Economics
The Open-Access, Open-Assessment E-Journal

**Discussion Paper**
No. 2015-58 | August 31, 2015 | http://www.economics-ejournal.org/economics/discussionpapers/2015-58

# Is There Publication Selection Bias in Minimum Wage Research during the Five-year Period from 2010 to 2014?

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**Abstract**
The impact of minimum wages on employment has always been a field of conflicts among economists and this divergence of views has usually taken the form of competing studies. Doucouliagos and Stanley (*Publication selection bias in minimum-wage research? A meta-regression analysis*, 2009) conducted a meta-analysis of 64 US studies which showed that literature is contaminated by publication selection bias, and once it is corrected, little or no evidence of a negative association between minimum wages and employment remains. This result contradicts the neoclassical theory and gives a Keynesian perspective which suggests that changes in minimum wages are not related with positive or negative employment effects. In their analysis, the authors use a meta-sample of 45 empirical studies published in academic journals in the 2010–2014 five-year period, to investigate whether minimum wage research has been affected by Doucouliagos and Stanley's study. Their results indicate that there is evidence of publication selection in the elasticities' meta-sample, but once it is corrected only a small negative effect remains and, in the coefficients' meta-sample, publication selection bias is not found and the genuine effect is again negative but small. In addition, the authors find that study characteristics related to the data, the model specifications, the minimum wage and employment measure used, and the industry concerned, diversify the sign of the minimum wage effect.

(Published in Special Issue Meta-Analysis in Theory and Practice)

**JEL** J38 J21 C12
**Keywords** Minimum wage; employment; meta-analysis

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**Citation** Georgios Giotis and Michael Chletsos (2015). Is There Publication Selection Bias in Minimum Wage Research during the Five-year Period from 2010 to 2014? Economics Discussion Papers, No 2015-58, Kiel Institute for the World Economy. http://www.economics-ejournal.org/economics/discussionpapers/2015-58

**Received** May 31, 2015 **Accepted as Economics Discussion Paper** August 27, 2015 **Published** August 31, 2015

## 1. Introduction

The impact of minimum wages on employment has been a field of conflicts within the economic society and especially in labor economics. One side supports that minimum wages have a negative effect on employment, another smaller side argues that there can be a positive impact, while there is also a side which argues that minimum wages do not affect (or only slightly affect) employment. More specifically, until the early 90's the neoclassical approach was the prevailing theory and strong consensus existed among economists that an increase in the minimum wage would cause a decrease in employment. However, the studies by Card (1992) and Katz and Krueger (1992) came to create a schism as they did not find evidence of adverse employment effects of minimum wages. Since then, a divergence of views exists in the literature, which is expressed by opposing views.

In this frame of competing theoretical and empirical studies, Doucouliagos and Stanley (2009) conducted a meta-analysis of 64 US studies which provided 1,474 estimates of the employment elasticity and concluded that literature is contaminated by publication selection bias, and once this publication selection is corrected, little or no evidence of a negative association between minimum wages and employment remains. This result contradicts the neoclassical theory and gave an opening to oligopolistic or monopsonistic theories, or efficiency wages and job search models, which opposed to the dominant neoclassical theory. In addition, we could say that their study gave a Keynesian perspective in minimum wage research, in the view that changes in minimum wages are not related with positive or negative employment effects at all.

Undoubtedly, Doucouliagos and Stanley meta-analysis in 2009 had an important impact on the economic research with the use of meta-analysis techniques, which are very useful statistical tools for reviewing empirical results, and boosted the meta-analysis studies in economics. The purpose of our paper is to see whether minimum wage research has been affected by their study and investigate the presence of publication selection bias in minimum wage literature since then. In addition, our objective is to find the genuine effect of minimum wage on employment, if any exists.

In our analysis, we use a meta-sample of 45 empirical studies published in academic journals in the 2010-2014 five-year period. When 1,068 elasticities and 484 coefficients are combined to constitute the meta-sample from these studies, evidence

of publication selection bias is found in the elasticities' meta-sample, but when it is corrected only a slight employment effect remains. On the other hand, no evidence of publication bias is found in the smaller coefficients' meta-sample and the true effect of minimum wage on employment is negative but small. Furthermore, study characteristics related to the data, the model specifications, the minimum wage and employment measure used, and the industry concerned, diversify the sign of the impact. In what follows, we present the previous literature on this issue using meta-analysis methods, the coding and indexing procedure, and some characteristics of our meta-sample and then we enter into the FAT-PET tests and the multiple meta-regression analysis. Finally, we present the concluding remarks of our analysis.

## 2. Review of meta-analysis literature on the employment effect of minimum wage

Until March 31, 2015, in our research, we have found six studies that use meta-analysis methods to investigate the employment effect of minimum wages. First, Card and Krueger (1995) analyzed 15 earlier US time-series studies on minimum wages and found publication bias in favor of studies that provided a statistically significant negative employment effect. The authors suggested that the most recent studies, which had more data and lower standard errors, did not show the expected increase in t-statistic and almost all the studies had a t-statistic of about two, just above the level of statistical significance at 5%. That study created a schism among economists and created the base for the New Minimum Wage Theory.

The second meta-analysis was conducted by Doucouliagos and Stanley (2009) using 64 US studies which offered 1,474 estimates of the employment elasticity and concluded that Card and Krueger's initial claim of publication bias was right and once this publication selection was corrected, an adverse employment effect was not supported by this large and rich research record on the employment effects of minimum-wage regulation. One year later, Boockmann (2010) conducted a meta-analysis of 55 empirical studies estimating the employment effects of minimum wages in 15 industrial countries since 1995. Almost 2/3 of the estimations of the meta-sample provided negative sign, implying that studies were still affected by the traditional neoclassical theory.

Nataraj *et al.* (2014) dealt with the employment effect of minimum wage in low-income countries with meta-analysis methods. Their meta-sample utilized fifteen studies from individual countries and two cross-country studies, and the meta-regression analysis showed an ambiguous effect of minimum wages on total employment, specifically a positive impact on informal employment and negative on formal employment. Another study published at the same year was conducted by Leonard *et al.* (2014). The authors used meta-analysis techniques to investigate the effect of increases in the UK minimum wage on employment. The meta-sample consisted of 16 studies which provided 710 partial correlations and 236 elasticities and according to the results no adverse effect of minimum wage could be found by the increases of the UK minimum wages apart from the residential home-care sector. In comparison to Doucouliagos and Stanley (2009), this study did not find evidence or publication bias as the larger US study did.

Closing the review of previous meta-analysis on the employment impact of minimum wages, we should mention Belman and Wolfson (2014) who use data from 23 international studies since 2000. Their meta-sample generated 439 estimates and the majority of the studies concerned the USA. Generally, we could say that the authors found negative and statistically significant effects of minimum wage which were very small, though.

Table 1, reports the basic characteristics of the previous meta-analysis studies discussed above. It seems quite interesting that in 2014 alone, three such studies have been published and, generally, we can say that the literature on the effect of minimum wages on employment is not only large but it is also growing. Within the framework of the large minimum wage research, we tried to investigate this issue using the highest possible number of related empirical studies published in academic journals during the last five years, in order to attempt to provide a general and objective picture of the literature after searching the academic journals thoroughly.

Table 1. Previous meta-analysis on the employment effect of minimum wages.

| | Author(s) | *Year* | Country(ies) examined | Studies in the meta-sample | Studies' time-period |
|---|---|---|---|---|---|
| 1 | Card and Krueger | 1995 | USA | 15 | 1970-1992 |
| 2 | Doucouliagos and Stanley | 2009 | USA | 64 | 1972-2007 |
| 3 | Boockman | 2010 | Industrial countries | 55 | 1995-2009 |
| 4 | Nataraj *et al.* | 2014 | Low-income countries | 17 | 1991-2011 |
| 5 | Leonard *et al.* | 2014 | UK | 16 | 1994-2012 |
| 6 | Belman and Wolfson | 2014 | Different countries | 23 | 2000-2013 |

## 3. The meta-sample and the indexing and coding of the data

In general, meta-analysis is a very useful tool to examine all the available research to present an objective picture of the literature. It is more than a review as it employs statistical techniques to summarize the empirical evidence and explore the sources of heterogeneity among studies. Moreover it can be used to provide the genuine effect when the publication bias is corrected. The initial but very important steps are the process of the identification of the studies and the coding of the observations which will constitute the meta-sample. Stanley *et al.* (2013) present the guidelines that all meta-analyses in economics should follow. In our analysis we try to fully comply with these protocols expressed by the meta-analysis of economics research-network (MAER-Net).

