An Evaluation of the International Experience of Minimum Wages in an Economic Downturn

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Abstract
We analyse the effect of Minimum Wages on employment in periods of economic downturn as well as periods of positive economic growth, using international panel data on 33 OECD and European countries for the period 1976-2008. We find that the neoclassical view that Minimum Wages tend to have a negative effect on employment is only valid when the regressions are not weighted by the population size of each country. We also do not find significant differences in the effects of Minimum Wages over the economic cycle for all age groups, except for the youth (15 to 24) where the impact of the Minimum Wage is more detrimental in the presence of an economic downturn.

Key words: Minimum Wage, Employment, Economic Downturn, Recession
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I. INTRODUCTION

The purpose of the paper is to obtain new estimates of the employment effect of the Minimum Wage by focusing on the recessionary experiences across countries. Using international data we will exploit: cross-national variation in the timing of the introduction of the minimum wage, the level and timing of its uprating and the exact timing of the recessionary experiences in different countries with a panel data set comprising 33 OECD and European countries for the period 1976-2008. Our panel data allow us to differentiate the effect of minimum wages on employment in periods of economic downturn as well as periods of economic growth. We will also be able to account for institutional and other policy related differences that might have an impact on employment other than the minimum wage.

Analysis of minimum wages inevitably raises theoretical and empirical issues. From a theoretical point of view, in a perfectly competitive labour market, a minimum wage set above the market-clearing level reduces labour demand and thus decreases employment. However, alternative economic models have been put forward that predict insignificant or positive employment effects of minimum wages, for example theories where firms have some degree of monopsonistic power or where labour market frictions exist. The earliest empirical studies, based on time-series data, confirmed standard economic theory showing a negative impact of minimum wage on employment. However, new life has been injected into this debate by the findings of Card and Krueger (1995) that minimum wage increases can, in some circumstances, result in net job gains rather than the losses predicted by conventional wisdom. The work of Card and Krueger has, in turn, been subject to intensive scrutiny and launched a wave of further empirical work on the impact of the minimum wages on employment. While many assessments of minimum wages have been carried out on a national basis, there have been few from an international perspective. The large differences across OECD and European countries in the Kaitz index (the Minimum Wage relative to average wages) are a great potential source of variation in the ‘bite’ of the Minimum Wage. In common with the rest of the literature we will evaluate the impact of minimum wages on employment using the variation in this ‘bite’.

There is a substantial literature that uses cross-country comparisons to investigate the impact of labour market policies generally: for the impact of labour market rigidities on
unemployment see Nickel (1997), Blanchard and Wolfers (2000), Nickell, Nunziata and Ochel (2005); for a review of cross-country studies on the impact of Employment Protection Legislation see Addison, J. And Teixeira (2003). However, few studies have used cross-countries analysis to estimate the minimum wage effects on employment. Indeed, apart from an older OECD study (1998), Neumark and Wascher (2004) is the only extensive study which looks at how changes in the incidence of the minimum wage across countries are correlated with changes in country specific’s youth employment rates, using a panel of countries from 1976 to 2000. Our paper will extend this analysis up to 2008 in five ways: first, the analysis will be extended up to 2008. Secondly, we will add more than 10 countries in the analysis. Moreover, we will analyse different age groups, not just youth as is the case in Neumark and Washer (2004). We will also add more time-varying policies and institutional regressors. Finally, we will focus on the economic recessions to provide for aggregate shocks to employment conditions.

The logic behind being concerned about controlling for the economic cycle in an analysis of the effects of the Minimum Wage on employment can be easily seen in a simple elaboration of the standard competitive equilibrium in the labour market. The conventional analysis would suggest the logic in figure 1. Here as a minimum wage \( \bar{w} \) is imposed, equilibrium employment falls from \( e^* \) to \( e' \). Now consider what happens when a recession occurs at the same time. This can be represented in figure 2. In a recession aggregate labour demand falls shifting \( D \) to \( D' \). This means that the competitive labour market would routinely contract and employment would fall from \( e^* \) to \( e' \). But this is precisely the fall in employment which would have occurred by the imposition of the Minimum Wage \( \bar{w} \). Hence it is impossible to determine whether the fall in employment (\( e^*-e' \)) is due to the imposition of the Minimum Wage or to the recession. In the same figure 2, consider now that we are in a time of economic growth with the aggregate demand for labour rising, moving \( D \) to \( D'' \). Again assuming that the Minimum Wage of \( \bar{w} \) has been imposed, here we reach a new equilibrium employment level of \( e'' \). Now without controlling for rising employment due to economic growth we could erroneously attribute the growth in employment (\( e''-e^* \)) to the Minimum Wage rather than to the effect of the growth in labour demand. Hence it is quite clear that any time series analysis of the Minimum Wage across countries should control for changing aggregate demand conditions to prevent any mis-attribution of growth in employment to the Minimum Wage.
The paper is organised as follow. Section II describes the dataset used and the characteristics of the data. Section III outlines the methodology for the analysis. The main results are presented in section IV. Section V concludes.

II. DATA

Data used in this study is drawn from different sources. Most of the data on population, unemployment and employment rates are drawn from the OECD Annual Labour Force Statistics database for OECD members and the European Union Labour Force Statistics for the remaining countries. This allows us to disaggregate our dependent variable by sex and by various age groups: total (15 to 64 years), adults (25 to 64), youth (15 to 64) and teenagers (15 to 19 years). There are few exceptions in the age groups: Italy, where prior to 1993 lower age limit is 14. Portugal, where the lower age limit from 1976 to 1991 is 12 years old and from 1992 to 1997 it is 14 years old. Spain, UK, US and Sweden where the lower age limit in the survey is 16 years. Finally, Hungary, where up to 1994 the adult and total age groups refer to ages 15 to 74.

