment effects of the UK NMW in order to synthesize, integrate and evaluate the large existing empirical evidence that has been conducted in the last few decades. In doing so, our analysis aimed to contribute to the existing evidence on the employment effect of minimum wages and complement previous meta-studies in the field, especially the meta-study by de Linde Leonard et al. (2014). This study departs from the previous UK minimum wage meta-study in three ways:

1. The focus of this study was exclusively on the employment effects of the NMW, whereas de Linde Leonard et al. (2014) included also effects of UK Wage Councils. Furthermore, we also included the most recent evidence that was published or issued within the last four years, whereas de Linde Leonard et al. (2014) looked at studies published up to 2012. Since then, the LPC has commissioned additional relevant empirical studies.
2. This study also included employment retention effects, that is, the probability of staying in employment after a minimum wage increase. De Linde Leonard et al. (2014) did not include employment retention effects of the NMW, but since a large part of UK minimum wage research provides estimates of these effects, we conducted a separate analysis including them.
3. By exploiting heterogeneity in the design and context of different studies, the meta-regression analytical approach taken for this study enabled us to specifically cover the extent to which effects may differ across different labour market sub-groups and under different economic conditions. From a policy perspective, these effects are potentially more insightful than the aggregate effects. Previous meta-studies have not paid particular attention to this aspect.

In order to achieve the objectives stated above, we followed three basic research steps (1) a systematic review of the existing evidence; (2) study selection, data extraction and coding; (3) a meta-regression analysis to detect potential publication bias and accommodate study heterogeneity.

1.3. What is Meta-(regression) analysis?

Meta-analysis is a form of systematic review employing a range of statistical methods to synthesise and evaluate specific empirical literature (Glass 1976). It is targeted at researchers and policymakers in order to help better understand the existing research findings on a given empirical effect or policy intervention (Stanley and Doucouliagos 2012). In contrast to narrative literature reviews, systematic reviews aim to include all research results by following an explicit and comprehensive search strategy, which should be replicable by others. Meta-regression analysis (MRA) is a form of meta-analysis designed to investigate empirical research in economics and other social sciences (Stanley 2001).

In essence, MRA is designed to model the effects of observed econometric specifications and heterogeneity in study designs investigating a specific phenomenon or policy intervention (e.g. employment effects of minimum wages). The reported estimates of applied econometric studies are often just a small sub-set of a large number of different specification choices the researchers made during the research process and there is no reliable way to know which model specification is the correct one. MRA can accommodate and correct potential misspecification and selection biases within applied econometric studies. For instance, the aforementioned primary empirical minimum wage studies apply a variety of empirical approaches (e.g. differences-in-differences, regression discontinuity), look at outcomes for individual sub-groups (e.g. youth, women), use different levels of analysis (e.g. individual, geographic regions), apply a range of different datasets (e.g. Labour Force Survey, British Household Panel, Annual Survey of Hours and Earnings), and most importantly, report a variety of minimum wage effect sizes. From a policy perspective, it is crucial to understand the extent to which these findings are driven by differences in study design and whether there is a 'true' underlying effect, once we control for the variation in study design factors and potential publication selection bias. Publication bias arises when researchers, editors or reviewers use statistical significance as a model selection criterion. Publication bias has been documented, and is a widely accepted fact in medical and social science, with a detrimental effect to published empirical findings (e.g. Feige 1975; Begg and Berlin 1988; Copas 1999; Card and Krueger 1995b). The added value of MRA is that it can identify, estimate and correct publication bias.

In summary, the research landscape of empirical minimum wage studies and their corresponding estimates is complex and characterised by a large degree of heterogeneity. The multidimensional nature of this research makes clear inference and policy advice more difficult. MRA is a tool to address these challenges and synthesise and evaluate research findings.

1.4. Limitations to the research approach

As described in the previous section, MRA is a powerful tool to synthesise findings from large empirical research findings. However, like every method, MRA has his limitations and caveats that should be considered when interpreting the findings of this study:

1. A meta-study depends on the data that feeds into the analysis. As the data inputs are estimates from existing empirical studies, a meta-analysis cannot fully overcome the weakness of the literature it synthesises. For instance, as Brewer et al. (2015) highlighted, many studies employ difference-in-difference designs, and suffer from low power when inference is conducted

correctly. A meta-analysis can only control and account for potential factors leading to low power in primary studies, however, the fundamental underlying empirical problems cannot be resolved with this approach.

2. Every meta-analysis is subject to a degree of subjectivity. While systematic reviews in medical research often make pre-judgments of what is 'good' and 'bad' research, meta-analysis in economics is more inclusive and aims to include all studies as long as they met some minimal inclusion/exclusion criteria. However, as empirical studies include a large number of estimates (e.g. including 'straw' or placebo regressions) there might be a disagreement between (meta-) researchers on what estimates from each study should be included. One way to address this challenge is to be as transparent as possible in the description of studies and estimates included, as well as being willing to make the meta-data accessible for other researchers (Stanley et al. 2013).

1.5. Outline

The report proceeds as follows. Chapter 2 describes the systematic review and data collection in more detail. It also presents some descriptive statistics of the meta-data sample. Subsequently, chapter 3 outlines the meta-regression approach in more detail and how it is able to detect publication bias. The chapter also reports the findings from a new meta-regression analysis of the employment effects of the UK NMW. Chapter 4 provides a summary of the study findings and outlines areas for future research in the area of meta-analyses.

2. The meta-sample: systematic review and data collection

This chapter describes the process of the systematic review and the collection of estimates relevant to the employment effects of the UK NMW. The chapter starts by outlining the search process to identify the relevant literature, followed by a description on how we extracted the data. The chapter further discusses the measurement of the effect size for the analysis and provides descriptive statistics on the collected estimates.

2.1. Obtaining the research data

2.1.1. Systematic review of the literature

The purpose of a systematic review is to obtain the full available set of empirical studies and their corresponding empirical estimates based on a specific set of inclusion/exclusion criteria from a wider set of different studies (Petticrew and Roberts 2006). Systematic reviews are valuable as a means to review all relevant research in a specific area in a transparent manner. In recent years, it has become common that systematic reviews in the economics literature are accompanied by a meta-analysis (Card et al. 2010; Doucouliagos and Stanley 2012; Kluve 2010). Key to each systematic review is to be as inclusive as possible, as any omission of studies can potentially lead to a selection bias in the subsequent synthesis of the research findings. Our approach to the systematic review is in line with the guidelines by Petticrew and Roberts (2006). It also corresponds to the characterisation set forth by Grant and Booth (2009), who developed a literature review typology based on an analytical *Search, Appraisal, Synthesis and Analysis* (SALSA) framework.

In essence, for the purpose of this study, the different steps and activities for the systematic review can be described as follows:

1. Search of academic literature in relevant databases;
2. Search of grey literature published by relevant institutions;
3. Hand-search of literature published by the LPC.

For academic literature, we searched the EBSCO information services database, which draws from five sub-databases: Academic Search Complete, Business Source Complete, EconLit, Scopus and Social Sciences Abstracts. For the grey literature search, we identified three potential authoritative sources of relevant studies: 1) RePEc – Research Papers in Economics, 2) IZA Discussion Papers, and 3) NBER Papers. While RePEc has a search engine that enabled us to conduct a reasonably similar search directly on its website, for IZA and NBER we used Google Advanced search. LPC reports were identified and accessed through the LPC website[3] and its archived version.[4] Each of the three types of searches consisted of the following steps:

1. Development and piloting of search terms;
2. Determination of final set of search terms;
3. Definition of inclusion and exclusion criteria;
4. Multi-stage (title, abstract, full-text) screening of identified literature with double-screening of a sample of records;
5. Extraction of information into a standardised data template.

The search terms were selected with the objective to identify all relevant studies while trying to avoid capturing irrelevant hits. The actual operationalization of search terms depended on the search engine for each source (as described below) but in general incorporated three general building blocks:

1) Subject search term 'minimum wage'
2) Geographical delimiters, i.e. UK, United Kingdom, England, Scotland, Wales, Northern Ireland, Great Britain, British
3) Further specifying search terms driven by the focus of the study, i.e. effect, impact, employment, hours, youth (or adolescent), women (or female or gender), part-time, recession

The search terms were selected on the basis of several piloting rounds with the objective to identify all relevant studies while minimising the chance of missing any relevant papers. Box 2-1 includes in more detail the search terms and the combinations thereof.