First of all, we began our research using the Google Scholar search machine, and afterwards the economic databases Econlit, Sciencedirect, RePEc and JSTOR. Our objective was to find those empirical studies published in academic journals which reported at least one estimate on the employment effect of minimum wage. The main the keywords used in the search were “minimum wage” and “employment” and we also used several other flections as a keyword. Before entering into the details of the identification, it has to be pointed out that we restricted the research only to those studies published during the five year period from 2010 to 2014 to investigate whether the study by Doucouliagos and Stanley in 2009 has affected the minimum wage literature on the employment impact onwards. Our search for studies was terminated January 31, 2015.

We chose to restrict our meta-sample only to studies published in an academic journal and not to broaden our search to unpublished papers or to other publication outlets without refereeing process. Moreover, apart from those papers not published in an academic journal, we filtered out the studies where at least one of the following characteristics was present:

- Studies using unemployment rate or labor force participation rate or self-employment as an employment measure.
- Studies which focus on the minimum wage effect on average wage, income inequality, income distribution, reservation wage, poverty, welfare, prices, profits, firm performance, job training or economic development.
- Theoretical studies which do not report regression estimates.

- Studies which use statistical and mathematical models to examine the minimum wage effect, mostly with the use of correlations, descriptive statistics and diagrams.
- Studies written in any other language than English.
- Studies which do not mention a direct minimum wage effect but focus, in general, on the effect of distribution of wages on employment measures.

After extensive reading and filtering, 58 empirical studies published in an academic journal remained. We then had to exclude 13 of them due to reasons described in detail in table A.2 of the appendix. The remaining 45 provided 1,068 elasticities and 484 coefficients which constitute our meta-sample. Most of the 13 excluded studies use a binary dependent variable, reporting employment probabilities (employing mostly probit and logit models). In our analysis we follow Doucouliagos and Stanley (2009) and we focus on employment elasticities (and coefficients) drawn from studies using a continuous measure of employment. Therefore, we had to exclude those studies from the meta-sample, in order to keep it homogeneous. In the appendix, table A.1 presents the 45 studies included in our meta-sample and table A.2 reports the 13 studies excluded with the reason of exclusion.

Moving on to the type of measurement for the minimum wage effect we use both elasticities and regression coefficients in separate meta-samples. The use of elasticities as the metric to measure the employment effect is followed in most studies and is considered more appropriate, because they are assumed to be relatively stable parameters.[3] On the other hand, the regression coefficients show how many units the dependent variable changes, when the independent changes by one unit. In total, our meta-sample consists of 1,068 elasticities and 484 coefficients providing a sum of 1,552 estimates.

Table 2 presents the summary statistics of the studies in the meta-sample, by year of publication. More specifically, it reports the name(s) of the author(s), the year of publication of the study, the country that the estimates concern, the number of estimates each study provided and the type and average estimate of each study.

[3] See Doucouliagos and Stanley (2009), p. 412.

Table 2. Summary statistics of the studies in the meta-sample.

| No | Author(s) | *Year* | Country | Estimates | *Type of estimate* | *Average estimate* |
|---|---|---|---|---|---|---|
| 1 | Cadena | 2014 | USA | 5 | Elasticities | 0.030 |
| 2 | Even and Macpherson | 2014 | USA | 71 | Elasticities | -0.082 |
| 3 | Hoffman | 2014 | USA | 9 | Elasticities | -0.030 |
| 4 | Neumark, Salas and Wascher | 2014 | USA | 54 | Elasticities | -0.199 |
| 5 | Sabia | 2014 | USA | 112 | Elasticities | -0.094 |
| 6 | Addison, Blackburn and Cotti | 2013 | USA | 34 | Elasticities | -0.030 |
| 7 | Coomer and Wessels | 2013 | USA | 21 | Elasticities | -0.816 |
| 8 | Giuliano | 2013 | USA | 8 | Elasticities | -0.370 |
| 9 | Kalenkoski and Lacombe | 2013 | USA | 3 | Elasticities | -0.216 |
| 10 | Kambayashi, Kawaguchi and Yamada | 2013 | Japan | 1 | Elasticity | -0.115 |
| 11 | Laporsek | 2013 | EU Members | 10 | Elasticities | -0.702 |
| 12 | Magruder | 2013 | Indonesia | 44 | Elasticities | 0.075 |
| 13 | Rani, U., Belser, P. and Ranjbar | 2013 | 6 countries | 6 | Elasticities | 0.490 |
| 14 | Addison, Blackburn and Cotti | 2012 | USA | 13 | Elasticities | 0.114 |
| 15 | Addison and Ozturk | 2012 | Cross-country | 13 | Elasticities | -0.269 |
| 16 | Bassanini | 2012 | OECD countries | 4 | Elasticities | 2.314 |
| 17 | Dinkelman and Ranchod | 2012 | South Africa | 16 | Elasticities | -1.570 |
| 18 | Dolton and Bondibene | 2012 | Cross-country | 20 | Elasticities | -0.165 |
| 19 | Majchrowska and Zolkiewski | 2012 | Poland | 30 | Elasticities | -0.105 |
| 20 | Papps | 2012 | Turkey | 3 | Elasticities | 0.001 |
| 21 | Sabia, Burkhauser and Hansen | 2012 | USA | 35 | Elasticities | -0.423 |
| 22 | Allegretto, Dube and Reich | 2011 | USA | 132 | Elasticities | -0.057 |
| 23 | Cuesta, Heras and Carcedo | 2011 | Spain | 11 | Elasticities | 0.123 |
| 24 | Draca, Machin and Van Reenen | 2011 | UK | 2 | Elasticities | 0.046 |
| 25 | Ni, Wang and Yao | 2011 | China | 72 | Elasticities | 0.199 |
| 26 | Sen, Rybczynski and Van de Waal | 2011 | Canada | 23 | Elasticities | -0.237 |
| 27 | Lee and Suardi | 2011 | Australia | 6 | Elasticities | -0.202 |
| 28 | Neumark and Wascher | 2011 | USA | 18 | Elasticities | -0.033 |
| 29 | Wang and Gunderson | 2011 | China | 27 | Elasticities | -0.040 |
| 30 | Belman and Wolfson | 2010 | USA | 86 | Elasticities | -0.007 |
| 31 | Dube, Lester and Reich | 2010 | USA | 133 | Elasticities | -0.025 |
| 32 | Myatt and McDonald | 2010 | Canada | 44 | Elasticities | -0.176 |
| 33 | Volorokosova | 2010 | Slovak Republic | 2 | Elasticities | 0.111 |
| 34 | Bhorat, Kanbur and Stanwix | 2014 | South Africa | 3 | Coefficients | 7.277 |
| 35 | Bhorat, Kanbur and Mayet | 2013 | South Africa | 15 | Coefficients | -0.919 |
| 36 | Boockman, Krumm, Neumann and Rattenhuber | 2013 | Germany | 6 | Coefficients | 0.407 |
| 37 | Frings | 2013 | Germany | 12 | Coefficients | 0.004 |
| 38 | Higuchi | 2013 | Japan | 8 | Coefficients | -0.040 |
| 39 | Nguyen | 2013 | Vietnam | 8 | Coefficients | -3.779 |
| 40 | Addison and Ozturk | 2012 | 14 countries | 14 | Coefficients | -0.211 |
| 41 | Dolton and Bondibene | 2012 | Cross-country | 10 | Coefficients | -0.209 |
| 42 | Dolton, Bondibene and Wadsworth | 2012 | UK | 258 | Coefficients | 0.012 |
| 43 | Papps | 2012 | Turkey | 4 | Coefficients | -13.329 |
| 44 | Wang | 2012 | China | 3 | Coefficients | 0.269 |
| 45 | Wang and Gunderson | 2012 | China | 21 | Coefficients | 0.123 |
| 46 | Comola and De Mello | 2011 | Indonesia | 8 | Coefficients | -0.002 |
| 47 | Dolton, Bondibene and Wadsworth | 2010 | UK | 60 | Coefficients | 0.006 |
| 48 | Persky and Baiman | 2010 | USA | 54 | Coefficients | 0.336 |

Note: The total number of the studies in the meta-sample is not 48 but 45 as three studies by Addison and Ozturk (2012), Dolton and Bondibene (2012) and Papps (2012) report both elasticities and coefficients.