Data on minimum wages is again available from the OECD Minimum Wage database and from the European Union Labour Force Statistics for those countries in which the national minimum wage is set by statute or by national collective bargaining agreement. For those countries in which no national minimum exists, but in which industry- or occupation-specific minimums are set by legislation or collective bargaining agreement, we use summary estimates constructed by Dolado et al. (1996)\(^1\). OECD and European Union Labour Force Statistics allow us to use as an indicator of the minimum wage the Kaitz Index, the ratio of the minimum wage to the average wage, as measured in this study by the median wage\(^2\). Using median rather than mean wages in the denominator provides a better basis for international comparison because of differences across countries in the dispersion of earnings. The Kaitz Index is one of the standard indicators used in the literature and it is intended to measure the extent to which the minimum wage cuts into the wage distribution, and to capture variation in the relative prices of less-skilled and more skilled labour induced by minimum wages. The closer the Kaitz

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1 For these 4 countries the panel length is shorter (Italy, from 1976 to 1991; Germany from 1976 to 1994; Denmark from 1983 to 1994; and finally Sweden from 1976 to 1992) . However, our main results are robust if we omit these countries from the analysis.

2 For a subset of 11 countries, we use mean wages in constructing their indices. These countries are: Sweden, Denmark, Germany, Italy, Slovenia, Latvia, Estonia, Bulgaria, Croazia, Turkey and Mexico.
index to one the “tougher” the bite of minimum wage legislation in any country and specific year. Appendix B contains a detailed description of the minimum wage variable by country.

We include into the analysis controls for other characteristics of the minimum wage systems which might have an influence on the employment effects of the minimum wage. First of all, we include an indicator of whether the minimum wage is a product of collective bargaining process, with unions, employers and the government all participating in the negotiations or whether minimum wage levels are simply set by statute. Data is drawn from two main sources: the ILO minimum wage database and EUROSTAT. Secondly, we add an indicator of whether countries have youth subminimum wages or not. Information is taken from ILO minimum wage database and the Low Pay Commission report (2009). We refer to Appendix A for a list of countries included in the analysis and their characteristics of the minimum wage system.

We also add into the analysis controls for the importance of other labour market policies and institutions which might have an influence on the employment effects of the minimum wage. Differently from Neumark and Washer (2004), none of these measures is cross-sectional and it is available for several years in the sample. The first of these measures is the OECD index of employment protection legislation, a synthetic indicator of the strictness of regulation on dismissals and the use of temporary contracts\(^3\). A second measure is the level of public expenditure in active labour market programs to bring unemployed workers to work as a percentage of GDP. Again this variable is drawn from the OECD\(^4\). A third measure again constructed from the OECD is trade union density such as the ratio of wage and salary earners that are trade union members, divided by the total number of wage and salary earners\(^5\). A fourth measure constructed by OECD is the average of the gross unemployment benefit replacement rates as a percentage of earnings and it is meant to quantify the generosity of unemployment insurance programs\(^6\). Finally, we used a World Bank indicator of the

\(^3\) The measure is available for 28 of the countries included in the analysis from 1985 to 2008. For the years in the panel before 1985, we fix the level of the measure in 1985.

\(^4\) The measure is available for 24 of the countries in the analysis from 1985 to 2007. For 2008, we use the level of the measure in 2007.

\(^5\) This measure is available for 24 of the countries in the analysis.

\(^6\) This measure is available for 24 of the countries in the analysis and it is drawn every two years for the entire length of our panel.
rigidity of hours. It looks at whether there are restrictions in night work, week holiday work, workweek and annual paid vacation\(^7\).

The full sample consists of 33 OECD and European countries, and it is reduced to 23 OECD countries when the full set of controls is added into the analysis. We refer to the appendix for a detailed list of the countries in the analysis.

In order to distinguish from periods of downturn and periods of economic growth by country, we use quarterly GDP growth rates from the OECD and Eurostat datasets. We explored two different definitions of a recession. One is the conventional one of two consecutive quarters of negative growth. The other is when two or more quarters within a year show a negative GDP growth rate (even if not consecutive\(^8\)). Since our results are invariant to which definition is chosen then we present only the results for the second. Figure 3 diagrammatically show how the latter dummy for a downturn looks over the years across countries in the analysis.

### III. METHODOLOGY

Neumark and Wascher (2004) by exploiting cross-national variation in the minimum wage estimated the effects of minimum wages on employment rates using a pooled cross-section data set comprising several OECD countries for the period 1976-2000. We re-estimate this model with an enlarged panel of OECD and European countries for the period 1976-2008:

\[
E_{jt} = \alpha + T_t + J_j + \beta MW_{jt} + \gamma X_{jt} + \epsilon_{jt} \quad (1)
\]

Where \(E_{jt}\) is employment at time \(t\) in county \(j\), \(MW_{jt}\) is a measure of the incidence of the minimum wage at time \(t\) in country \(j\), \(X_{jt}\) is a set of controlling regressors at time \(t\) in country \(j\), \(T_t\) is a set of year effects and \(J_j\) is a set of country specific fixed effects. The literature has most conveniently used the Kaitz index (namely the ratio of the level of the Minimum Wage to the average or median wage in the economy) as a measure of the ‘bite’ of the Minimum Wage. The idea being that the larger the value the higher up into the wage distribution the minimum will bite. Alternative measures, not used here, are the fraction of those people employed who are paid as the Minimum Wage, the ‘Spike’, or the fraction of those paid at the Minimum Wage or less, the ‘Share’. We cannot use

\(^7\) The measure is available from 2004 to 2008. For the years in the panel before 2004, we fix the level of the measure in 2004.