Box 2-1: Search terms for systematic review of relevant literature

1) AB "Minimum Wage*" AND AB ("United Kingdom*" OR UK* OR "Great Britain*" OR England* OR Scotland* OR Wales* OR "Northern Ireland" OR British) AND AB (effect* OR impact* OR employment OR hours OR (women OR female OR gender) OR (youth OR adolescent*) OR (part-time OR "part time") OR recession)
2) TI "Minimum Wage*" AND TI ("United Kingdom*" OR UK* OR "Great Britain*" OR England* OR Scotland* OR Wales* OR "Northern Ireland" OR British) AND TI (effect* OR impact* OR employment OR hours OR (women OR female OR gender) OR (youth OR adolescent*) OR (part-time OR "part time") OR recession)

To be included in our review, the inclusion/exclusion criteria for the search were set as follows:

- Only studies published in English;
- Only studies looking at the UK;

[3] As of 24 August 2016: https://www.gov.uk/government/publications?departments%5B%5D=low-pay-commission

[4] As of 24 August 2016: http://webarchive.nationalarchives.gov.uk/20130708092703/http://lowpay.gov.uk/lowpay/rep_research_index.shtml

- Only studies containing at least one new empirical estimate of the employment effect attributable to a NMW change;
- No theoretical papers or magazine/periodical items;
- Both peer-reviewed and non-peer reviewed sources included;
- No a priori limitation on quantitative research designs and methods;

It is worth noting that some meta-analyses have been conducted on published peer-reviewed studies only because peer-reviewed papers should be of greater quality. However, including only published studies may induce a bias to the meta-data sample. They tend to exclude estimates from various model specifications that researchers conducted in the research process before publication, often based on the preferences of editors and referees. In addition, newer studies are often not published and hence would be automatically excluded. Often, these newer studies use different datasets or new estimation methods that may challenge the existing views, and hence should be included. The added value of MRA is that we were able to control for whether studies are published or not and therefore include 'grey literature' in the sample. This is in line with the guidelines for meta-regression analyses expressed by the meta-analysis of economics research network (MAER-Net) with which our analysis aimed to fully comply.[5]

The initial search process delivered over 800 studies. After removal of duplicates and title and abstract screening, the set of studies was narrowed down to about 200.[6] These remaining 200 studies were independently screened by two researchers according to the pre-defined inclusion criteria and the study sample was further narrowed down to 48 empirical studies relevant to the NMW. This included different versions of the same paper, for instance (1) various versions of the same discussion paper (e.g. IZA and CEP); (2) LPC reports for which some of the results have been published in a peer-reviewed journal at a later stage; (3) discussion papers not (yet) published in a peer-reviewed journal but where at different points in time new relevant estimates have been added. Generally, we applied the rule that the most recent version of a study should be included. However, if a study was published in a journal and a previous LPC report exists (or discussion paper), we also consulted the previous version of the study and compared what potential estimates have not made it into the journal version and included them in our sample.[7] This is because the LPC reports and other discussion papers tend to be inclusive in their reporting and omitting part of the published estimates can lead to a bias. This process resulted in retaining 28 studies for data extraction.

2.1.2. Data extraction

The next step in the data collection process was to extract relevant estimates and information on different dimensions of the study, including for instance whether the study was published in a peer-reviewed

[5] Stanley et al. (2013)

[6] From title and abstract screening it was often pretty clear that the study was not relevant to the UK NMW, including often general summaries of minimum wage literature or governmental white papers.

[7] Note that in that case we treated the different studies as 'one' and the 'same' study because the estimates stem from the same data generating process. In practical terms, that means the estimates were collected under the same study number. For instance, the estimates from Dolton et al. (2009), Dolton et al. (2010) and the employment effects from Dolton et al. (2011) have been combined.

journal, the total number of observations, and the data set used for specific estimates etc. (see Table 3-3 for more details). In line with the MAER-NET guidelines we extracted multiple estimates per study and did not restrict ourselves to including only one estimate per study (e.g. the author's 'favourite' estimate).[8] The process identified 22 relevant studies with a total of 2,313 corresponding estimates (1,451 on employment and hours and 862 employment retention probabilities) with sufficient information needed for further analysis, including the regression coefficient, its standard error and the total number of observations. We had to exclude 6 studies because they either did not include the necessary information to calculate effect sizes (e.g. total number of observations); only estimated relative employment (e.g. supervisors vs. employees) or only estimated the effect of NMW increases on second jobs. Please see the Appendix for more details of which studies were not included in the final sample.

Note that the empirical effects included in a meta-analysis should be as comparable as possible to ensure the homogeneity of the meta-sample (Stanley and Doucouliagos 2012).[9] To that end, in what follows, we report separate analyses for employment retention probabilities, which are conditional on being in work in the period before an increase in the NMW, and hence not fully comparable to general employment effects. As employment retention probabilities form a large part of UK NMW estimates we decided not to exclude them but run separate analyses on them.

2.2. Measurement of NMW effect sizes

As the relevant outcome measure in the regression analysis, we aimed to capture the employment effect of the NMW. This is ideally measured as an elasticity, reporting by how much employment changes in per cent in response to a one per cent minimum wage increase. The advantage of using elasticity as the effect size is that it represents an economic, rather than a statistical effect, and it is the most commonly used among the empirical economic effects. However, there is a major drawback with using elasticities as the effect size in this analysis, in that they are often not directly reported in empirical papers, except when for instance the econometric model is estimated in double-log form (that is when the outcome variable and the predictor variable of interest are in logarithmic form). In other functional forms, the elasticity needs to be calculated from the reported descriptive statistics. Unfortunately, many studies in the UK NMW literature often do not directly report elasticities, and many do not report the appropriate sample mean statistics of the necessary variables, which hindered our conversion of coefficients into elasticities.[10] Hence, we were only able to include 241 estimated NMW elasticities.[11]

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[8] Note that we did not include estimates that authors conducted as 'straw' or 'placebo' regressions, often reported as robustness checks. However, we included those robustness regressions that for example, varied the sample (e.g. on different labour market sub-groups) or different regional classifications. As a rule of thumb, as long as the difference could be coded by different research dimensions, we included the estimate.

[9] For instance, estimates from binary regressions (e.g. probit or logit) should not be combined with estimates from continuous variable studies (e.g. ordinary least square) as log-odds ratios cannot directly be compared to effect sizes from a linear regression. Only if authors provide marginal effects or a binary regression (a linear probability model) was conducted.

[10] Note that we were cautious in converting coefficients into elasticities using the sample means of the key variables. One problem we came across is that if authors report sample means of key variables, often they were not directly

In order to maximise the number of comparable estimates we also converted all empirical estimates that report their standard errors or t-values together with the degrees of freedom into partial correlation coefficients. The partial correlation coefficient is a statistical measure of the strength and direction of the association between two variables (e.g. a measure of employment and the NMW), *ceteris paribus*, that is, holding all other factors constant (Stanley and Doucouliagos, 2012).

Table 2-1: Studies and estimates included in the meta-analysis

	Study	Number of estimates	Number of elasticities	Number of retention coefficients
1	Bewley, H., & Wilkinson, D. (2015)	364	72	310
2	Bryan, M., Salvatori, A., & Taylor, M. (2013)	296		296
3	Conlon, G., et al. (2015)	50		6
4	Dickens, R., Riley, R., & Wilkinson, D. (2015)			84
5	Dickson, M., & Papps, K. (2016)	8		40
6	Fidrmuc, J., & Tena, J. D. (2013)	23		6
7	Papps, K., & Gregg, P. (2014)	6		26
8	Stewart, M. (2004)			94
9	Connolly, S., & Gregory, M. (2002)	21	13	
10	Dickens, R., Riley, R., & Wilkinson, D. (2014)	24		
11	Dolton, P., Bondibene, C.R., & Stops, M. (2015)	80		
12	Dolton, P., Bondibene, C.R., & Wadsworth, J. (2009/2010/2011)	256		
13	Draca, M., Machin, S., & Van Reenen, J. (2011)	2	2	
14	Galindo-Rueda, F., & Pereira, S. (2004)	110	110	
15	Georgiadis, A. P. (2006)	16	16	
16	Machin, S., & Wilson, J. (2004)	12	12	
17	Machin, S., Rahman, L., & Manning, A. (2003)	16	16	
18	Riley, R., & Bondibene, C.R. (2015)	9		
19	Riley, R., & Bondibene, C.R. (2013)	50		
20	Stewart, M. B. (2002)	8		
21	Stewart, M.., & Swaffield, J. K. (2008)	96		
22	Urwin, P., Jack, G., & Lissenburgh, S. (2006)	4		
	Total	1451	241	862

Generally, partial correlations are not directly reported in empirical studies and need to be calculated using routinely reported regression coefficients. In essence, the calculation of the partial correlation coefficient is as follows:

applicable as they refer to the overall sample and not the sub-samples (e.g. female employees) for which the actual estimate was calculated. Not using the correct values can potentially lead to very wrong estimates of elasticities and to bias and errors in the calculations.

[11] Note that the study by de Linde Leonard et al. (2014) had an almost similar number of elasticities but also included older studies that looked at the employment effects of Wage Councils etc. For some reason, these studies were more likely to report direct elasticities than newer studies conducted on the NMW.

$$r = \frac{t}{\sqrt{t^2 + df}}$$

Where r is the partial correlation, t is the estimate's t-statistic and df is the number of degrees of freedom (assumed to be equal to the number of observations or clusters minus the number of regressors minus 1). The corresponding standard error of the partial correlation can then be calculated as:

$$se(r) = \sqrt{\frac{1 - r^2}{df}}$$

Regarding interpretation of partial correlation coefficients, Cohen's (1988) guidelines suggest that any correlation less than 0.1 is negligible. For instance, if a partial correlation equals 0.1, the variable under investigation (in our case, the NMW) can only explain about one per cent of the remaining unexplained variation in employment, after considering all the other independent variables. By using partial correlations rather than elasticities only, our meta-sample comes as close as possible to reflecting all relevant empirical information in the UK NMW empirical literature.

2.3. Descriptive statistics

Table 2-2 reports summary statistics across the three different meta-samples for partial correlations, elasticities and employment retention probabilities. Note that across the three samples, the majority of estimates are negative (the proportion of negative estimates is larger than 50 per cent). Looking at the mean, the data suggest that there is a very small negative effect for employment and hours (partial correlations) and employment retention, but a small positive employment effect of the NMW for the elasticities sub-sample. However, when looking at the median, all medians suggest a small negative effect. Note that the descriptive statistics reported in Table 2-2 should be interpreted with care as they do not account for potential publication bias.