## 4. Publication bias and FAT-PET tests

In meta-analysis the simplest way to see if there is publication bias is the funnel graph, which is nothing more than a scatter diagram of all empirical estimates and these estimates' inverse of the standard error. In figures 1 and 2 we present the funnel graphs of the estimated minimum wage elasticities and coefficients, respectively.

Although it may seem that the elasticities are distributed symmetrically around zero, the majority of the estimated elasticities of the meta-sample are negative as presented in table 3. This means that the majority of the values are gathered in the left portion of the graph which reveals selection for negative employment effects of minimum wages in the published studies of our meta-sample. As we can see in table 3, almost 2/3 of the elasticities in our meta-sample have a negative sign, which could imply publication bias in favor of studies with negative minimum wage effects.

With respect to the coefficients of our meta-sample, it seems that most of them gather around the zero value, but we certainly cannot jump into secure conclusions as the estimates are widely distributed. However, according to table 3, the coefficients are relatively equally divided into positive and negative values.

Table 3. Characteristics of the estimates.

| Elasticities | Number | Percent |
|---|---|---|
| Negative<br>(Significantly negative at 10% level) | 710<br>(261) | 66.48% |
| Zero | 3 | 0.28% |
| Positive<br>(Significantly positive at 10% level) | 355<br>(105) | 33.24% |
| Total | 1,068 | |
| **Coefficients** | **Number** | **Percent** |
| Negative<br>(Significantly negative at 10% level) | 230<br>(87) | 47.52% |
| Zero | 1 | 0.21% |
| Positive<br>(Significantly positive at 10% level) | 253<br>(111) | 52.27% |
| Total | 484 | |

Figure 1. Funnel graph of minimum-wage elasticities (n=1,068).

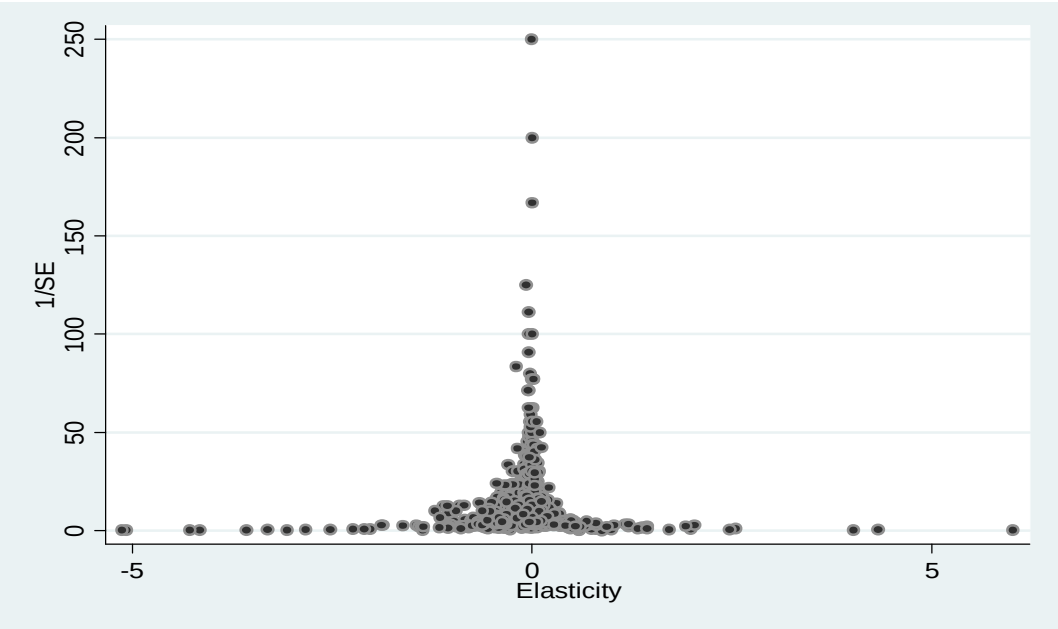
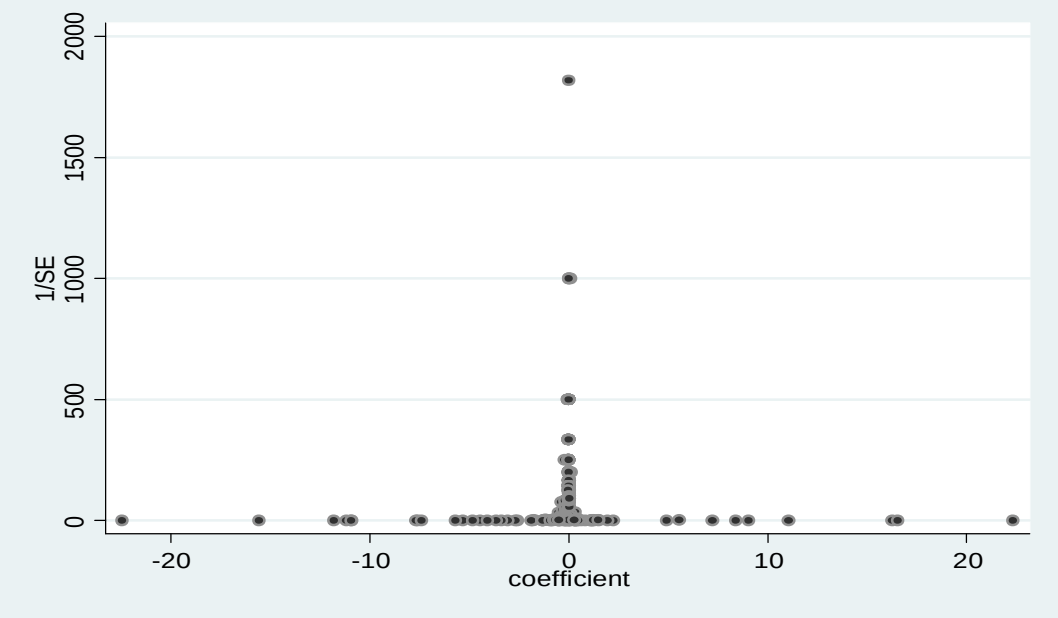



Figure 2. Funnel graph of minimum-wage coefficients (n=484).




At this point it has to be mentioned that we cannot *a priori* conclude that there is publication bias just by looking at the funnel graphs, because they are considered to be quite vulnerable to misjudgments and subjective interpretation and criticism. Therefore, in order to test the hypothesis of presence of publication bias, we have to use the FAT-PET tests presented in table 4.

Table 4. Funnel Asymmetry Test (FAT) and Precision Effect Test (PET).

| | *Elasticities* | | | | *Coefficients* | | | |
|---|---|---|---|---|---|---|---|---|
| | ***Column 1 OLS*** | ***Column 2 Robust*** | ***Column 3 REML*** | ***Column 4 WLS*** | ***Column 5 OLS*** | ***Column 6 Robust*** | ***Column 7 REML*** | ***Column 8 WLS*** |
| Dependent variable: t-stat | | | | | | | | |
| 1/SE | -0.017*** | -0.017** | -0.016*** | -0.003* | 0.003* | 0.003 | 0.003* | 0.009*** |
| | (0.004) | (0.007) | (0.004) | (0.002) | (0.002) | (0.005) | (0.002) | (0.002) |
| Constant | -0.427*** | -0.427*** | -0.438*** | -0.882*** | -0.680* | -0.680 | -0.715* | -2.730*** |
| | (0.087) | (0.100) | (0.089) | (0.105) | (0.358) | (0.518) | (0.379) | (0.826) |
| Observations | 1.068 | 1.068 | 1.068 | 1.068 | 484 | 484 | 484 | 484 |
| R-squared | 0.015 | 0.015 | 0.013 | 0.003 | 0.006 | 0.006 | 0.004 | 0.053 |

Notes: *, **, *** denote statistical significance at 10%, 5% and 1% level of significance respectively. Standard errors are reported in parentheses. Columns 1 and 5 present the results using the ordinary-least-squares estimation method. Columns 2 and 6 report the robust regression version of the OLS estimation. Columns 3 and 7 present the results with restricted maximum likelihood (REML). Columns 4 and 8 present the results using the weighted-least-squares estimation method.