\(^8\) We also constructed an alternative dummy for downturn when two or more consecutive quarters within a year show a negative GDP growth rate. Results are qualitatively similar.
these measures of the bite of the Minimum Wage in this study as we do not have data on the whole distribution of earnings in each country. In previous work on the UK alone Dolton et al. (2008) have investigated each of these measures of the bite to see to what extent the measure of the bite may change the conclusion about the effect of the Minimum Wage on employment. It seems as if the central conclusions vis-à-vis employment may not be too sensitive to how one measures the ‘bite’.

The countries in the study have very different patterns of minimum wage changes over time, which helps to separate the influences of minimum wages from the influences of other macroeconomic events affecting employment in multiple countries.

Most importantly for the purpose of this paper, the long cross-country panel can be exploited in order to estimate a model that takes into account the different effects of the minimum wage on employment in periods of economic downturn respect from periods of economic growth.

This can be done by extending the model to analyse the minimum wage effects during economic recessions:

\[ E_{jt} = \alpha + T_t + J_j + \beta MW_{jt} + \gamma X_{jt} + \delta C_c + \theta C_c MW_{jt} + \epsilon_{jt} \]  

Where \( C_c \) is a dummy equal to one if the economy is facing an economic downturn and zero otherwise. The coefficient of interest will be \( \theta \), which measures the differences of the effect of the minimum wage on employment in periods of recession relative to periods of economic growth. Therefore, the hypothesis being tested here is whether the interaction of a downturn with the bite of the Minimum wage has an employment effect, over and above, the effect of either the downturn per se (\( \delta \)) or the imposition of the Minimum Wage, per se, (\( \beta \)).

In the model country fixed effects will be added to capture country-specific factors that may influence employment rates. Example of such factors might include government policies as well as cultural and institutional differences across countries. Year effects will control for global shocks or policies that might influence employment rates in all countries. Some specifications will also include country-specific time trends in order to control for incremental changes in the employment rate associated with longer-term developments in labour force participation or labour demand that are unrelated to changes in a country’s minimum wage laws. Also, country-level data will be
supplemented with information on cross-country differences in minimum wage systems and on other labour market institutions and policies. Standard errors are robust to heteroskedasticity and serial correlation of unknown form (Wooldridge, 2002, p.75).

IV. RESULTS

Summary statistics

In Figure 4 countries are ranked by the Kaitz index. As can be seen there is substantial variation in the bite of the minimum wage across countries, with the level of the minimum wage ranging from more than 70% of the average wage in Italy to under 30% in Turkey. Generally, countries of continental Europe show the highest levels of the minimum wage. Australia is the only non-European country with a minimum wage ratio around 60%. In contrast, US and UK and Japan are towards the bottom, together with Mexico and some new European accession countries such as Estonia, Croatia, Hungary, Czech Republic and Lithuania with a Kaitz index under 40%.

Figure 5 shows changes in the Kaitz index across countries over the period of our analysis. It is interesting to see how some countries like the Netherlands, Belgium, Spain, Australia and Mexico have experienced a decreasing bite of the minimum wage over the years. However, other countries such as France, Slovak Republic, Czech Republic, Turkey and Korea show an increasing Kaitz index especially over the last few years.

Changes in real level of the Minimum Wage (in US dollars purchasing power parities) by country are shown in Figure 6. Particularly notable is that over the last 10 years, nearly all countries have allowed the minimum wage to increase in real terms. However, in some countries (e.g. Netherlands, US, Canada) there has been a substantial erosion of the real value of the minimum wage since the mid-1970s to the late 1980s. It is also important to point out how, for some countries, changes in real level of the Minimum Wage do not always correspond to changes in the Kaitz index. For example, Australia has experienced an increase in the real level of the Minimum Wage but a decrease in the Kaitz index. Also, in Japan, Luxembourg and France the increase in real wages is more marked than the raise in the Kaitz index. The same is true for Ireland and the UK from 2000 onwards. These changes could be a result of changes in the distribution of earnings.
Estimates of the minimum wage model

Adults and all

Tables 1 presents results of the effects of minimum wage on employment for two different age groups: those from 15 to 64 years (panel A), and adults from 25 to 64 years (panel B). In the first 8 columns regressions are unweighted. In the last eight columns regressions are weighted by the population of each country. The logic of weighting these regressions is that directly allow for the relative size of the labour market in the regressions. If this is not done, then explicitly we are assuming that we should attach as much weight to a small country like, Lithuania, as a large country such as Germany in forming our estimations and inferences. We remain agnostic about which is the “correct” procedure, but our dual analysis does help us to establish whether certain countries could have a disproportionate effect in getting certain regression results. For each specification, the first 4 columns do not include controls, the second 4 columns control for different characteristics of the minimum wage systems across countries and other labour market policies and institutions that might affect employment.

Columns 1 and 5 of both weighted and unweighted specifications report estimates from a simple regression of the dependent variable on the NMW measure, effectively the establishing the correlation between the two variables. The coefficients of the minimum wage are all negative and statistically significant.

In columns 2 and 6, we add fixed year effects to control for global shock or policies that might influence employment rates in all countries. Again the coefficients are negative and significant in both tables.

In column 3 and 7, we also add fixed country effects to capture persistent country-specific factors that might influence employment rates. Examples of such factors might include government policies as well as cultural or other institutional differences across countries that lead to cross-sectional variation in the propensity to work.