Table 2-2: Descriptive statistics – partial correlations, elasticities and employment retention probabilities

Outcome measure	*Mean*	*SD*	*Median*	*% positive*	*% negative*
Employment and hours					
Partial Correlation	-0.005	0.044	-0.001	48.39	51.61
Elasticity	0.013	0.858	-0.012	43.08	56.92
Retention					
Coefficient	-0.001	0.015	-0.001	47.8	52.2

3. Meta-regression analysis

3.1. Publication selection bias

As described in the previous chapter, MRA is a type of meta-analysis using statistical methods to analyse, filter and summarise all available empirical findings. It is designed to model the effects of observed econometric specifications and their associated misspecification biases, including potential publication selection bias. In essence, publication bias can arise when research findings are selected upon their statistical significance, potentially leading to exaggerations of their size. Card and Krueger (1995b) list reasons why publication bias may emerge (see also de Linde Leonard et al. 2014):

1. Reviewers and editors of academic journals may be predisposed to accept only articles consistent with the predominant conventional view in the area of research;
2. Researchers may use the presence of conventionally expected results as model selection tests;
3. Researchers, reviewers and editors may have a natural predisposition to treat statistically significant results more favourably.

In other words, publication bias may reflect the issue that the probability of a paper being published depends on its reported results (Belman and Wolfson 2014). For instance, amid increasingly strong competition for scarce journal pages, editors may tend to reject papers because their results are not statistically significant or not novel enough. While there are many potential reasons for a selective publication process, not accounting for it may give rise to biased estimates of an effect like the employment effect of minimum wages. Card and Krueger (1995b) reported the presence of publication bias in favour of studies providing a statistically significant (negative) employment effect. In Doucouliagos and Stanley (2009), a meta-analysis of the US minimum wage literature, publication bias was found to be a strong contributor to the finding of an adverse employment effect. In summary, the real problem of publication bias is not its existence per se, but rather the potentially large biases it imposes on summaries of existing research.

3.1.1. Funnel plot and test for publication bias

A common practice, used in medical research, to detect publication bias is informally examining a so called 'funnel plot' (Sutton et al. 2000). A funnel plot is a simple scatter diagram of an empirical estimate and its corresponding precision (e.g. the inverse of the estimates' standard error: 1/SE). Since a measure of variability of each estimate is placed on the y-axis, the estimates at the bottom have larger corresponding standard errors and hence, are more widely dispersed. In contrast, the more precisely estimated estimates are more compactly distributed towards the top. The most accurate estimates can therefore be found at the top of a funnel graph and these estimates should be less affected by publication selection as their relative higher precision decreases the probability of being statistically insignificant. In essence, if no publication bias exists, then the scatter diagram should resemble an inverted (symmetric) funnel.

Figures 3-1 to 3-3 display the funnel plots for the employment effects of the NMW using three different samples, (a) all estimates of partial correlations; (b) elasticities; (c) employment retention coefficients.

Figure 3-1: Funnel plot of NMW employment partial correlations (n = 1,451)

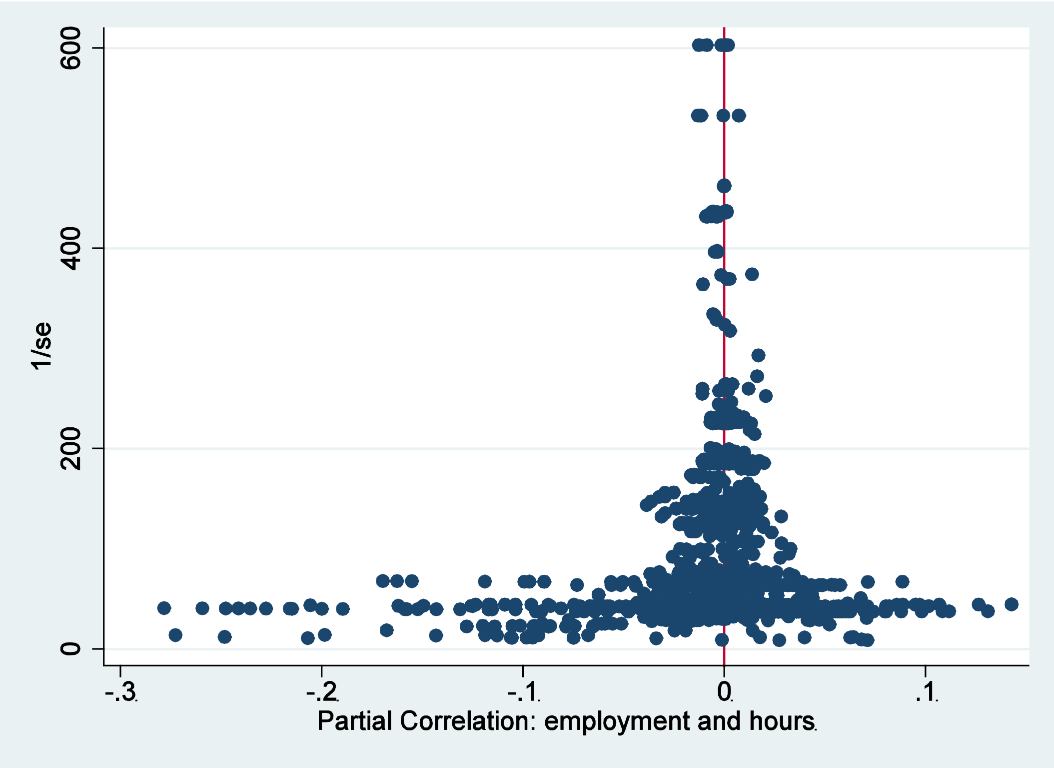


Figure 3-1 plots the estimates from the partial correlations sample and overall it suggests that the partial correlations are roughly symmetrically distributed around zero. At very low precision there are some larger negative partial correlations present. In a similar fashion, Figure 3-2 suggests that there are, at lower levels of precision, more negative than positive elasticities. By contrast, Figure 3-3 plots the estimates from the employment retention sample and suggests that at lower precision more positive retention coefficients exist, but the distribution is more symmetric for estimates with larger precision. Across all three graphs, the majority of estimates cluster somewhat around zero.

Figure 3-2: Funnel plot of NMW employment elasticities (n = 241)

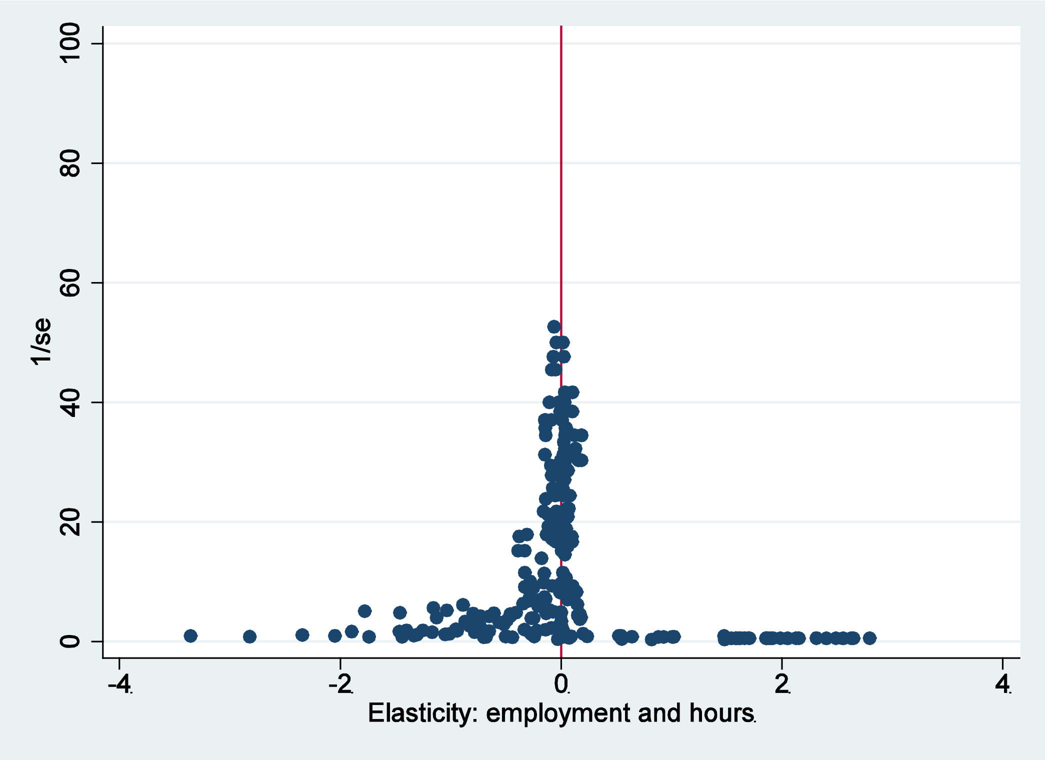
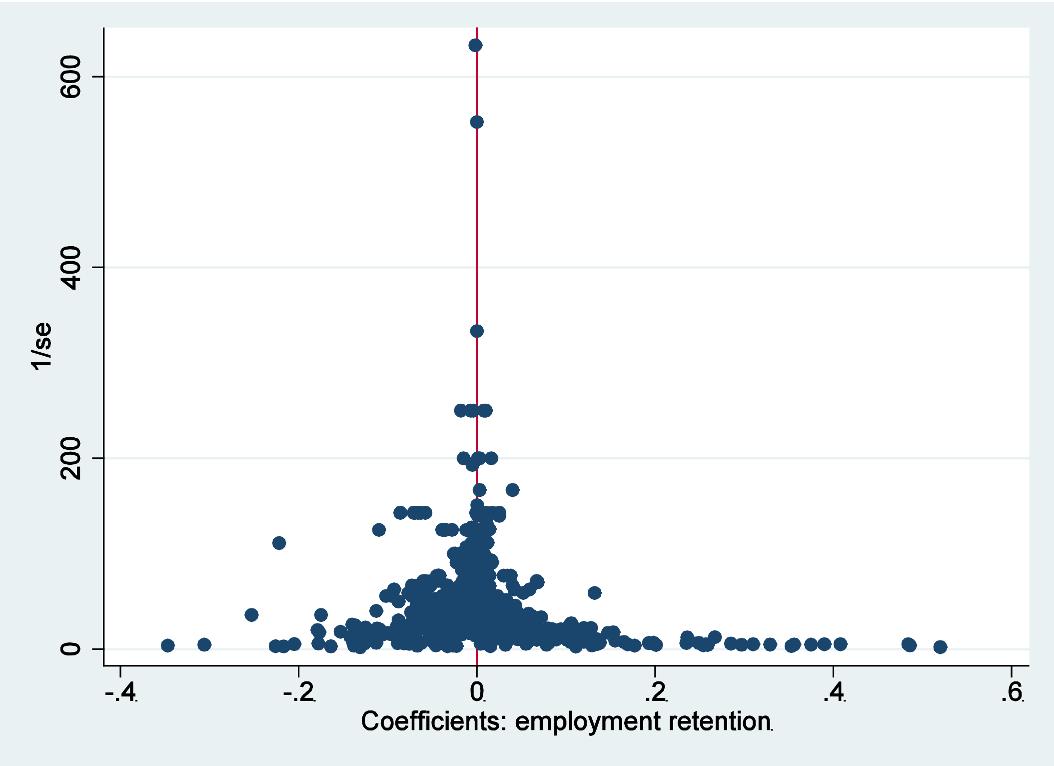