The FAT and PET tests are two tests which investigate the presence of publication bias and the genuine effect, respectively. Firstly, the FAT test (Funnel Asymmetry Test) estimates equation (1) with the assumption that all the $\beta_1$ are zero, meaning that there is no heterogeneity. In other words, it is a t-test of $\beta_0$.

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

where, $t$ is the t-statistic of the elasticity or coefficient of the $i$ study, $SE$ is the relative standard error, and $v$ is the error term.

In order to identify if there is publication bias in our meta-samples we follow Stanley *et al.* (2008) and we estimate equation (1). The results reported in table 4, indicate presence of publication bias, especially in the elasticities' meta-sample since "constant" is statistically significant. Moreover, the sign is negative which clearly suggests publication selection for negative employment effects of minimum wages. However, this result comes as no surprise, since in the minimum wage research there is presumption that minimum wages affect employment negatively, as a consequence of the dominant, for many years, neoclassical theory.

Secondly, the PET test, is a Precision Effect Test of $\beta_1$ (i.e. *1/SE*) and tests the genuine effect, beyond publication bias. According to table 4, the PET test shows that, once publication bias is corrected only a slight negative employment effect remains for the elasticities' meta-sample, and the genuine employment impact is positive, but almost zero, for the coefficients' meta-sample.

However, like any regression model, the estimates of FAT-PET tests can become biased when important explanatory variables are omitted. Therefore, we need to include moderator variables to control for the possible heterogeneity across studies In what follows we perform a multiple meta-regression analysis, incorporating into the model 20 possible moderators that take into account the study heterogeneity, in order to find the factors which can affect the sign of the minimum wage impact.

## 5. Multiple Meta-Regression-Analysis (MRA)

The previous section applied the FAT-PET to investigate whether there is evidence of publication bias and if so what is the genuine effect of minimum wage on employment. Our results point to the existence of publication bias and, once it is corrected, the impact is too small to be of any practical use. However, these tests do not take into account the heterogeneity across the studies which arises from the fact that the expected value of a reported estimate will often depend on many other factors like the estimation method, the minimum wage measure employed, the employment measurement used, the structure of the data, the age-groups concerned or the related industry. If we do not include in our model moderators to control for the heterogeneity across studies, our initial results can become biased.

Therefore, we identified 20 moderators as potential explanatory variables of the heterogeneity across the estimates that were produced by the studies. Those moderators are described in table 5. We have to mention that the excel file of our meta-sample, apart from these 20 moderators, included additional controllers which we did not take into account, though. These moderators relate, for example, to the number of observations of each estimate or the data period used, but we did not incorporate them into our multiple meta-regression analysis since in some studies their values were not reported and in addition could not be calculated. Nevertheless, when we included them in our analysis, the results did not change, giving robustness to the findings of tables 6 and 7.

Table 5. Moderator variables for multiple meta-regression analysis.

| *Moderator variable* | *Definition* | *No. of elasticities (out of 1,068)* | *No. of coefficients (out of 484)* |
|---|---|---|---|
| DID | = 1, if it is a difference-in-difference estimate. | 248 | 416 |
| Endogen | = 1, if estimate comes from IV/Arellano-Bond/Blundell-Bond estimation | 54 | 18 |
| USE | = 1, if estimate relates to the USA | 734 | 55 |
| Europe | = 1, if estimate relates to a European country | 58 | 349 |
| MWlag | = 1, if estimate relates to a lagged minimum-wage effect | 187 | 282 |
| Double | = 1, if estimate comes from a double log specification | 623 | Not consistent |
| PanelCross | = 1, if estimate relates to panel data or cross-section with time-series as base. | 938 | All studies use panel or cross-section data |
| Teens | = 1, if estimate relates to teenagers | 354 | No study on teenagers |
| Youth | = 1, if estimate relates to youth | 78 | 5 |
| Hours | = 1, if the dependent variable is hours worked | 137 | 95 |
| Time | = 1, if time effects or time trends are included | 810 | 365 |
| FE | = 1, if region/state/industry/country fixed effects are used | 769 | 355 |
| UR | = 1, if a model includes an unemployment measure as a business circle indicator | 695 | 30 |
| Educ | = 1, if model controls for education or schooling | 314 | 51 |
| Kaitz | =1, if the Kaitz measure of the minimum wage is used (i.e. minimum to average wage ratio) | 240 | 120 |
| Dummy | = 1, if a dummy variable measure of the minimum wage is used | 22 | 53 |
| MWlevel | = 1, if the level of the minimum wage is used | 578 | 15 |
| Retail | = 1, if estimates are for the retail industry | 19 | 3 |
| FoodDrink | = 1, if estimates are for the food, beverage or drinking industry | 170 | 54 |
| OtherIndustry | = 1, if estimates are for another specific industry or a group of industries | 107 | 38 |

Commenting on the characteristics of the moderators, we can see that there are some differences across studies which relate to various parameters. To begin with the models used, we can see that 664 observations out of the total 1,552 observations of our meta-sample, applied the difference-to-difference methodology to investigate the impact on employment some time before and after (usually six months or one year) a change in the level of minimum wage. Moreover, 72 estimates came from regressions

which control for endogeneity with the use of GMM models (Arellano-Bond or Blundell-Bond estimations) or IV/2SLS estimation methods.

Another aspect which has some interest is that the big majority of the studies producing elasticities, came from studies conducted for the USA, while the picture is totally different in the meta-sample consisted of coefficients for European countries. Studies which use regression coefficients to investigate the employment effect of minimum wage, report the change in units of employment when minimum wage changes by one unit, which is the interpretation of the linear model specification used in most studies of European countries. On the other hand, US studies use mainly elasticities, which is an alternative way to approach the minimum wage impact and provides different explanation with respect to nature of change in the minimum wage and the resulting change in the employment measure.

Concerning the structure of the data, it is obvious that the vast majority of the elasticities has been drawn from panel or cross-section datasets (938), while only 130 of the observations were derived from time-series data. In the meta-sample of coefficients all observation came from studies with panel or cross-section structure of data. At this point it has to be mentioned that time-series studies were mostly used until the early 90's, but since then they have been relatively abandoned in the minimum wage research.

The estimates which showed the lagged effect of the minimum wage and not the contemporary one are 187 (for elasticities) and 282 (for coefficients). In addition, 623 of the elasticities of the meta-sample came from a double log specification, while this moderator is not valid for the meta-sample of coefficients. We also included moderators related to teenagers and the youth group of the population providing many elasticities but only 5 regression coefficients.

Furthermore, 232 observations out of total 1,552 where extracted from specifications that had the variable 'hours worked' as employment measure. Variability also existed on the minimum wage measure used, with most of the estimates using the level (nominal or real) of the minimum wage, the Kaitz index (minimum to average wage ratio) or a minimum wage dummy. Additionally, many studies controlled for cyclical effects and education/schooling, which was mostly seen in US studies.

Closing the discussion on the moderators, we would say that characteristics related to the inclusion of fixed and time effects, are largely taken into account in the

studies of the meta-sample, since the vast majority of them controlled for county/state/industry/region fixed effects or time effects/time trends. Moreover, the all-set meta-sample studies includes estimates of specific industries/sectors within a country. Therefore, we should include moderators to control for such differences, hence we incorporate three such explanatory variables in the model: retail, food-beverage-drinking or if estimates are for another specific industry or a group of industries.

Now, taking into account the study heterogeneity, we follow Adam *et. al.* (2013) and we include in equation (1) the moderators as potential explanatory variables of this heterogeneity. Then, the meta-regression model we estimate takes the form:

$$t_i = \beta_0 + \beta_1(1/SE_i) + \sum_{k=1}^{K} \frac{a_k Z_{jk}}{SE_j} + v_j \qquad (2)$$

where $t$ is the t-statistic of the estimate of the $i$ study, $SE$ is the standard error of the estimate, $Z_k$ are moderator variables, and $v_j$ is the error term.