Coefficients are still negative and significant when regressions are not weighted. However, when regressions are weighted by the size of the population and the full set of controls is added into the analysis (column 7), country and year effects remove the significance of the coefficient, suggesting no overall difference in employment rates between countries where the minimum wage bites most compared to countries where the minimum wage bites the least.
Finally, in columns 4 and 8, we also add into the analysis country specific time trends, intended to capture factors that might influence employment trends within a country. One should be cautious in interpreting this last set of results because of the loss in terms of degrees of freedom that country-specific time trends might cause. Adding time trends reverse the sign and remove the significance of the coefficients in most specifications, suggesting no overall difference in employment growth rates between countries where the minimum wage bites most compared to areas where the minimum wage has less impact. The coefficient of the weighted results of adults (pane B column 8) is positive and significant.

**Youth and teenagers**

One possible concern is a lack of focus on the outcomes of groups thought to be potentially more at risk, or at the margin of adjustment, following any change in labour costs. Therefore, we also assess whether the estimates differ for youth (those aged 16-24) and teenagers (those aged 16 to 19).

Table 2 repeats the exercise for these two age groups. In particular, panel A restricts the analysis to young people, aged 15 to 24. Panel B restricts the analysis to teenagers, aged 15 to 19. In addition to the control variables used in the total and adult specifications, we include two additional controls: first of all, the unemployment rate of adults, which is included to control for aggregate economic conditions. Secondly, as a supply side control, the relative size of the youth cohort (the ratio of the youth population to the adult population). In the first 8 columns regressions are unweighted. In the last 8 columns regressions are weighted by the size of population of each country. The first 4 columns of each specification control only for the unemployment rate of adults and the relative size of the youth cohort; the second 4 columns control also for different characteristics of the minimum wage systems across countries and other labour market policies and institutions are also added.

Columns 1 and 5 report estimates from a simple regression of the dependent variable on the minimum wage measure, again effectively establishing the correlation between the two variables. Minimum wage coefficients in the unweighted specifications are all positive and in the majority of the cases statistically significant for both age groups. In the weighted specifications, however, coefficients of the simple correlation between employment and the Kaitz index are insignificant.
In columns 3 and 6 of both tables, both country and year effects are added into the analysis. If the regressions are unweighted, we find the coefficients to be negative and significant for both youth and teenagers. However, if regressions are weighted by the size of the population, coefficients on young people in panel A are still negative but they become insignificant, suggesting no overall difference in youth employment growth rates between countries where the minimum wage bites most compared to countries where the minimum wage has less impact. In panel B, where we concentrate on teenagers, the coefficients become positive and significant. However, one should notice that empirical results for teenagers may be more ambiguous because of interactions between minimum wages, employment and schooling, as Neumark and Wascher (1996) suggest.

Finally, in columns 4 and 8 we add country specific time trends, intended to capture factors that might influence employment trends within a country. Again, one should be cautious in interpreting this last set of results because of the loss in terms of degrees of freedom that country-specific time trends might cause. When we add time trend the coefficients in the unweighted regressions remain negative and significant for both age groups. Coefficients of the weighted results of the 15 to 24 age group are negative and significant, while they are insignificant for teenagers.

**The role of other labour market institutions on employment**

In the main analysis we control for labour market policies and institutions that might affect employment other than the minimum wage, therefore in this section we summarize the results for these policies and institutions, concentrating on specifications which include controls and both year and country effects (Tables 1 and 2, column 7).

The first OECD indicator we consider measures the level of public expenditure in active labour market programs to bring unemployed workers to work as a percentage of GDP. Therefore, a lower value indicates a lower commitment to such policies and institutions. In particular, such policies could include public employment services, training, employment incentives (such as recruitment and employment maintenance incentives), supported employment and rehabilitation, direct job creation.

By improving the efficiency of the job matching process and by enhancing the work experience and skills of the unemployed, active labour market policies can increase employment. However, the efficacy of active labour market policies has been found to
vary significantly between different types of programmes and how these programmes are designed. Furthermore, the positive effects need to be weighted against the costs of taxes necessary to fund them, which may in turn increase unemployment. Also, certain programmes may reduce job search effort amongst the unemployed.

In this paper, a high degree of commitment to active labour market policies legislation is found to be associated with lower employment prospects for all employment groups. However, the results might be affected by some degree of endogeneity bias because such a synthetic indicator of active labour market policies spending is likely to be procyclical.

The second measure provides information on employment protection regulations across countries. This OECD index of employment protection is an indicator of the strictness of regulation on dismissals and the use of temporary contracts. In particular, it measures the procedures and costs involved in dismissing individuals or groups of workers and the procedures involved in hiring workers on fixed-term or temporary work agency contracts. High values are associated with countries having a high degree of employment protection, while low values indicate relative ease in dismissing employees.

Basic economic theory relating to employment protection legislation (EPL) would predict that EPL lowers labour turnover (both hiring and layoff) on the one hand, but increases the length of unemployment spells on the other hand, with ambiguous net effects on aggregate employment and unemployment rates. Econometric estimates of the impact of EPL on the unemployment rate do not clearly provide an unambiguous conclusion on this matter. For example, Nickell (1997) and Nunziata (2002) find no significant effect. However, by reducing turnover, the job prospects of those relatively weakly attached to the labour market, such as young workers, have found to be compromised (OECD 2004).

In this paper, a high degree of EPL is found to be associated with lower employment prospects for youth and teenagers. However, there is no association between EPL and the employment prospects of adult people.

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9 See [www.oecd.org/employment/protection](http://www.oecd.org/employment/protection) for details on the methodology and weights used to compiled the indicators.
The third measure we use as a control is a measure of the generosity of unemployment insurance programs. The summary measure constructed by OECD is defined as the average of the gross unemployment benefit replacement rates as a percentage of earnings.\(^{10}\)

Relatively high unemployment benefits that are available for a relatively long duration can have adverse effects on labour market performance, by reducing the job-search intensity or by lowering the economic cost of unemployment.