Figure 3-3: Funnel plot of NMW employment retention (n = 862)



However, it should be noted that simply looking at the funnel graphs can be misleading as they are vulnerable to misjudgement and subjective interpretation. Therefore, we follow Stanley and Doucouliagos (2012) and apply the Funnel Asymmetry Test (FAT) and the Precision Effect Test (PET) or, in short, FAT-PET. These tests have been shown to be effective in identifying and filtering publication bias and in detecting whether there is a 'genuine' effect of the minimum wage once potential publication bias has been taken into account.

The mechanism of FAT-PET is simple but extremely effective. It is based on the assumption that, due to the bias to mainly publish statistically significant results, researchers with small samples and low precision are forced to search more intensely for their 'best' model specification, depending on their data and econometric technique, until they find larger estimates. Otherwise their results will not be statistically significant. By contrast, researchers with larger samples do not need to search so hard to find statistical significance in their estimates and will be more likely satisfied with lower estimates (Stanley and Doucouliagos 2012). In essence, should publication bias be present, the reported effect is, all else equal, positively and statistically significantly correlated with its standard error. Following the idea of Egger et al. (1997), such considerations suggest that the magnitude of the reported estimate depends on its standard error, or to depict this more formally in equation (1):

$$effect_i = \beta_0 + \beta_1 SE_i + \varepsilon_i \qquad (1)$$

where $effect_i$ represents an individual estimate and SE_i is its corresponding standard error. The term $\beta_1 SE_i$ models publication selection bias, and the parameters β_0 serve as estimates corrected for publication bias. However, the error term ε_i is not expected to be independently and identically distributed because the estimated effect is a regression coefficient from a larger sample within a study and hence the variance of $effect_i$ will vary from one estimate to another. This leads to the problem that estimating equation (1) with OLS will suffer from heteroscedasticity. Stanley and Doucouliagos (2012) suggest researchers should estimate and employ a weighted least squares (WLS) approach, which weights the standard errors by the inverse of each estimate's variance (e.g. 1/SE*SE). Equivalently, equation (1) can be divided by SE_i and estimated as:

$$t_i = \beta_1 + \beta_0 (1/SE_i) + v_i \qquad (2)$$

where t_i is the *t*-statistic of each individual estimated empirical effect and $(1/SE_i)$ represents its precision and $v_i = \varepsilon_i / SE_i$, which makes its variance approximately constant.

Hence, a simple MRA to test for the presence of publication selection is $H_0\colon \beta_1 = 0$, representing the test of whether or not there is publication selection present, and is called the funnel-asymmetry test (FAT). In addition, note that β_0 is the coefficient on precision in equation (2) and testing $H_0\colon \beta_0 = 0$, is the so called precision-effect test (PET), used to identify whether there is a 'genuine' underlying empirical effect net of a potential publication selection bias. Table 3-1 reports the estimates for the MRA model depicted in equation (2). As authors in the literature usually report multiple estimates, and since estimates within a study are likely not to be independent from each other, we have adjusted the WLS estimates for within-study dependence. Following closely Stanley and Doucouliagos (2012) we apply cluster-robust standard errors and random and fixed-effects unbalanced panel estimators.[12] Note that fixed-effects panel MRA models are our preferred option as random effects are likely to be correlated with the MRA independent variables (e.g.$1/SE_i$). Nevertheless, for the sake of completeness, we report both random and fixed effects in the following results sections. An additional factor in favour of fixed-effects MRA is the potential influence of unobserved study quality, which is filtered out when accounting for study effects (Doucouliagos and Stanley 2012).[13]

Table 3-1: Weighted least squares of meta-regression model (2)

	(1)	(2)	(3)
Variables	***Cluster***	***RE Panel***	***FE Panel***
a) Sample: employment and hours - partial correlations			
Intercept: Beta_1 (FAT)	-0.0597	-0.0686	0.0273
	(0.217)	(0.281)	(0.265)
(1/SE): Beta_0 (PET)	-0.0015	-0.0021	-0.0022
	(0.002)	(0.002)	(0.002)
n	*1,451*	*1,451*	*1,451*
b) Sample: employment and hours - elasticities			
Intercept: Beta_1 (FAT)	-0.7220	-0.6345	-0.4139
	(0.583)	(0.549)	(0.208)
(1/SE): Beta_0 (PET)	-0.0096	-0.0061	-0.0097
	(0.009)	(0.011)	(0.013)
n	*241*	*241*	*241*
c) Sample: employment retention - coefficients			
Intercept: Beta_1 (FAT)	-0.0788	0.0428	-0.0496
	(0.328)	(0.511)	(0.282)
(1/SE): Beta_0 (PET)	-0.0076	-0.0081	-0.0082
	(0.008)	(0.006)	(0.006)
n	*862*	*862*	*862*

Notes: entries report coefficient estimates for equation (2). Cluster robust standard errors are reported in parentheses (study nr). FAT is test for publication bias. PET is a test for the existence of a minimum wage effect corrected for publication bias. RE-panel and FE-panel represent the random/fixed effects panel meta-regression model. If the literature is free of publication bias, the intercept (FAT) should not be statistically significant.

Table 3-1 reports the estimated results for MRA model (2) for the three meta-samples, (a) partial correlations on employment and hours; (b) elasticities on employment and hours and; (c) coefficients of employment retention. The parameter estimates in Table 3-1 reveal that there is no statistical evidence of publication selection bias in the UK NMW literature, as the intercept (FAT) is not statistically significant for any of the three measures of employment effects. Hence, the hypothesis $H_0: \beta_1 = 0$ at $p > 0.05$ cannot

[12] Note that while most common panel data are pooled time-series and cross-sectional data, any multidimensional data may de facto be regarded as a panel.

[13] Assume that unobserved study quality is likely correlated with observed methodological and model specification choices by the study authors, likely affecting the precision of reported empirical effects. Fixed-effects panel methods filter out any study-level effects that are constant within study, which does not apply to random-effects panel methods or pooled OLS.

be rejected for the three research samples. This is in contrast to Doucouliagos and Stanley (2013) who found that most of economics research contains some publication selection bias but confirms the findings from de Linde Leonard et al. (2014) that showed no publication bias in the UK minimum wage literature.

In addition, the estimates reported in Table 3-1 suggest that there is no 'genuine' effect of the NMW on employment after taking into account and filtering potential publication selection. Across the three different employment measures and research samples, the parameter estimates for an estimate's precision (PET) are negative but not statistically significant. In other words, there is no evidence of a genuine nonzero effect as the hypothesis $H_0\colon \beta_0 = 0$ at p > 0.05 cannot be rejected. Even if the literature had passed the PET for the three employment measures across the three meta-samples from a statistical point of view, their practical or economic significance would be of no importance. For instance, the PET coefficient in column (3), panel (b) reports an elasticity of -0.0097, which means that a 10 per cent increase in the NMW would reduce employment by about 0.09 per cent. Such an adverse employment effect is so small that it is negligible and has no meaningful policy implication. Also when considering partial correlations (column (3), panel (a)), the adverse employment effect is -0.0022, and based on the notion that only partial correlations beyond 0.10 are of relevance, the size of the effect is negligible.