The results of our meta-regression analysis are presented in tables 6 and 7, where the meta-samples of 1,068 elasticities and 484 coefficients are used, respectively. We decided to employ the General-to-Specific methodology in our analysis following Stanley and Doucouliagos (2009) and Benos and Zotou (2014), which begins having all the explanatory variables in the equation that we estimate. Afterwards, we remove the least statistically significant, one at a time, until all variables which remain are statistically significant. It may not seem ideal but as Charemza and Deadman (1997) refer at page 78 of their book 'the strength of general to specific modeling is that the model construction proceeds from a very general model in a more structured, ordered fashion, and in this way avoids the worst of data missing'.

Table 6. Multiple Meta-Regression-Analysis using Elasticities (Dependent variable: t-stat).

| | *Using General-to-Specific Methodology* | | | |
|---|---|---|---|---|
| | ***Column 1 OLS*** | ***Column 2 Robust*** | ***Column 3 REML*** | ***Column 4 WLS*** |
| 1/SE | -0.030*** (0.009) | -0.028** (0.014) | -0.029*** (0.009) | -0.026 (0.018) |
| DID/SE | 0.036*** (0.010) | 0.033*** (0.012) | 0.035*** (0.010) | 0.043*** (0.007) |
| USE/SE | 0.135*** (0.012) | 0.128*** (0.016) | 0.133*** (0.012) | 0.152*** (0.009) |
| Europe/SE | 0.034*** (0.010) | 0.034** (0.015) | 0.033*** (0.010) | 0.037*** (0.005) |
| MWlag/SE | -0.048*** (0.012) | -0.035* (0.020) | -0.049*** (0.012) | -0.071*** (0.009) |
| Double/SE | -0.103*** (0.010) | -0.097*** (0.011) | -0.101*** (0.010) | -0.116*** (0.009) |
| PanelCross/SE | | | | -0.042*** (0.015) |
| Teens/SE | -0.139*** (0.010) | -0.136*** (0.013) | -0.138*** (0.010) | -0.114*** (0.008) |
| Youth/SE | -0.144*** (0.019) | -0.142*** (0.024) | -0.143*** (0.019) | -0.137*** (0.015) |
| Hours/SE | 0.094*** (0.015) | 0.091*** (0.012) | 0.092*** (0.093) | 0.091*** (0.013) |
| Educ/SE | | | | -0.017*** (0.006) |
| Kaitz/SE | 0.026** (0.011) | | 0.025** (0.011) | 0.048*** (0.006) |
| Dummy/SE | -0.110*** (0.035) | -0.103*** (0.020) | -0.107*** (0.035) | -0.111*** (0.025) |
| Retail/SE | -0.161*** (0.040) | -0.157** (0.072) | -0.160*** (0.040) | -0.207*** (0.032) |
| OtherIndustrySE | 0.771*** (0.216) | 0.829*** (0.162) | 0.915*** (0.235) | 0.832** (0.332) |
| Constant | -0.248*** (0.094) | -0.224** (0.093) | -0.252*** (0.096) | -0.703*** (0.117) |
| Observations | 1,068 | 1,068 | 1,068 | 1,068 |
| R-squared | 0.286 | 0.282 | 0.281 | 0.460 |
| Notes: *, **, *** denote statistical significance at 10%, 5% and 1% level of significance respectively. Standard errors are reported in parentheses. | | | | |

Table 7. Multiple Meta-Regression-Analysis using Coefficients (Dependent variable: t-stat).

| | *Using General-to-Specific Methodology* | | | |
|---|---|---|---|---|
| | ***Column 1 OLS*** | ***Column 2 Robust*** | ***Column 3 REML*** | ***Column 4 WLS*** |
| 1/SE | -0.083*** (0.028) | -0.025*** (0.009) | -0.083*** (0.029) | -0.017*** (0.003) |
| Endogen/SE | -0.192*** (0.026) | -0.233*** (0.015) | -0.192*** (0.027) | -0.256*** (0.024) |
| USE/SE | | 0.035** (0.015) | | |
| Europe/SE | 0.061** (0.028) | | 0.061** (0.029) | |
| Youth/SE | -0.220** (0.111) | -0.281*** (0.042) | -0.222* (0.114) | |
| FE/SE | 0.022*** (0.003) | 0.026** (0.010) | 0.022*** (0.003) | 0.020*** (0.003) |
| Educ/SE | 0.082*** (0.028) | 0.027* (0.015) | 0.083*** (0.029) | 0.018*** (0.004) |
| Kaitz/SE | 0.010** (0.005) | | 0.010** (0.005) | 0.002*** (0.004) |
| Dummy/SE | 0.345*** (0.130) | 0.293*** (0.043) | 0.346** (0.133) | |
| Retail/SE | | -0.806** (0.332) | | |
| FoodDrink/SE | -0.412** (0.189) | -0.470*** (0.046) | -0.418** (0.194) | |
| OtherIndustrySE | -0.338** (0.130) | -0.285*** (0.043) | -0.339** (0.134) | |
| Constant | 0.179 (0.294) | 0.305 (0.188) | 0.226 (0.320) | -0.975 (0.731) |
| Observations | 484 | 484 | 484 | 484 |
| R-squared | 0.477 | 0.468 | 0.461 | 0.522 |
| Notes: *, **, *** denote statistical significance at 10%, 5% and 1% level of significance respectively. Standard errors are reported in parentheses. | | | | |

What is important in the multivariate meta-regression analysis is to examine the presence of publication bias and the genuine effect of minimum wage on employment, after any other potential explanatory factors are taken into account. Initially, about the existence of publication selection, we notice that the constant in the elasticities' meta-sample is negative and statistically significant, indicating publication selection in favor of studies with negative minimum wage effects. However, in the smaller coefficients' meta-sample the intercepts are not statistically significant suggesting no evidence of publication selection bias.

Another significant dimension is the genuine effect in the multiple meta-regressions, in order to see if the very small effect of minimum wages on employment found in the previous section remains. Firstly, in the elasticities' meta-sample, the coefficient of 1/SE that represents the magnitude of the impact takes value from -0.026 to -0.030 with three of them being statistically significant. Secondly, in the coefficients' meta-sample, the sign of the impact is negative and statistically significant in all columns and the magnitude is from -0.017 to -0.083, which indicates small negative minimum wage effect.

Except for the investigation of the existence of publication bias and the genuine effect, as we have explained earlier, the multivariate meta-regression analysis presented in tables 6 and 7 can be used to find the sources of heterogeneity of the results among studies. In both tables, we employ four estimation methods in order to provide robustness to the results, which generally do not seem to produce different results and variability in the sign of the estimates. Column 1 shows the estimations using the ordinary-least-squares estimation method, and column 2 reports the robust version of the OLS estimation. Column 3 presents the results when we use random effects model (REML), which is the benchmark method for estimating the between-study variance, and column 4 reports the results using the weighted-least-squares estimation method, which is considered better than conventional random-effects meta-analysis methods when there is publication (or small-sample) bias.

The estimation results in table 6 indicate that effects regarding DID specification, US studies, European studies and studies which refer to hours worked as dependent variable or use the Kaitz index as the minimum wage measurement, tend to report a positive employment impact of minimum wages. On the other hand, elasticities related to a lagged minimum wage measure, or drawn from double log specifications, or refer to younger age groups (teenagers and youth) or use a dummy

variable as minimum wage, report a negative employment effect of minimum wages. The results also depend on the type of industry or sector concerned, as elasticities from retail industry revealed negative minimum wage effects, food-beverage or drinking sector does not seem to affect the sign of the impact, while, if the elasticities relate to other industry or group of industries, they tend to report positive minimum wage effects. Furthermore, endogeneity, time effects, fixed effects, the unemployment rate and the use of the level of minimum wage as a measurement, do not appear to explain any heterogeneity of the minimum wage elasticities.

Table 7 reports the estimation results from the meta-sample consisted of coefficients. Using this meta-sample, the sources of heterogeneity seem to diversify. Specifications using fixed effects, controlling for education and using the Kaitz index or a dummy variable, are found to produce positive regression coefficients. On the other hand, estimation methods dealing with endogeneity relating to the youth and coming from food-beverage and drinking industry, tend to report negative minimum wage effects. Moreover, the R-squares are over 46% in all four estimations methods, which are considered satisfactory in multiple meta-regressions.