In this paper and in accordance with most of the literature, high unemployment benefits are found to be associated with lower employment prospects for all groups.

The fourth is a measure of rigidity of hours, which is constructed by the World Bank. The rigidity of hours index has 5 components: (i) whether there are restrictions on night work; (ii) whether there are restriction on weekly holiday work; (iii) whether the workweek can consist of 5.5 days; (iv) whether the workweek can extend to 50 hours or more (including overtime) for two months a year to respond to a seasonal increase in production; and (v) whether paid annual vacation is 21 working days or fewer. If there are no restrictions, the economy receives a score of 0. If the regulations are very strict, the economy receives a score of 100. Thus, high values of the index indicate the presence of substantial rigidities associated with working hours, whereas low values are suggestive of more flexibility.

As expected, in this paper, a high degree of labour market regulation in terms of hours is found to be associated with lower employment prospects for all employment groups.

The final measure we use as a control is union density again constructed from OECD. Trade union density corresponds to the ratio of workers that are trade union members, divided by the total numbers in the labour force.\(^{11}\)

In theory, strong trade unions have the ability to push wages above market clearing levels, at the cost of lower employment. However, it has long been argued that, in practice, union influence on wage formation varies depending on the structure of collective bargaining. The empirical literature, however, remains inconclusive overall.

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\(^{10}\) For further details, see OECD (1994), The OECD Jobs Study (chapter 8) and Martin J. (1996), “Measures of Replacement Rates for the Purpose of International Comparisons: A Note”, OECD Economic Studies, No. 26. Pre-2003 data have been revised.

\(^{11}\) For more information and full methodology, see [http://www.oecd.org/dataoecd/37/2/35695665.pdf](http://www.oecd.org/dataoecd/37/2/35695665.pdf).
In this paper, high union density is found to be associated with higher employment prospects for all groups in accordance with some empirical studies (e.g. Boone and Van Ours (2004), that using cross-country analysis find negative and significant impact of union density on unemployment).

**Accounting for differences in minimum wage effects in periods of economic downturn and growth**

*Adults and all*

In the second part of the analysis, we add into the model interactions to distinguish between minimum wage effects on employment in periods of economic downturn respect from periods of economic growth. Figure 3 plots the dummy variable we use to distinguish between periods of growth from periods of downturn. It is essential for our identification strategy that there is variation across countries in periods of downturn. Also, it is important that countries are entering and exiting from global recessions in different stages. Figure 3 clearly shows that countries in our sample are facing different periods of economic downturn and it also shows how diverse is the time span of global recessions across countries.

Panel A and B, of table 3 shows results for two different age groups, total (those from 15 to 64) and adults (those from 25 to 64). In the first 4 columns we simply add into the analysis a dummy for whether the economy is facing a period of downturn or a period of growth. In the second 4 columns of the analysis we also add an interaction of this dummy with the Kaitz index to differentiate the effect of the minimum wage in periods of downturn. Again we start from a simple OLS regression and we gradually add year effects, country effects and country-specific time trends. In each specification controls for other labour market institutions and the different characteristics of minimum wage systems are included. Again weighted and unweighted results are compared in the table.

If we concentrate on specifications where only a dummy for periods of downturn is added into the analysis, coefficients for the downturn variable are negative and significant, especially in specifications where both year and country effects are included, showing that in general employment rates tend to be lower in periods of economic downturn than in periods of growth. When the interaction between the Kaitz index and the dummy for downturn is added into the analysis, generally coefficients become insignificant suggesting no differences in the effect of the minimum wage over the economic cycle.
Youth and teenagers

Panel C and D, of table 3 shows results for two other age groups, young (those aged 15 to 24) and teenagers (those aged 15 to 19).

Again in the first 4 columns we simply add into the analysis a dummy for whether the economy is facing a period of downturn or a period of growth. In the second 4 columns of the analysis we also add an interaction of this dummy with the Kaitz index to distinguish the effect of the minimum wage in periods of downturn. Again we started with a simple OLS regression and we gradually add year effects, country effects and country-specific time trends.

If we concentrate on specifications where only a dummy for periods of downturn is added into the analysis, coefficients of the downturn variable are generally insignificant, especially in specifications where both year and country effects are included.

Focusing on column 7 where both year and country effects are included, when the interaction between the Kaitz index and the dummy for downturn is added into the analysis, generally the coefficients of the interactions for those aged 15 to 24 are negative and significant, suggesting differences in the effect of the minimum wage over the economic cycle. In particular, in periods of downturn the effects of the minimum wage on employment appear to be more detrimental than in periods of growth. Interaction coefficients for those aged 15 to 19 are generally insignificant, suggesting no differences in the effect of the minimum wage over the economic cycle.

V. CONCLUSIONS

The paper had two main purposes. First, to exploit the substantial differences across countries in relative minimum wage levels to obtain new estimates of the employment effects of the minimum wage. Even though an important source of variation is provided by the large differences across countries in the minimum wage relative to average wages, relatively few studies have attempted to test such propositions directly (partial exceptions being OECD (1998) and Neumark and Wascher (2004)). Secondly and more importantly, the aim of this study was to estimate the effect of minimum wages on employment over the economic cycle. Specifically, the long panel of 33 OECD and European countries from 1976 to 2008 allowed us to differentiate the effect of minimum wages on employment in periods of economic downturn as well as periods of positive economic growth. We also have been able to account for institutional and other policy-
related differences that might have an impact on employment other that the minimum wage.