3.1.2. Robustness of the FAT-PET

Table 3-2 reports estimates for different sub-samples in order to check the robustness of the findings. Panel (a) presents the estimates for MRA outlined in equation (2) after removing outliers, defined as the cluster-robust MRA models in Table 3-1 for the absolute value of the standardised residuals being greater than 4.5. Panel (b) reports the cluster-robust estimates for MRA equation (2) for only negative employment measures, including partial correlations and elasticities for the employment and hours meta-sample and the coefficients of the employment retention probabilities sample. Similar to the findings presented in Table 3-1, looking at the PET estimates, there is no evidence of a significant 'genuine' employment effect. Note that in panel (b) the intercept for the FAT suggests a negative selection effect, which serves as a test that the MRA method works to filter radical selection.

In summary, when the entire aggregated research literature on employment effects of the NMW was investigated, we found neither evidence of a significant employment effect nor evidence of publication selection bias. This corroborates the findings from the earlier UK meta-analysis by de Linde Leonard et al. (2014), which also showed no evidence of an employment effect or presence of publication bias. One potential explanation for the lack of publication bias in contrast to the US minimum wage literature could be the LPC, which aims to publish and put into the public domain all their commissioned reports.

Note that the goal of this meta-analysis was to provide a comprehensive review and assessment of the existing empirical studies in the UK NMW literature. While the estimates of the simple FAT-PET tests outlined above are strong tests for the existence of an overall genuine effect and publication bias, they can be biased, like any regression model, when important explanatory variables are omitted. Hence, in what follows we included moderator variables to control and accommodate study heterogeneity and to identify what factors may affect the direction and magnitude of the NMW employment effect.

Table 3-2: Robustness analysis for meta-regression model (2) – fixed-effects weighted least squares

	(1)	(2)	(3)
	E & H: partial correlations	**E & H: elasticities**	**ER: coefficients**
a) Outliers removed			
Intercept: Beta_1 (FAT)	0.2766	-0.3011	0.0591
	(0.136)	(0.135)	(0.254)
(1/SE): Beta_0 (PET)	-0.0030	-0.0133	-0.0072
	(0.002)	(0.009)	(0.006)
n	*1,362*	*218*	*797*
b) negative measures only			
Intercept: Beta_1 (FAT)	-1.1988	-1.9915	-1.1529
	(0.208)**	(0.113)**	(0.282)**
(1/SE): Beta_0 (PET)	-0.0027	-0.0014	-0.0083
	(0.002)	(0.008)	(0.006)
n	*753*	*134*	*464*

Notes: entries report coefficient estimates for equation (2) using different sub-samples. Cluster robust standard errors are reported in parentheses (by studynr). FAT is test for publication bias. PET is a test for the existence of a minimum wage effect corrected for selection bias. Fixed effect WLS meta-regression model is used (similar to Column 3 in Table 3-1. Column (1) is for the meta-sample including partial correlations on employment and hours, column (2) is for the meta-sample including elasticities on employment and hours and column (3) is for the meta-sample including employment retention probabilities.

In addition, we investigated in more detail whether the NMW had different effects on different labour market sub-groups and at different times. It is important to stress that while the overall aggregate employment effects show no adverse employment effects, this could differ for distinct labour market sub-groups, such as part-time and/or female employees. There might also be different effects across the extensive (employment) and intensive (hours) margin.

3.2. Multiple MRA – taking into account study heterogeneity

In order to accommodate study heterogeneity the simple MRA model in equation (2) can be expanded as follows:

$$t_i = \beta_1 + \beta_0(1/SE_i) + \sum \beta_k Z_{ki}/SE_i + \sum \delta_j K_{ji} + v_i \quad (3)$$

where β_0 is replaced by $\beta_0 + \sum \beta_k Z_{ki}$ with the Z-variables allowing for heterogeneity and potential misspecification bias representing different study dimensions. Note that the term K_{ji} may represent any factor that is associated with the researcher's decision to report a statistically significant employment effect and hence is driving potential publication selection bias. As we did not identify any publication selection bias in the UK NMW literature we did not add K-variables. While already many potential Z-variables can be included in the regression, adding K-variables may increase the multicollinearity problem (Stanley and Doucouliagos 2012).

3.2.1. Moderator variables

A question that naturally arises is which Z-variables should be included as moderator variables in MRA model outlined in equation (3). Table 3-3 lists the moderator variables included with their means for each of the three meta-samples.

Table 3-3: Potential moderator variables for UK NMW research

Moderator variable	Definition	Mean: E&H PC	Mean: E&H Ela	Mean: ER
Published	equal to 1, if the estimate comes from a published study	0.207	0.245	0.206
Raw	equal to 1, if estimate relates to unadjusted specification	0.341	0.116	0.298
Panel	equal to 1, if estimate relates to panel data (base: cross-section)	0.536	0.701	0.225
Double	equal to 1, if estimate relates to double log specification	0.040	0.245	-
Lag	equal to 1, if estimate relates to a lagged NMW effect	0.089	0.324	-
Hours	equal to 1, if hours worked was used as employment outcome	0.556	0.232	-
Gap	equal to 1, if the wage gap is used as MW measure (base: below NMW)	0.152	0.083	0.216
Toughness	equal to 1, if the ratio of minimum to average is used (base: below NMW	0.153	0.299	-
Un	equal to 1, if a model includes unemployment	0.077	0.249	-
Youth	equal to 1, if estimate relates to youths (below age 22)	0.079	-	0.090
Female	equal to 1, if estimate relates to female employees	0.303	0.203	0.492
Male	equal to 1, if estimates relates to male employees	0.208	0.075	0.341
Part	equal to 1, if estimate relates to part-time employment	0.090	0.037	0.146
NMWintro	equal to 1, if estimate relates to NMW introduction in 1999	0.135	0.328	0.084
NMWbet	equal to 1, if estimate relates to NMW upratings after intro until 2007	0.154	0.033	0.209
NMWrec	equal to 1, if estimate relates to NMW upratings between 2007 and 2010	0.122	0.066	0.217
NMWafter	equal to 1, if estimate relates to NMW upratings after 2010	0.079	0.133	0.044
Firm	equal to 1, if analysis is on the firm level	0.117	0.448	-
Area	equal to 1, if analysis is on the spatial level	0.285	0.299	0.021
ASHE	equal to 1, if estimate based on ASHE/NES data	0.495	0.336	0.430
LFS	equalt to 1, if estimate is based on LFS data	0.349	-	0.565
Home	equal to 1, if estimate comes from residential home care data	0.030	0.183	-
LP	equal to 1, if estimates relates to low pay sector (other than home care)	0.042	0.149	0.037
DID	equal to 1, if it is a difference-in-difference estimate	0.870	0.618	0.889
RD	equal to 1, if it is regression discontinuity estimate	0.053	-	0.014
Lead	time impact measured (1 = 1 year later)	-	-	0.637

We started by including all moderator variables that have been identified in previous meta-analyses as important study dimensions (see e.g. Doucouliagos and Stanley, 2009; de Linde Leonard et al., 2014). Such dimensions include for instance, whether the minimum wage measure was lagged, or the definition of the NMW applied in the empirical model (e.g. a dummy for below the NMW before the introduction or uprating, the gap to the new measure or the relative ratio). In addition, we added indicators for different labour market sub-groups that have been documented to potentially be adversely affected by minimum wage increases, namely young people, women, men, and part-time workers. We also included different indicators of when the NMW impact was measured, for instance at the NMW introduction in

1999, in the years between introduction and the great recession (2001-2007), during the recession (2007-2010) and after the recession (2011 upwards). To that end we took into account that the NMW might have had different effects at its introduction and in subsequent annual upratings. We also distinguish estimates related to the residential home care sector and other low pay sectors (e.g. retail, agriculture, hospitality, cleaning, security, hairdressers, and textile).

Some of the estimates in our meta-samples have a rather high precision. Looking into more detail, it turned out that these estimates were not coding errors but all based on ASHE (or its predecessor NES) with relatively large sample sizes. Hence, we control for this in the subsequent analysis. Finally, unlike previous meta-analyses we also include indicators on whether the estimate relates to firm-level or area-level data (compared to individual-level data).

Note that in Table 3-3 not all measures are applicable to each sample as some moderators were not present among the estimates in each of the samples (e.g. by nature, no employment retention estimate used hours as the outcome measure). For the multiple MRAs reported in Table 3-4 to 3-6 we used the meta-samples with potential outliers removed (as used in Table 3-2, panel (a)). If the absolute value of the standardised residual was greater than 4.5 we deleted it from the sample. This prevents a single typo in the published research or in the data coding process making some coincidentally related research dimension more important than it is.

3.2.2. Multivariate MRA: findings

Tables 3-4 and 3-5 report the findings for the employment and hours meta-samples using partial correlations and elasticities as the effect measure, whereas Table 3-6 reports the findings for the employment retention meta-sample. The first column reports the estimates using cluster-robust weighted least squares and all moderator variables. As Stanley and Doucouliagos (2012) suggest, we employed a general-to-specific strategy by removing those variables that had the largest p-values until all p-values are smaller than 0.05. This is because there is much multicollinearity across all the moderator variables and some accommodation should be made to identify the more important research dimensions.