Comparing these two tables, we can notice some differences with respect to the sign and the magnitude of the results. For instance, in the elasticities' meta-sample, the effect of minimum wage on employment is positive and particularly large when study is related to a specific industry apart from retail and food-beverage-drinking sector, while in the coefficients' meta-sample the sign is negative, but still considerably large. Furthermore, studies which use a dummy variable as minimum wage measure display a negative and relatively stable magnitude around -0.110 in table 6, but the sign is positive and much higher in table 7. Therefore, the two meta-samples generate some differences in the factors which account for the heterogeneity of the minimum effect on employment and thus results on the moderators should be treated with caution.

In summary, we would say that, during the five-year period from 2010 to 2014, the minimum wage literature seems to be characterized by publication bias, in the elasticities' meta-sample. However, once this publication bias is corrected, the genuine effect of minimum wage is negative but small. Nevertheless, in the coefficients' meta-sample, evidence of publication bias is not supported and the magnitude of the impact is once again negative and small. Besides that, the sign of the impact in both meta-samples is affected by the study characteristics of the meta-

sample related to the data, the model specifications, the minimum wage and employment measures used, and the industry concerned.

## 6. Conclusions

The minimum wage literature is not only large but also growing and the empirical studies on the employment effect of minimum wages still produce controversial results. During the last five years we have found dozens of published and unpublished studies on the employment effect of minimum wages which approach the impact from different point of views and use various methods and models. The objective of this paper is to investigate the relationship between minimum wages and employment using a meta-sample of 45 empirical studies published in academic journals within the 2010-2014 period. Our analysis points to the existence of publication bias in the elasticities' meta-sample but once it is corrected, the impact is so small that is of no significant use. On the other hand, in the coefficients' meta-sample, no evidence of publication bias is found in the multiple meta-regression analysis and again the minimum wage effect is negative but small. In addition, we identify as potential sources of heterogeneity of the results the study characteristics related to the data, the model specifications, the group of population, the minimum wage and employment measurements and the industry concerned.

Our meta-analysis, which consists of 1,068 elasticities and 484 regression coefficients, indicates that the minimum wage has only a small effect on employment. In this frame, space has begun to be given to other theories in the minimum wage research such as the Keynesian perspective, according to which, changes in minimum wages are not related with either positive or negative employment effects. Therefore, perhaps the appropriate ground has been created to investigate the impact through the role of specific aspects of the minimum wage and employment characteristics. Further research on the role of education, the skills of the employees, the age, the specific industry or sector and several other factors need to be conducted in order to find a mechanism which will describe the procedure of any direct or indirect effect of minimum wages on the employment measures.

Undoubtedly, the minimum wage is a very useful tool in the hands of policy makers and it can improve the economic conditions of the more vulnerable groups and the utility of the low-income families. The issue of the employment effect of minimum wages provides many avenues of research and a number of preferable

alternatives to a researcher. Naturally, like most research, the more the topics are reviewed the more questions are raised and it is essential a minimum wage setting model to be found which will improve the economic effectiveness and the social welfare. Consequently, the need of the minimum wage research not to compromise to the existing contradictory empirical results and to progress, is a matter of great importance in the constantly changing and demanding economic environment that we live in.

**Acknowledgements**

The authors are grateful to Dimitris Zikos for his helpful suggestions and generous comments. We have also benefited from valuable comments and discussions by Nikos Benos, Pantelis Kammas and Antonis Adam. Any remaining errors are ours.

**References**

Adam, A., Kammas, P. and Lagou, A. (2013). The effect of globalization on capital taxation: What have we learned after 20 years of empirical studies? *Journal of Macroeconomics* 35(3): 199-209.

Belman, D. L. and Wolfson, P. (2014). *What Does the Minimum Wage Do?* Upjohn Institute Press.

Benos, N. and Zotou, S. (2014). Education and economic growth: A meta-regression analysis. *World Development* 64: 669-689.

Boockman, B. (2010). The combined employment effects of minimum wages and labor market regulation: A meta-analysis. IZA Discussion Paper, No. 4983.

Card, D. (1992). Do minimum wages reduce employment? A case study of California, 1987-1989. *Industrial and Labor Relations Review* 46(1): 38-54.

Card, D. and Krueger, A. B. (1995), Time-series minimum wage studies: A meta-analysis. *American Economic Review* 85(2): 238-243.

Charemza, W. and Deadman, D. (1997). *New directions in econometric practice*. 2nd Edition. Cheltenham: Edward Elgar.

Doucouliagos, C. H. and Stanley, T. D. (2009). Publication selection bias in minimum-wage research? A meta-regression analysis. *British Journal of Industrial Relations* 47(2): 406-428.

Katz, L. and Krueger, A., (1992). The effect of the minimum wage in the fast food industry. *Industrial and Labor Relations Review* 46(1): 6-21.

Leonard, M., Stanley, T. D. and Doucouliagos, H. (2014). Does the UK minimum wage reduce employment? A meta-regression analysis. *British Journal of Industrial Relations* 52(3): 499-520.

Nataraj, S., Perez-Arce, F. Srinivasan, S. V. and Kumar, K. B. (2014). The impact of labor market regulation on employment in low-income countries: A meta-analysis. *Journal of Economic Surveys* 28(3): 551-572.

Stanley, T. D., Doucouliagos, C. and Jarrell, S. (2008). Meta-regression analysis as the socioeconomics of economics research. *The Journal of Socio-Economics* 37: 276-292.

Stanley, T. D., Giles, M., Heckemeyer, J. H., Johnston, R. J., Laroche, P., Nelson, J. P., Paldam, M., Poot, J., Pugh, G., Rosenberger, R. S. and Rost, K. (2013). Meta-analysis of economics research reporting guidelines. *Journal of Economic Surveys* 27(2): 390-394.

Stanley, T. D. and Doucouliagos, C. (2012). *Meta-regression analysis in economics and business*. Routledge Advances in Research Methods.

Stanley, T. D. and Doucouliagos, C. (2015). Neither fixed nor random: weighted least squares meta-analysis. *Statistics in Medicine* 34: 2116-2127.

## Appendix

Table A.1: Studies included in the meta-sample, by year of publication.

| | Study | Country |
|---|---|---|
| 1 | Belman, D. L. and Wolfson, P. (2010). The effect of legislated minimum wage increases on employment and hours: A dynamic analysis. *LABOUR* 24(1): 1-25. | USA |
| | Note: We excluded 4 employment elasticities and 2 volume (hour) elasticities from table 4, since we couldn't calculate (with the use of TINV function in excel) the t-statistics from their six p-values reported in the study which had value = 0. | |
| 2 | Dolton, P., Bondibene, C. R. and Wadsworth, J. (2010). The UK national minimum wage in retrospect. *Fiscal Studies* 31(4): 509-534. | UK |
| 3 | Dube, A., Lester, T. W. and Reich M. (2010). Minimum wage effects across state borders: Estimates using contiguous counties. *The Review of Economics and Statistics* 92(4): 945-964. | USA |
| | Note: In the two minimum wage elasticities of table B.1, the sizes of the samples are not reported and we are unable to calculate them. | |
| 4 | Myatt, T. and McDonald J. T. (2010). The robustness of provincial panel-data studies of minimum wages in Canada. *Canadian Journal of Regional Science* 33(3): 77-88. | Canada |
| | Note: In table 2, the minimum wage elasticities do not report standard errors or t-stats and we are unable to calculate them. Therefore, these specific estimates were excluded from the meta-sample. | |
| 5 | Persky, J. and Baiman, R. (2010). Do state minimum wage laws reduce employment? Mixed messages from fast food outlets in Illinois and Indiana. *Journal of Regional Analysis and Policy* 40(2): 132-142. | USA |
| 6 | Vokorokosová, R. (2010). Do minimum wage changes influence employment? *Economic Analysis* 43(1-2): 83-90. | Slovak Republic |
| 7 | Allegretto, S., Dube, A., and Reich, M. (2011). Do minimum wages really reduce teen employment? Accounting for heterogeneity and selectivity in state panel data. *Industrial Relations* 50(2): 205-240. | USA |
| | Note: In some estimated elasticities (eight in table 5 and twenty in table 8), we are unable to calculate the sizes of the samples. | |
| 8 | Comola, M. and De Mello, L. (2011). How does decentralized minimum wage setting affect employment and informality? The case of Indonesia. *Review of Income and Wealth* 57: 79-99. | Indonesia |
| | Note: We had to exclude 7 estimates (coefficients) from the meta-sample, since their relative t-statistics were 0.000. Therefore, we could not calculate the values of their standard errors which are necessary for publication selection bias correction. | |
| 9 | Cuesta, M. B., Heras, R. L. and Carcedo, J. M. (2011). Minimum wage and youth employment rates 2000-2008. *Revista de Economía Aplicada* 19(56): 35-57. | Spain |
| 10 | Draca, M., Machin, S. and Van Reenen, J. (2011). Minimum wages and firm profitability. *American Economic Journal: Applied Economics* 3: 129-151. | UK |
| 11 | Lee, W-S. and Suardi, S. (2011). Minimum wages and employment: Reconsidering the use of a time-series approach as an evaluation tool. *British Journal of Industrial Relations* 49(2): 376-401. | Australia |
| 12 | Neumark, D. and Wascher, W. (2011). Does a higher minimum wage enhance the effectiveness of the earned income tax credit? *Industrial and Labor Relations Review* 64(4): 712-746. | USA |
| | Note: We did not include the estimates of the interactions of minimum wage with EITC since these estimates show if a higher minimum wage enhances the employment effect of the earned income tax credit. We also excluded estimates of the interaction of minimum wage with the dummy KIDS, as these estimates show if minimum wage benefits more the | |