A number of interesting conclusions can be drawn. Regarding the first part of the analysis, the neoclassical view that minimum wages tend to have a negative effect on employment is only valid when the regressions are not weighted by the population size of each country. However, when regression are weighted, country and year effects remove the significance of the coefficients, suggesting no overall difference in employment between countries where the minimum wage bites most compared to countries where the minimum wage has less impact.

Regarding the second part of the analysis where we differentiate the effects of minimum wage over the economic cycle, in general we do not find significant differences in the effect of minimum wages over the economic cycle. However, for the youth age group (15 to 24), we find that impact of the minimum wage is more detrimental in the presence of an economic downturn.
Figure 3. Periods of economic downturn across countries
(1=at least two quarters of downturn per year, 0 otherwise)
Sources: OECD, EUROSTAT, WORLD BANK.

Note: Australia AU, Belgium BE, Bulgaria BG, Canada CA, Croatia HR, Czech Republic CZ, Denmark DK, Estonia EE, France FR, Germany DE, Greece GR, Hungary HU, Ireland IE, Italy IT, Japan JP, Korea KR, Latvia LV, Lithuania LT, Luxembourg LU, Malta MT, Mexico MX, Netherlands NL, New Zealand NZ, Poland PL, Portugal PT, Romania RO, Slovak Republic SK, Slovenia SI, Spain ES, Sweden SE, Turkey TR, United Kingdom UK, United States US.
Figure 4. Kaitz index ranked across countries
(for each country, mean of the Kaitz index across years in the panel)

Sources: OECD Minimum Wage database and EUROSTAT.
Note: see figure 1.
Figure 5. Kaitz Index across countries and years

a. Anglo-Saxon Countries

b. Central European Countries

Source: OECD. Minimum Wage database. Kaitz index relative to the median earnings.
For UK before 1994, source: Dolado et al. (1996), Kaitz index relative to average earnings.

Source: OECD. Minimum Wage database. Kaitz index relative to the median earning
c. Mediterranean Countries

Source: OECD, Minimum Wage database. Kaitz index relative to the median earnings. For Ireland before 2000, source: Dolado et al. (1996), Kaitz index relative to average earnings.

d. Collective Agreement Countries

Source: Dolado et al. (1996), Kaitz index relative to average earnings.
e. EU Recent Accession Countries

Source: OECD, Minimum Wage database. Kaitz index relative to the median earnings.

f. EU Recent Accession Countries

Source: EUROSTAT. Kaitz index relative to the mean earnings.
For Lithuania, Kaitz Index relative to median earnings.
g. EU Recent Accession Countries

Source: EUROSTAT. Kaitz index relative to the median earnings. For Bulgaria and Croazia, Kaitz index relative to mean earnings.

h. Developing and Asian Countries

Source: OECD, Minimum Wage database. For Japan and Korea, Kaitz index relative to the median earnings. For Turkey and Mexico, Kaitz index relative to the mean earnings.
Figure 6. Real Hourly Minimum Wage (US$PPP)

a. Anglo-Saxon Countries

Source: OECD, Minimum Wage database

b. Central European Countries

Source: OECD, Minimum Wage database.
c. Mediterranean Countries

Source: OECD, Minimum Wage database.

d. Eastern European Countries

Source: OECD, Minimum Wage database.
e. Developing and Asian Countries

![Graph showing real hourly minimum wages for Japan, Korea, Turkey, and Mexico from 1976 to 2008.](image)

Source: OECD, Minimum Wage database.
### Table 1. Estimates of the Minimum Wage Model Using International Data (all and adults)

<table>
<thead>
<tr>
<th>Variable</th>
<th>(1) OLS</th>
<th>(2) FE</th>
<th>(3) FE</th>
<th>(4) FE</th>
<th>(5) OLS</th>
<th>(6) FE</th>
<th>(7) FE</th>
<th>(8) FE</th>
<th>Panel A: All (15-64) Unweighted</th>
<th>Panel A: All (15-64) Weighted</th>
<th>Panel B: Adults (25-64) Unweighted</th>
<th>Panel B: Adults (25-64) Weighted</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Kaitz Index (L.)</strong></td>
<td>-0.044*</td>
<td>-0.051**</td>
<td>-0.132**</td>
<td>0.001</td>
<td>-0.065**</td>
<td>-0.057**</td>
<td>-0.090**</td>
<td>0.009</td>
<td>-0.143**</td>
<td>-0.145**</td>
<td>-0.083**</td>
<td>0.022</td>
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<td>(0.023)</td>
<td>(0.029)</td>
<td>(0.012)</td>
<td>(0.021)</td>
<td>(0.023)</td>
<td>(0.023)</td>
<td>(0.017)</td>
<td>(0.026)</td>
<td>(0.024)</td>
<td>(0.027)</td>
<td>(0.014)</td>
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<tr>
<td>Youth Submin.</td>
<td>-</td>
<td>-</td>
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<td>-</td>
<td>-0.006</td>
<td>-0.009</td>
<td>0.023**</td>
<td>-0.003</td>
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<tr>
<td>Act. Policies</td>
<td>-</td>
<td>-</td>
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<td>-</td>
<td>-</td>
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<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>Empl. Prot.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-0.010**</td>
<td>-0.006*</td>
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<td>0.025**</td>
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<tr>
<td>Repl. Rate</td>
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<td>-0.014**</td>
<td>-0.014**</td>
<td>0.007</td>
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<tr>
<td>Rig. of Hours</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>-0.029**</td>
<td>-0.031**</td>
<td>-0.006**</td>
<td>-0.003</td>
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<tr>
<td>Union Density</td>
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<td>0.028**</td>
<td>0.036**</td>
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<td>-0.004</td>
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</tbody>
</table>

Notes: HAC robust fixed effect estimates in brackets. * significant at 10% level, ** significant at 5% level.