Hence, columns 3, 5 and 7 report the estimated coefficients applying the general-to-specific approach for (1) cluster-robust weighted least squares estimation and, subsequently, (2) random-effects; and (3) fixed-effects panel regressions. Note that the random-effects estimator assumes that unobserved study effects are independent of the included moderator variables, which is clearly a strong assumption. Stanley and Doucouliagos (2012) suggest, in the interest of robustness, reporting both random- and fixed-effects, but prefer fixed-effects panel methods. As the elasticity sample is a much smaller sub-sample of the overall NMW empirical estimates and potentially a selective sub-sample, in what follows we will report the results for both, but put more emphasis on the results of the larger partial correlations sample. What is more, similar to conventional econometric analysis, MRA parameter estimates are sensitive to changes in the data and methods applied. In that regard, we believe that only those research dimensions that are entirely robust against all three empirical methods used (Cluster, RE Panel, FE Panel) are genuine.

Table 3-4: Weighted least squares multiple MRA model (3) - partial correlations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Full		*General-to-Specific*					
Moderator variables	Cluster		Cluster		RE Panel		FE Panel	
	beta	*se*	beta	*se*	beta	*se*	beta	*se*
Precision: 1/SE	-0.0062	*(0.009)*	-0.0072	*(0.002)****	-0.0060	*(0.003)***	-0.0060	*(0.004)*
Published/SE	-0.0031	*(0.002)*						
Raw/SE	0.0006	*(0.000)*						
Panel/SE	**0.0098**	***(0.003)*****	**0.0092**	***(0.001)*****	**0.0087**	***(0.001)*****	**0.0084**	***(0.002)*****
Double/SE	**0.0150**	***(0.003)*****	**0.0151**	***(0.001)*****	**0.0168**	***(0.005)*****	**0.0169**	***(0.006)*****
Lag/SE	**-0.0086**	***(0.002)*****	**-0.0119**	***(0.001)*****	**-0.0084**	***(0.001)*****	**-0.0076**	***(0.002)*****
Hours/SE	0.0006	*(0.003)*						
Gap/SE	0.0005	*(0.000)**						
Toughness/SE	**0.0194**	***(0.004)*****	**0.0164**	***(0.003)*****	**0.0168**	***(0.002)*****	**0.0166**	***(0.002)*****
UN/SE	-0.0054	*(0.001)****						
Young/SE	-0.0045	*(0.004)*						
Female/SE	-0.0042	*(0.005)*						
Male/SE	-0.0036	*(0.005)*						
Part/SE	-0.0021	*(0.001)**						
NMWintro/SE	**-0.0063**	***(0.003)****	**-0.0093**	***(0..002)*****	**-0.0061**	***(0.002)*****	**-0.0053**	***(0.002)****
NMWbet/SE	0.0032	*(0.002)*						
NMWrec/SE	0.0005	*(0.001)*						
NMWafter/SE	**0.0030**	***(0.001)****	**0.0019**	***(0.001)*****	**0.0018**	***(0.001)****	**0.0017**	***(0.001)****
Firm/SE	-0.0034	*(0.007)*						
Area/SE	-0.0090	*(0.003)***	-0.0063	*(0.002)***	-0.0081	*(0.005)*	-0.0078	*(0.006)*
ASHE/SE	**-0.0037**	***(0.006)***	**-0.0029**	***(0.001)*****	**-0.0039**	***(0.002)****	**-0.0044**	***(0.002)****
LFS/SE	-0.0012	*(0.007)*						
Home/SE	-0.0847	*(0.012)****	-0.0893	*(0.009)****	-0.0900	*(0.013)****	-0.0721	*(0.048)*
LP/SE	0.0010	*(0.003)*						
DID/SE	**0.0094**	***(0.002)*****	**0.0070**	***(0.001)*****	**0.0056**	***(0.001)*****	**0.0059**	***(0.001)*****
RD/SE	0.0054	*(0.003)*						
Constant	-0.0832	*(0.166)*	-0.0056	*(0.122)*	-0.0520	*(0.235)*	-0.0420	*(0.262)*

*Notes: cluster robust standard errors are reported in parentheses (studynr); *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. The dependent variable is the t-stat of the partial correlation coefficient. See table 3-3 for definitions of the different moderator variables.*

Several interesting patterns emerge from the meta-analysis of the UK NMW research. Firstly, even after taking into account study heterogeneity, on aggregate we can only identify very small adverse employment effects of the NMW, which are negligible in magnitude. For instance, the partial correlation coefficients for precision in Table 3-4, columns 3, 5 and 7 are between -0.006 and -0.0072 and hence much lower than 0.1, which is the size at which a partial correlation is deemed significant. Even if we add other research dimensions that have been identified to be statistically significant and underpin an adverse employment effect (e.g. *Lag, NMWintro*), the partial correlation coefficient is way short of becoming equal to or larger than 0.1. If we add other statistically significant research dimensions (e.g. *Panel*), the findings suggest that the employment effect is even positive (but not statistically or economically relevant).

Second, similar to the findings of de Linde Leonard et al. (2014), measuring the minimum wage in relative terms through *Toughness,* the relative NMW measure, has a relative positive effect on the partial correlation coefficients of the estimated employment effects. For instance, combining the coefficient in column 7 with the coefficient for precision would lead to an overall positive employment effect (but negligible in size).

Third, similar to de Linde Leonard et al. (2014), our findings suggest a larger adverse employment effect in the UK residential home care industry (*Home*). The coefficient is relatively large in both samples, partial correlations and elasticities, and of similar size to that reported by de Linde Leonard et al. (2014) but not statistically significant once we include study fixed-effects.

Fourth, in the partial correlations sample, estimates based on differences-in-differences (*DID*) have a relatively larger positive magnitude than estimates based on other identification strategies, hence making an estimated employment effect less negative.[14]

However, this does not apply to the elasticities or employment retention samples. Fifth, the timing (and hence the relative strength) of the NMW increases matters. The MRA parameter estimates suggest that there was a relatively larger adverse employment effect from the introduction of the NMW in 1999, *NMWintro*, which holds for the partial correlations sample and also for the elasticities sample, although the parameter estimate for the latter is not statistically significant. However, the adverse employment effect is probably too small to be of economic relevance (much lower than 0.1). Table 3-5 suggests that for the elasticities sample, in the years between the NMW introduction and the great recession, the NMW upratings may have led to larger adverse employment effects (*NMWbet*). This also applies for the upratings during and after the recession (*NMWrec, NMW after*), however, the elasticities are much lower than during the introduction of the NMW (which is not statistically significant for the elasticities sample).

Sixth, estimates based on the ASHE/NES data are relatively smaller in magnitude than estimates based on other datasets, reducing the partial correlations of the estimated employment effects between 0.0029 and 0.0044 and hence in combination with the coefficient for precision leading to a relatively larger adverse employment effect, all else equal. This is probably due to the relatively large sample size of the ASHE, which may reduce the efforts required of researchers to find larger estimates in order to report statistically significant effects. In contrast, for the employment retention sample, the parameters reported in Table 3.6 suggest that estimates based on ASHE/NES or LFS data are relatively larger in magnitude than estimates based on other datasets.

Seventh, there appears to be a relatively larger adverse employment effect for estimates related to low pay sectors (*LP*). However, this only applies to the elasticities sample and not for the partial correlations

[14] In combination with the negative coefficient of precision, the combined effect is still slightly negative but less, all else equal.

sample. Finally, for the elasticities and employment retention samples, we observed some larger adverse employment effects for part-time employees (*Part*).

In addition, the multivariate MRAs presented in Tables 3-4 to 3-6 are consistent with the simple MRA findings presented in Tables 3-1 and 3-2 that there is no publication bias in the aggregated UK NMW literature. The results presented here show that certain research dimensions have different effects on finding an (adverse) employment effect of the NMW. Especially it seems that part-time employees may have been more adversely affected. Furthermore, the relatively large increase at the introduction, and potentially the upratings during the recession, may have also resulted in heterogeneous employment effects. In what follows we explore whether specific sub-groups may have been more likely to be subject to larger adverse employment effects than the overall aggregated literature may suggest and also taking into account the timing of the NMW increase, either at introduction or during the recession.