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| | employment of families with children in comparison to those being childless. These estimates do not imply a direct employment impact of minimum wage and had to be excluded from the meta-sample. | |
| 13 | Ni, J., Wang, G. And Yao, X. (2011). The impact of minimum wages on employment: Evidence from China. *The Chinese Economy* 44(1): 18-38. | China |
| 14 | Sen, A., Rybczynski, K. and Van De Waal, C. (2011). Teen employment, poverty, and the minimum wage: Evidence from Canada. *Labour Economics* 18: 36-47. | Canada |
| 15 | Wang, J. and Gunderson, M. (2011). Minimum wage impacts in China: Estimates from a prespecified research design, 2000-2007. *Contemporary Economic Policy* 29(3): 392-406. | China |
| 16 | Addison, J. T., Blackburn, M. L. and Cotti, C. D. (2012). The effect of minimum wages on labour market outcomes: County-level estimates from the restaurant-and-bar sector. *British Journal of Industrial Relations* 50(3): 412-435. | USA |
| 17 | Addison, J. T. and Ozturk O. D. (2012). Minimum wages, labor market institutions, and female employment: A cross-country Analysis. *Industrial and Labor Relations Review* 65(4): 779-809. | Several OECD countries |
| | Note: Study is a cross-country analysis and 13 elasticities are based on cross-national data. However, there are 14 coefficients which concern a single country and are included in our meta-sample. Moreover we have to mention that we did not include the estimates with respect to the labor force participation rate as we do not consider it as an employment measure. | |
| 18 | Bassanini, A. (2012). Aggregate earnings and macroeconomic shocks: The role of labour market policies and institutions. *Review of Economics and Institutions* 3(3): 1-44. | Several OECD countries |
| 19 | Dinkelman, T. and Ranchhod, V. (2012). Evidence on the impact of minimum wage laws in an informal sector: Domestic workers in South Africa. *Journal of Development Economics* 99: 7-45. | South Africa |
| | Note: We did not include in the meta-sample estimates from table 4 as they indicate employment probabilities (probability of working as a domestic worker). | |
| 20 | Dolton, P. and Bondibene, C. R. (2012). The international experience of minimum wages in an economic downturn. *Economic Policy* 27(69): 99-142. | Several OECD countries |
| | Note: Minimum wage elasticities from table 4 are not included in our meta-sample, since they do not report standard errors or t-stats which are both needed for publication selection bias correction. | |
| 21 | Dolton, P., Bondibene, C. R. and Wadsworth, J. (2012). Employment, inequality and the UK national minimum wage over the medium-term. *Oxford Bulletin of Economics and Statistics* 74(1): 78-106. | UK |
| 22 | Majchrowska, A. and Zolkiewski Z. (2012). The impact of minimum wage on employment in Poland. *Investigaciones Regionales* 24: 211-239. | Poland |
| 23 | Papps, K. L. (2012). The effects of social security taxes and minimum wages on employment: Evidence from Turkey. *Industrial and Labor Relations Review* 65(3): 686-707. | Turkey |
| 24 | Sabia J. J., Burkhauser, R. V. and Hansen B. (2012). Are the effects of minimum wage increases always small? New evidence from a case study of New York state. *Industrial and Labor Relations Review* 65(2): 351-376. | USA |
| | Note: We are unable to calculate the sizes of the samples in table 5. | |
| 25 | Wang, X. (2012). When workers do not know - The behavioral effects of minimum wage laws revisited. *Journal of Economic Psychology* 33: 951-962. | China |
| 26 | Wang, J. and Gunderson, M. (2012). Minimum wage effects on employment and | China |

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|---|---|---|
| | wages: dif-in-dif estimates from eastern China. *International Journal of Manpower* 33(8): 860-876. | |
| 27 | Addison, J. T., Blackburn, M. L. and Cotti, C. D. (2012). Minimum wage increases in a recessionary environment. *Labour Economics* 23: 30-39. | USA |
| 28 | Bhorat, H., Kanbur, R. and Mayet, N. (2013). The impact of sectoral minimum wage laws on employment, wages, and hours of work in South Africa. *IZA Journal of Labor & Development* 2(1): 1-27. | South Africa |
| | Note: We did not include in our meta-sample the minimum wage impact on employment presented in table 5 of their paper, because the dependent variable is a dummy variable equal to 1 if the individual is employed in the respective sector and equal to 0 otherwise, suggesting probability. | |
| 29 | Boockmann, B., Krumm, R., Neumann, M. and Rattenhuber, P. (2013). Turning the switch: An evaluation of the minimum wage in the German electrical trade using repeated natural experiments. *German Economic Review* 14(3): 316-348. | Germany |
| | Note: We did not include the coefficients of tables 4 and 7 in our meta-sample, as they refer to the impact on the probability of remaining in employment. We also excluded the estimates of table 5 concerning the effect on hiring and separations at the company (columns 1 and 2, respectively) which are not considered as employment measures in our analysis. | |
| 30 | Coomer, N. M. and Wessels, W. J. (2013). The effect of the minimum wage on covered teenage employment. *Journal of Labor Research* 34: 253-280. | USA |
| | Note: Estimates from table 2 were not included in the meta-sample, since they come out from logit estimation, implying probability. | |
| 31 | Frings, H. (2013). The employment effect of industry-specific, collectively bargained minimum wages. *German Economic Review* 14(3): 258-281. | Germany |
| 32 | Giuliano, L. (2013). Minimum wage effects on employment, substitution, and the teenage labor supply: Evidence from personnel data. *Journal of Labor Economics* 31(1): 155-194. | USA |
| | Note: Apart from tables 4 and 6, the study reports additional estimates on relative employment of teenagers, on teenage employment flows, and on employment and hiring shares in tables 5, 7 and 9, respectively, which do not represent direct impact of minimum wages on employment measures. Therefore, these specific additional estimates were not included in the meta-sample. | |
| 33 | Higuchi, Y. (2013). The dynamics of poverty and the promotion of transition from non-regular to regular employment in Japan: Economic effects of minimum wage revision and job training support. *Japanese Economic Review* 64(2): 147-200. | Japan |
| | Note: We did not include in our meta-sample estimates with respect to the minimum wage impact on employment, since the authors use a logit model and a random-effect logit model which suggests probability. We included only the estimates concerning the minimum wage impact on hours worked. | |
| 34 | Kalenkoski, C. M. and Lacombe, D. J. (2011). Minimum wages and teen employment: A spatial panel approach. *Papers in Regional Science* 92(2): 407-418. | USA |
| 35 | Kambayashi, R., Kawaguchi, D. and Yamada, K. (2013). Minimum wage in a deflationary economy: The Japanese experience, 1994-2003. *Labour Economics* 24: 264-276. | Japan |
| | Note: We did not include the minimum wage elasticities of new hires (it does not represent a direct employment measure) and employment (study reports the probability of being employed for a woman which is not a continuous measure of employment that we use in our meta-analysis). | |
| 36 | Laporšek, S. (2013). Minimum wage effects on youth employment in the European Union. *Applied Economics Letters* 20(14): 1288-1292. | EU Members |
| 37 | Magruder, J. R. (2013). Can minimum wages cause a big push? Evidence from | Indonesia |