For specifications with the full set of controls (column 5 to 8) and (13 to 16), the sample is restricted to 23 countries: for data limitation Mexico, Turkey, Lithuania, Romania, Slovenia, Malta, Bulgaria, Latvia, Estonia and Croatia are omitted from the analysis. However, results in specifications (1) to (10) are qualitatively similar omitting those countries.

| Years Effects | N | Y | Y | Y | N | Y | Y | N | Y | Y | N | Y | Y |
| Country Effects | N | N | Y | Y | N | N | Y | Y | N | N | Y | Y | Y |
| Time Trends | N | N | N | Y | N | N | Y | N | N | Y | N | N | Y |

*Controls*
### Table 2. Estimates of the Minimum Wage Model Using International Data (youth and teenagers)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Panel A: Youth (15-24), Unweighted</th>
<th>Panel B: Youth (15-19), Unweighted</th>
<th>Panel A: Youth (15-24), Weighted</th>
<th>Panel B: Youth (15-19), Weighted</th>
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<tr>
<td>Kaitz Index (L.)</td>
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<td>OLS FE</td>
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<tr>
<td>Act. Policies</td>
<td>0.112** (0.046)</td>
<td>0.018 (0.061)</td>
<td>0.160** (0.061)</td>
<td>0.018 (0.061)</td>
</tr>
<tr>
<td>Act. Policies</td>
<td>0.112** (0.046)</td>
<td>0.018 (0.061)</td>
<td>0.160** (0.061)</td>
<td>0.018 (0.061)</td>
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<tr>
<td>Adult Unempl.</td>
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<td>-1.537** (0.095)</td>
<td>-1.664** (0.095)</td>
<td>-1.537** (0.095)</td>
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<tr>
<td>Rel. Cohort Size</td>
<td>0.353** (0.122)</td>
<td>-0.259** (0.119)</td>
<td>0.499** (0.127)</td>
<td>-0.259** (0.119)</td>
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<td>Bargained Min.</td>
<td>-0.008 (0.018)</td>
<td>0.107 (0.010)</td>
<td>0.033** (0.008)</td>
<td>0.211 (0.007)</td>
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<td>Panel A: Youth (15-24), Weighted</td>
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<tr>
<td>Time Trends</td>
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Notes: See table 1.1
Table 3. Differences in Minimum Wage effects by periods of economic downturn and growth

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<th>Variable</th>
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<th>(12) OLS</th>
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</tr>
<tr>
<td>Katz Index(Lagged)</td>
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<td>-0.057**</td>
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<td>-0.071**</td>
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<td>-0.090**</td>
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<td>-0.105**</td>
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<td>(0.023)</td>
<td>(0.017)</td>
<td>(0.022)</td>
<td>(0.023)</td>
<td>(0.023)</td>
<td>(0.018)</td>
<td>(0.023)</td>
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<td>(0.020)</td>
<td>(0.024)</td>
<td>(0.023)</td>
<td>(0.018)</td>
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<tr>
<td>Downturn (lagged)</td>
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<td>-0.006*</td>
<td>-0.006**</td>
<td>-0.034</td>
<td>-0.039</td>
<td>-0.009</td>
<td>-0.006</td>
<td>-0.010</td>
<td>-0.009</td>
<td>-0.009**</td>
<td>-0.006**</td>
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<td>(0.002)</td>
<td>(0.024)</td>
<td>(0.024)</td>
<td>(0.011)</td>
<td>(0.008)</td>
<td>(0.006)</td>
<td>(0.006)</td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.017)</td>
<td>(0.019)</td>
<td>(0.011)</td>
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<td>MW* Downturn (lagged)</td>
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<td>0.072</td>
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<td><strong>Panel B: Adults (25-64)</strong></td>
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<tr>
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<td>-0.009**</td>
<td>-0.005**</td>
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<td><strong>Panel C: Youth (15-24)</strong></td>
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<td>(0.027)</td>
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<td>-0.006*</td>
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<td>0.034</td>
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<td><strong>Panel D: Youth (15-19)</strong></td>
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<td>(0.039)</td>
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<td>(0.004)</td>
<td>(0.036)</td>
<td>(0.035)</td>
<td>(0.013)</td>
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<td>Y</td>
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</table>

Notes: Regression includes the full set of control. See table 1.1.
### APPENDIX A

**Characteristics of the Minimum Wage Systems**

<table>
<thead>
<tr>
<th>Country</th>
<th>Method of Setting</th>
<th>System</th>
<th>Youth subminimum</th>
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<tbody>
<tr>
<td>Australia</td>
<td>statute</td>
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<td>Belgium</td>
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</tr>
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<td>yes</td>
</tr>
<tr>
<td>France</td>
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<td>national</td>
<td>limited</td>
</tr>
<tr>
<td>Germany</td>
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<td>sectoral collective agreements</td>
<td>some</td>
</tr>
<tr>
<td>Greece</td>
<td>negotiated</td>
<td>national</td>
<td>no</td>
</tr>
<tr>
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<td>statute</td>
<td>national</td>
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<tr>
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<td>Labour Committees</td>
<td>sectoral collective agreements</td>
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</tr>
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<td>Bulgaria</td>
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<td>Croatia</td>
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</table>

Sources “Method of Setting”: ILO, Minimum Wage Database; Eurostat, “Minimum Wages in January 2009”.

Sources “System”: The Minimum Wage Revisited in the Enlarged EU, table 1.1 pg.2; for extra-European countries: ILO, Minimum Wage database.

APPENDIX B

Definition of the Kaitz Index

**Australia**
*Minimum Wage:* Federal minimum weekly wage (August each year) -- extrapolated from 1997 back to 1985 in line with Metals Industry Award C14 wages and National Wage Case decisions.