Table 3-5: Weighted least squares multiple MRA model (3) -elasticities

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Full		General-to-Specific					
Moderator variables	Cluster		Cluster		RE Panel		FE Panel	
	beta	*se*	beta	*se*	beta	*se*	beta	*se*
Precision: 1/SE	-0.0745	*(0.207)*	-0.0052	*(0.009)*	0.1030	*(0.046)***	0.0879	*(0.060)*
Published/SE	0.1390	*(0.034)****	0.1092	*(0.011)****	0.0977	*(0.027)****	0.3417	*(0.202)*
Raw/SE	0.0083	*(0.007)*						
Panel/SE	0.1598	*(0.171)*						
Double/SE	0.0007	*(0.068)*						
Lag/SE	-0.1074	*(0.083)*						
Hours/SE	-0.0168	*(0.033)*						
Gap/SE	0.0341	*(0.045)*						
Toughness/SE	0.0404	*(0.005)****	0.0389	*(0.005)****	-0.0542	*(0.061)*	0.0697	*(0.176)*
UN/SE	-0.0193	*(0.077)*						
Male/SE	**-0.0108**	***(0.000)******	**-0.0113**	***(0.001)******	**0.0003**	***(0.005)***	**-0.0107**	***(0.000)******
Female/SE	**0.0161**	***(0.000)******	**0.0153**	***(0.001)******	**0.0165**	***(0.001)******	**0.0163**	***(0.000)******
Part/SE	**-0.1451**	***(0.000)******	**-0.1449**	***(0.000)******	**-0.1444**	***(0.001)******	**-0.1450**	***(0.000)******
NMWintro/SE	-0.1318	*(0.071)*						
NMWbet/SE	**-0.0055**	***(0.000)******	**-0.0061**	***(0.001)******	**-0.0062**	***(0.000)******	**-0.0055**	***(0.000)******
NMWrec/SE	**-0.0138**	***(0.000)******	**-0.0144**	***(0.001)******	**-0.0116**	***(0.001)******	**-0.0138**	***(0.000)******
NMWafter/SE	**-0.0347**	***(0.000)******	**-0.0353**	***(0.001)******	**-0.0322**	***(0.001)******	**-0.0347**	***(0.000)******
Firm/SE	0.0353	*(0.069)*						
Area/SE	0.2009	*(0.116)*						
ASHE/SE	-0.1340	*(0.029)****	-0.1265	*(0.015)****	-0.1059	*(0.043)***	-0.2976	*(0.161)*
Home/SE	-0.2648	*(0.028)****	-0.1925	*(0.024)****	-0.2288	*(0.024)****	-0.3824	*(0.295)*
LP/SE	**-0.5675**	***(0.047)******	**-0.5622**	***(0.070)******	**-0.7049**	***(0.123)******	**-0.5851**	***(0.048)******
DID/SE	0.0153	*(0.073)*						
Constant	-0.7008	*(0.200)***	-0.6516	*(0.239)***	-0.0524	*(0.561)*	-0.5001	*(0.299)*

*Notes: cluster robust standard errors are reported in parentheses (studynr); *** p<0.01, ** p<0.05, * p<0.10. The dependent variable is the t-stat of the elasticity. See table 3-3 for variable definitions for the different moderator variables.*

Table 3-6: Weighted least squares multiple MRA model (3) –employment retention probability

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Full		*General-to-Specific*					
Moderator variables	Cluster		Cluster		RE Panel		FE Panel	
	beta	*se*	beta	*se*	beta	*se*	beta	*se*
Precision: 1/SE	-0.0483	*(0.006)****	-0.0264	*(0.005)****	-0.0425	*(0.012)****	-0.0436	*(0.013)****
Published/SE	-0.0059	*(0.006)*						
Raw/SE	-0.0017	*(0.002)*						
Panel/SE	0.0075	*(0.006)*						
Gap/SE	0.0049	*(0.005)*						
Youth/SE	0.0025	*(0.009)*						
Female/SE	-0.0011	*(0.004)*						
Male/SE	-0.0020	*(0.006)*						
Part/SE	**-0.0148**	***(0.002)*****	**-0.0211**	***(0.005)*****	**-0.0180**	***(0.003)*****	**-0.0180**	***(0.003)*****
NMWintro/SE	0.0116	*(0.005)**						
NMWbet/SE	-0.0026	*(0.005)*						
NMWrec/SE	0.0035	*(0.002)*						
NMWafter/SE	-0.0103	*(0.015)*						
ASHE/SE	**0.0207**	***(0.007)****	**0.0214**	***(0.007)****	**0.0369**	***(0.009)*****	**0.0379**	***(0.010)*****
LFS/SE	**0.0406**	***(0.007)*****	**0.0383**	***(0.003)*****	**0.0499**	***(0.010)*****	**0.0507**	***(0.011)*****
DID/SE	0.0070	*(0.005)*						
RD/SE	-0.0190	*(0.009)**	-0.0128	*(0.003)****	-0.0085	*(0.005)**	-0.0083	*(0.005)*
Lead/SE	0.0104	*(0.004)***						
Constant	-0.0228	*(0.124)*	-0.2390	*(0.145)*	-0.1588	*(0.205)*	-0.1593	*(0.117)*

*Notes: cluster robust standard errors are reported in parentheses (studynr); *** p < 0.01, ** p < 0.05, * p < 0.10. The dependent variable is the t-stat of the employment retention coefficient. See table 3-3 for variable definitions of the different moderator variables.*

3.2.3. Sub-group analysis

The previous section outlined the extent to which the effects in the aggregated UK NMW empirical research differ across different research dimensions and highlighted that some labour market sub-groups, such as part-time employees, may have been relatively more adversely affected than other groups. In addition, the NMW may have had a relatively greater adverse effect at its introduction or during the great recession. From a policy perspective, these less aggregated effects by sub-groups can be more insightful than the overall effect. In addition, we also distinguished between employment (extensive margin) and hours (intensive margin) and examined whether we can find any relevant differences across these two margins for the employment and hours sub-sample using partial correlations.

In order to investigate this matter in more detail, we drew again on the MRA model outlined in equation (3) but slightly changed the moderator variables. More specifically, we investigated the interaction of the sub-group variables *Female*, *Male*, *Youth* and *Part (part-time)* with the indicator variables of whether it was a period of NMW introduction, *NMWintro, or during the recession, NMWrec.*[15]

Table 3-7: MRA sub-group analysis by employment and hours – partial correlations

	(1)	(2)	(3)	(4)	(5)	(6)
	Cluster		RE Panel		FE Panel	
Sub-groups	*emp*	*hours*	*emp*	*hours*	*emp*	*hours*
Precision: 1/SE	0.0017	0.0018	0.0017	0.0018	-0.0012	-0.0027
se	*(0.006)*	*(0.002)*	*(0.006)*	*(0.002)*	*(0.007)*	*(0.009)*
Youth/SE	-0.0055	0.0021	-0.0055	0.0021	-0.0054	0.0041
se	*(0.004)*	*(0.002)*	*(0.004)*	*(0.002)*	*(0.004)*	*(0.003)*
Female/SE	**0.0373**	-0.0009	**0.0373**	-0.0009	**0.0355**	0.0025
se	*(0.003)****	*(0.005)*	*(0.003)****	*(0.005)*	*(0.001)****	*(0.002)*
Male/SE	0.0018	-0.0009	0.0018	-0.0009	-0.0001	0.0030
se	*(0.003)*	*(0.005)*	*(0.003)*	*(0.005)*	*(0.001)*	*(0.001)**
Part/SE	**-0.1178**	**0.0015**	**-0.1178**	**0.0015**	**-0.1177**	**0.0028**
se	*(0.000)****	*(0.001)**	*(0.000)****	*(0.001)**	*(0.000)****	*(0.001)***
NMWrec/SE	**0.0187**	-0.0017	**0.0187**	-0.0017	**0.0168**	-0.0039
se	*(0.005)****	*(0.008)*	*(0.005)****	*(0.008)*	*(0.004)****	*(0.003)*
(Female*NMWrec)/SE	**-0.0224**	-0.0022	**-0.0224**	-0.0022	**-0.0205**	-0.0000
se	*(0.005)****	*(0.008)*	*(0.005)****	*(0.008)*	*(0.004)****	*(0.003)*
(Part*NMWrec)/SE	**-0.0212**	**0.0046**	**-0.0212**	**0.0046**	**-0.0211**	**0.0052**
se	*(0.000)****	*(0.001)****	*(0.000)****	*(0.001)****	*(0.000)****	*(0.001)****
(Youth*NMWrec)/SE	-0.0042	-0.0049	-0.0042	-0.0049	-0.0072	-0.0013
se	*(0.007)*	*(0.008)*	*(0.007)*	*(0.008)*	*(0.005)*	*(0.003)*
(Male*NMWrec)/SE	**-0.0232**	0.0036	**-0.0232**	0.0036	**-0.0213**	0.0056
se	*(0.005)****	*(0.008)*	*(0.005)****	*(0.008)*	*(0.004)****	*(0.005)*
Intercept	-0.5744	-0.0722	-0.5744	-0.0722	0.2025	-0.2784
se	*(0.147)****	*(0.201)*	*(0.147)****	*(0.201)*	*(0.198)*	*(0.915)*

*Notes: cluster robust standard errors are reported in parentheses (studynr); *** p < 0.01, ** p < 0.05, * p < 0.10. The dependent variable is the t-stat of the partial correlation coefficient. See table 3-3 for variable definitions for the different moderator variables. As additional moderator variables were included: Panel, Double, Toughness, DID and ASHE.*

Table 3-7 reports the findings for the employment and hours meta-sample. The results confirm those from the previous section that compared to partial correlation coefficients related to all and full-time only employees there is a relatively larger adverse employment effect for part-time employees, which seems to be slightly larger during the recession. There is a statistically significant positive effect on hours, but the partial correlation coefficient is very small and therefore not of economic relevance.

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[15] Note that due to lack of sufficient numbers of estimates within some of the sub-group cells, we were only able to build interactions for these two NMW variables. For the employment and hours meta-sample only interactions with *NMWrec* were feasible.