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| | Indonesia. *Journal of Development Economics* 100: 48-62. | |
| 38 | Nguyen, C. V. (2013). The impact of minimum wages on employment of low-wage workers. Evidence from Vietnam. *Economics of Transition* 21(3): 583-615. | Vietnam |
| | Note: We did not take into account the minimum wage effect on self-employment as we do not consider it as an employment measure in our analysis. | |
| 39 | Rani, U., Belser, P. and Ranjbar, S. (2013). Role of minimum wages in rebalancing the economy. *World of Work Report* 1: 45-74. | Brazil, Costa Rica, India, Mexico, Peru, Vietnam |
| 40 | Bhorat, H., Kanbur, R. and Stanwix, B. (2014). Estimating the impact of minimum wages on employment, wages, and non-wage benefits: The case of agriculture in South Africa. *American Journal of Agricultural Economics* p. 1-18. | South Africa |
| | Note: We did not include in the meta-sample the minimum wage impact on employment presented in table 4 of that study, because the dependent variable is a dummy variable equal to 1 if the individual is employed in the agriculture sector and equal to 0 otherwise, suggesting probability (probability of being employed as a farm worker after introducing the minimum wage law). | |
| 41 | Cadena, B. C. (2014). Recent immigrants as labor market arbitrageurs: Evidence from the minimum wage. *Journal of Urban Economics* 80: 1-12. | USA |
| 42 | Even, W. E. and Macpherson, D. A. (2014). The effect of the tipped minimum wage on employees in the U.S. restaurant industry. *Southern Economic Journal* 80(3): 633-655. | USA |
| | Note: We had to exclude one elasticity from table 2 of that study, since its standard error is zero and in the REML estimation (in the meta-regression analysis) the command metareg requires the standard errors not to have zero value. | |
| 43 | Hoffman, S. D. (2014). Employment effects of the 2009 minimum wage increase: New evidence from state-based comparisons of workers by skill level. *The B.E. Journal of Economic Analysis & Policy* 14(3): 695-721 | USA |
| | Note: We are unable to calculate the size of the sample of the estimates. | |
| 44 | Neumark, D., Salas, J. M. I. and Wascher, W. (2014). Revisiting the minimum wage-employment debate: Throwing out the baby with the bathwater? *Industrial and Labor Relations Review* 67(Supplement): 608-648. | USA |
| | Note: We are unable to calculate the size of the sample of the estimates in some estimates. | |
| 45 | Sabia, J. J. (2014). The effects of minimum wages over the business cycle. *Journal of Labor Research* 35: 227-245. | USA |

Table A.2: Studies excluded from the meta-sample, by year of publication.

| | |
|---|---|
| 1 | Maloney, T. and Pacheco, G. (2010). Interpreting changes in minimum wage incidence rates. *Australian Journal of Labour Economics* 13(3): 219-240. |
| Reason for exclusion | Study does not investigate direct minimum wages effects on employment measures but behavioural effects, which suggest that the large increases in the minimum wages between 1997 and 2008 did not reduce low-wage employment in New Zealand. By isolating these behavioural effects, that study provides an alternative way of estimating the possible disemployment effects of the minimum wage. With respect to our analysis, the regressions results are not on an employment measure but on "incidence rates" and, therefore, we excluded that study from our meta-sample. |
| 2 | Mondragón-Vélez, C., Peña, X. and Wills, D. (2010). Labor market rigidities and informality in Colombia. *Journal of the Latin American and Caribbean Economic Association* 11(1): 65-101. |
| Reason for exclusion | Study examines the minimum wage effect on the size of the informal sector and, by using a probit model, the transition into and out of informality (transition probability). However, we use a continuous measure of dependent variable in our analysis. |
| 3 | Ahn, T., Arcidiacono, P. and Wessels, W. (2011). The distributional impacts of minimum wage increases when both labor supply and labor demand are endogenous. *Journal of Business & Economic Statistics* 29(1): 12-23. |
| Reason for exclusion | Study reports employment probabilities. More specifically, minimum wage estimates (elasticities) are reported in the four columns of table 7 of the study. The first three columns report the minimum wage effect on the probability of search, the probability of obtaining employment conditional on search, and the unconditional probability of employment, respectively. In addition, the fourth column shows the share of individuals in particular groups who see their expected probability of employment increase with an increase in the minimum wage. |
| 4 | Alaniz, E., Gindling, T. H. and Terrell, K. (2011). The impact of minimum wages on wages, work and poverty in Nicaragua. *Labour Economics* 18(1): 45-59. |
| Reason for exclusion | Study uses a binary dependent variable reporting employment probability. More specifically, the employment effect of minimum wages is reported in tables 4, 5 and 6 of that study. Table 4 concerns the impact of minimum wages on the probability that a worker keeps his/her employment in the covered sector, table 5 concerns the impact of minimum wages on the probability of leaving the private covered sector for another sector, and table 6 refers to the impact of minimum wages on the probability of entering the private covered sector from another sector. |
| 5 | Centeno, M., Duarte, C. and Novo, Á. A. (2011). The impact of the minimum wage on low-wage earners. *Economic Bulletin and Financial Stability Report Articles*, Banco de Portugal: 107-121. |
| Reason for exclusion | Elasticities in that study come from "linear probability models" and "probit models" suggesting probabilities. However, our analysis focuses on employment estimates drawn from studies using a continuous measure of employment. |
| 6 | Pacheco, G. (2011). Estimating employment impacts with binding minimum wage constraints. *The Economic Record* 87(279): 587-602. |
| Reason for exclusion | Study adopts a probit model specification to investigate the employment effect of minimum wages, and a tobit one to investigate the impact on total weekly hours worked in all jobs, implying probabilities. |
| 7 | Aretz, B., Arntz, M. and Gregory, T. (2013). The minimum wage affects them all: Evidence on employment spillovers in the roofing sector. *German Economic Review* 14(3): 282-315. |
| Reason for exclusion | Study uses a binary dependent variable, reporting employment probabilities (logit estimations) of being employed in the roofing sector in the next year, while our analysis focuses on employment elasticities drawn from studies using a continuous measure of employment. |
| 8 | Georgiades, A. (2013). Efficiency wages and the economic effects of the minimum wage: Evidence from a low-wage labour market. *Oxford Bulletin of Economics and Statistics* 75(6): 962-979. |
| Reason for | Study deals with the minimum wage impact on the ratio of supervisors to supervised employees. |

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| exclusion | The focus of our meta-analysis is on employment. |
| 9 | Campolieti, M., Gunderson, M. and Lee, B. (2014). Minimum wage effects on permanent versus temporary minimum wage employment. *Contemporary Economic Policy* 32(3): 578-591. |
| Reason for exclusion | Study uses a binary dependent variable and reports probabilities. However, in our meta-sample we use estimates drawn from studies using a continuous measure of employment. |
| 10 | Dickens, R., Riley, R. and Wilkinson, D. (2014). The UK minimum wage at 22 years of age: a regression discontinuity approach. *Journal of the Royal Statistical Society* 177(1): 95-114. |
| Reason for exclusion | Study uses a regression discontinuity approach to examine the effects of a minimum wage increase on the probability of employment (and other labour market outcomes). |
| 11 | Jia, P. (2014). Employment and working hour effects of minimum wage increase: Evidence from China. *China & World Economy* 22(1): 61-80. |
| Reason for exclusion | Study reports 48 minimum wage coefficients in tables 6-10, but not their standard errors or t-statistics, which are both needed for publication selection bias correction. |
| 12 | Fialová, K. and Schneider, O. (2014). Labor market institutions and their impact on shadow economies in Europe. *Review of Economics and Institutions* 5(1): 1-40. |
| Reason for exclusion | Estimates of table 4 which present the effect on Small Business Employment (i.e. the share of labour force employed in firms with fewer than ten employees) could have been included in our meta-sample. However, standard errors or t-statistics are not reported for these coefficients, which are both needed for publication selection bias correction. |
| 13 | Reynaga, N. C. and Sánchez A. (2014). Minimum wage and job mobility in Peru. *The Business and Economics Research Journal* 7(1): 23-50. |
| Reason for exclusion | Study uses a probit estimation reporting employment probabilities while we include estimates on an continuous measure of employment in our analysis. |