Furthermore, estimates related to female employees seem to be relatively larger in magnitude for NMW increases before and after the great recession but there seems to be a relatively larger adverse employment effect for estimates specifically related to female or male employees[16], as well as part-time employees during the recession, but no statistically significant (nor economically relevant) effect on hours. However, when combining the effects, as summarised in Table 3-8 for the partial correlations sample, the findings suggest a positive employment effect (extensive margin) for female employees, which may reflect a supply effect and a negative employment effect for part-time employees.[17]

Table 3-8: Sub-group analysis – summary using columns 5 and 6 of Table 3-7

Partial correlations:		*Emp*		*hours*	
Youth	recession	0.003	*(0.007)*	-0.004	*(0.009)*
	other	-0.007	*(0.007)*	0.001	*(0.010)*
Female	recession	**0.03**	***(0.007)****	-0.004	*(0.007)*
	other	**0.034**	***(0.007)****	-0.001	*(0.007)*
Male	recession	-0.006	*(0.007)*	0.002	*(0.011)*
	other	-0.001	*(0.007)*	0.001	*(0.009)*
Part	recession	**-0.123**	***(0.011)****	0.001	*(0.007)*
	other	**-0.119**	***(0.007)****	0.001	*(0.009)*

*Notes: standard errors in parentheses; *** p< 0.001, ** p < 0.05, * p < 0.10; based on linear combination of precision estimate and FE panel estimates for the sub-groups reported in Table 3-7 columns (5) and (6).*

Table 3-9 reports the finding for the employment retention probabilities meta-sample. There seems to be a relatively larger adverse retention ratio for the young during the great recession. In addition, again, part-time employees seem to be more likely to be adversely affected. The combined effects are summarised in Table 3-10. The findings suggest that during the great recession, young employees have seen their employment ratios reduced by about 7.9 percentage points. Part-time employees have been particularly negatively affected during the introduction of the NMW and in the time between the introduction and the recession as well as after the recession (however not during the recession). For instance, the employment retention probability for part-time employees seems to be reduced by around 3.9 percentage points following the NMW's introduction.

In summary, while the aggregated analysis on the employment effects of the NMW suggests no adverse effect, the sub-group analysis suggests that part-time employees may have endured some relatively larger adverse negative employment effects, compared to other labour market groups. Interestingly, young employees seem generally not to have been adversely affected by NMW increases, only the findings during the recession suggest a decrease in their employment retention probabilities.

[16] i.e. compared to estimates related to all employees.

[17] Note that almost 80 per cent of estimates on part-time employees are related to female part-time employees, so in essence, the effect for female workers may pick up a supply effect for full-time female employees in light of an increasing minimum wage.

Table 3-9: MRA sub-group analysis employment retention – coefficients

	(1)	(2)	(3)
Sub-group	Cluster	RE Panel	FE Panel
Precision: 1/SE	-0.0286	-0.0286	-0.0274
	(0.004)***	(0.004)***	(0.020)
Youth/SE	0.0101	0.0101	0.0121
	(0.007)	(0.007)	(0.009)
Female/SE	-0.0043	-0.0043	-0.0064
	(0.004)	(0.004)	(0.004)
Male/Se	-0.0069	-0.0069	-0.0091
	(0.008)	(0.008)	(0.008)
Part/SE	**-0.0178**	**-0.0178**	**-0.0172**
	(0.005)***	(0.005)***	(0.003)***
NMWintro/SE	0.0180	0.0180	0.0059
	(0.006)**	(0.006)***	(0.005)
NMWrec/SE	-0.0033	-0.0033	0.0509
	(0.006)	(0.006)	(0.010)***
(Female*NMWintro)/SE	**-0.0171**	**-0.0171**	**-0.0088**
	(0.006)**	(0.006)***	(0.004)*
(Part*NMWintro)/SE	-0.0046	-0.0046	-0.0007
	(0.006)	(0.006)	(0.003)
(Young*NMWintro)/SE	**-0.0182**	**-0.0182**	**-0.0215**
	(0.007)**	(0.007)**	(0.009)**
(Male*NMWintro)/SE	-0.0118	-0.0118	-0.0004
	(0.008)	(0.008)	(0.006)
(Female*NMWrec)/SE	0.0044	0.0044	-0.0500
	(0.007)	(0.007)	(0.011)***
(Part*NMWrec)/SE	0.0027	0.0027	0.0024
	(0.004)	(0.004)	(0.004)
(Youth*NMWrec)/SE	**-0.0534**	**-0.0534**	**-0.1142**
	(0.011)***	(0.011)***	(0.020)***
(Male*NMWrec)/SE	0.0121	0.0121	-0.0428
	(0.009)	(0.009)	(0.017)**
Constant	-0.1699	-0.1699	-0.1393
	(0.136)	(0.136)	(0.167)
Observations	825	825	825

*Notes: cluster robust standard errors are reported in parentheses (studynr). *** p< 0.001 ** p < 0.05, * p < 0.10. The dependent variable is the t-stat of the employment retention coefficient. See table 3-3 for variable definitions.*

Table 3-10: Sub-group analysis – summary using column 3 of Table 3-9

Employment retention		beta	se
Young	intro	-0.0309	*(0.019)*
	recession	**-0.0786**	***(0.023)****
	other	-0.0153	*(0.027)*
Female	intro	-0.0366	*(0.03)*
	recession	-0.0329	*(0.019)*
	other	-0.0337	*(0.02)*
Male	intro	-0.0310	*(0.021)*
	recession	-0.0285	*(0.019)*
	other	-0.0365	*(0.026)*
Part	intro	**-0.0394**	***(0.018)****
	recession	0.0087	*(0.026)*
	other	**-0.0446**	***(0.019)*****

Notes: standard errors in parentheses. *** $p < 0.001$, ** $p < 0.05$, * $p < 0.10$; based on linear combination of FE panel estimates for precision and different sub-group combinations.

4. Discussion

4.1. Summary

We conducted a comprehensive systematic review and meta-analysis of the UK NMW empirical research on employment. Our study complemented the previous UK minimum wage meta-analysis by de Linde Leonard et al (2014) in that this analysis focused on the NMW since its introduction in 1999 but with the objective of analysing in more detail specific labour market sub-groups, such as women, part-time employees and young people. We also investigated different increases in the NMW, for instance whether the NMW upratings had different effects during the introduction or during the great recession. Overall, this meta-study included more than 2,000 estimates from the empirical NMW literature and hence almost doubled the sample size of the previous UK meta-analysis by de Linde Leonard et al. (2014).

The findings of the study can be summarised as follows: in line with de Linde Leonard et al. (2014) we found no publication selection bias in the aggregated UK NMW literature and no overall statistically or economically significant adverse employment effect, neither on employment and hours nor on employment retention probabilities. However, when we investigated the employment effects for specific labour market sub-groups, we found that part-time employees may have been more adversely affected by NMW increases than other sub-groups, irrespective of when the uprating happened. This was especially the case when we look at employment retention probabilities, where estimates related to part-time employees showed a larger negative impact on employment retention at the introduction of the NMW and across all periods except during the great recession. In response, sub-group specific NMW rates, similar to the ones applied for employees under 25 years of age, may be considered by the LPC for other labour market sub-groups in the future. What is more, we provide some evidence that the employment retention of young workers may have been relatively more adversely affected during the great recession than that of other sub-groups.

Furthermore, our MRA identified certain research dimensions that affect the magnitude of the reported empirical employment effects. For instance, the use of a relative measure of the minimum wage (toughness) leads to a relatively larger magnitude of the estimated employment effect. Other differential effects may matter as well, but these effects are less robust and have smaller impact on the magnitude of the estimated employment effects, including whether the study used differences-in-differences, included a lag of the minimum wage measure or used the ASHE data. In addition, we found that estimates measuring the impact of the NMW introduction in 1999 showed statistically significant adverse impacts on employment, compared with estimates not related to the introduction period, but the size (and hence economic relevance) of the effects is probably negligible. Similar to de Linde Leonard et al. (2014) we found some adverse employment effects in the residential home care sector, but the effect was not robust across all econometric model specifications.

4.2. Potential areas for future research

Building on our analysis, we identify several research areas that appear to merit further attention. Firstly, a general area of concern in meta-analysis is the dependence of estimates within and between different studies. In the previous sections we outlined how to deal with within-study dependence of estimates, i.e. the problem that estimates within a study are clearly not independent from each other.[18] However, how to deal with between-study dependence is less straightforward. For instance, many authors write more than one paper about the same topic. What is more, authors in a specific research area may also be strongly interlinked with each other, for instance by working in the same university department or sitting on the same board of editors of an academic journal. Researchers may also form different research collaborations over time. Hence, it must be expected that they influence each other's work and so estimates are not independent across studies. One methodological improvement of this between-study dependence in meta-analyses could be to map networks of these researcher interrelationships and then apply appropriate estimation methods to take them into account, such as those used in spatial econometrics.[19]

Secondly, meta-studies can be very powerful in synthesising and evaluating existing empirical research. However, as we already highlighted in section 1.4 of this study, there is a great degree of subjectivity in this research area. Therefore, it is important for meta-analysts to be as transparent as possible in the description of studies and estimates that are included in the data. To that end, making the meta-data publicly accessible for other researchers is key, as it allows the replication and evaluation of the analysis. The LPC could play an active role in this area by encouraging further meta-analyses and potentially creating its own database of studies and corresponding estimates that could be updated from time to time. This would allow a rerun of the estimation of the employment effects on a regular basis.

Thirdly, the effect sizes for particular labour market groups, such as part-time workers, may need some further investigation. That is, the majority of existing empirical studies do not pay specific attention to potentially vulnerable groups. In order to better understand the heterogeneous employment impacts on these specific labour market subgroups, the LPC could place special emphasis on them in future research it commissions.

[18] E.g. applying cluster-robust estimates or random and fixed-effects panel estimation methods.

[19] We note that Professor Peter Dolton is working on such a network analysis, which is a highly welcomed innovative approach in the area of meta-analysis.

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