*Median wage:* Median gross weekly earnings of full-time workers in main job (August each year).

*Source:* OECD Minimum Wage Database.

**Belgium**
*Minimum wage:* Minimum monthly wage (annual averages) -- Revenu Minimum Mensuel Moyen Garantie (RMMMG) -- for experienced workers aged 22 and over (21 and over prior to 1992).

*Median wage:* Median gross monthly earnings of full-time workers.

*Source:* OECD Minimum Wage Database.

**Bulgaria**
*Minimum wage:* Monthly minimum wage

*Mean wage:* Mean value of the average gross monthly earnings of full-time workers including overtime earnings, regular and irregular bonuses and payments for time not worked. Only enterprises with at least 1 employee are covered (industry and services excluding public administration).

*Source:* EUROSTAT.

**Canada**
*Minimum wage:* Weighted (by labour force) average of provincial minimum hourly wage (Can$).

*Median wage:* Median gross hourly earnings of full-time workers.

*Source:* OECD Minimum Wage Database.

**Croatia**
*Minimum wage:* Monthly minimum wage

*Mean wage:* Mean value of the average gross monthly earnings of full-time and part-time workers, only enterprises with at least 10 employees are covered (industry and services excluding public administration).

*Source:* EUROSTAT.
**Czech Republic**

*Minimum wage*: Minimum gross monthly wage (annual average).

*Median wage*: Median monthly earnings of employees who worked at least 1 700 hours during the year.

*Source*: OECD Minimum Wage Database.

**Denmark**

The average hourly minimum wage divided by an average hourly wage.

*Source*: Dolado et al. (1996).

**Estonia**

*Minimum wage*: Monthly minimum wage

*Mean wage*: Mean value of the October gross monthly earnings of full-time workers (industry and services excluding public administration).

*Source*: EUROSTAT.

**France**


*Median wage*: Median gross annual earnings of full-time workers in the private and semi-private sector.

*Source*: OECD Minimum Wage Database.

**Germany**

Average monthly minimum wage divided by an average monthly wage.

*Source*: Dolado et al. (1996).

**Greece**

*Minimum wage*: Minimum monthly wage for an unqualified, single, worker with no work experience (annual average and assuming paid for 14 months).

*Median wage*: Median gross annual earnings of full-time workers.

*Source*: OECD Minimum Wage Database.

**Hungary**

*Minimum wage*: Minimum gross monthly wage (May each year).

*Median wage*: Median monthly earnings of full-time employees (May each year).

*Source*: OECD Minimum Wage Database.
Ireland
Before 2000:
The average hourly minimum wage divided by an average hourly wage.
Source: Dolado et al. (1996).
From 2000:
Minimum wage: minimum gross hourly wage (March each year).
Median wage: median hourly earnings of full-time employees.
Source: OECD Minimum Wage Database.

Italy
Average minimum monthly wage divided by an average wage.
Source: Dolado et al. (1996).

Japan
Minimum wage: Weighted average of prefectural hourly minimum wages (June each year and weighted by employment).
Median wage: Median gross monthly earnings, including overtime and all special payments, for June of each year (estimated by applying the ratio of mean total to mean scheduled earnings to median scheduled earnings).
Source: OECD Minimum Wage Database.

Korea
Minimum wage: minimum hourly wage (June each year).
Median wage: median gross monthly earnings, including overtime and all special payments, for June of each year.
Source: OECD Minimum Wage Database.

Latvia
Minimum wage: Monthly minimum wage
Mean wage: Mean value of the average gross monthly earnings of full-time workers (industry and services excluding public administration).
Source: EUROSTAT.

Lithuania
Minimum wage: Monthly minimum wage
Median wage: Median value of the average gross monthly earnings of full-time workers (industry and services excluding public administration).
Source: EUROSTAT.
**Luxembourg**

*Minimum wage*: minimum monthly wage -- Salaire Social Minimum (SSM) -- (October each year).

*Median wage*: median gross monthly earnings of full-time, full-year workers (annual earnings divided by 12).

*Source*: OECD Minimum Wage Database.

**Malta**

*Minimum wage*: Monthly minimum wage (in Malta the minimum wage is fixed at a weekly rate. These hourly or weekly rates have been converted to a monthly rate).

*Median wage*: Median value of the average gross monthly earnings of full-time workers (industry and services excluding public administration).

*Source*: EUROSTAT.

**Mexico**

*Minimum wage*: Weighted average of regional daily minimum wages (annual average and weighted by employment).

*Mean wage*: Mean hourly wages of manual workers in manufacturing.

*Source*: OECD Minimum Wage Database.

**Netherlands**

*Minimum wage*: Minimum weekly earnings -- Minimumloon -- for persons aged 23 to 64 (annual average).

*Median wage*: Median gross annual earnings of full-time employees (including overtime payments).

*Source*: OECD Minimum Wage Database.

**New Zealand**

*Minimum wage*: minimum weekly wage for workers aged 20 and over (February each year).

*Median wage*: median usual weekly earnings of full-time employees (February each year).

*Source*: OECD Minimum Wage Database.

**Poland**

*Minimum wage*: Minimum monthly wage (September of each year) (Zl).

*Median wage*: Median gross monthly earnings of full-time workers.

*Source*: OECD Minimum Wage Database.
Portugal
Minimum wage: Minimum monthly wage -- Salário Mínimo Nacional (SMN) -- for non-agricultural workers aged 20 and over (annual average).
Median wage: Median gross annual earnings of full-time workers.
Source: OECD Minimum Wage Database.

Romania
Minimum wage: Monthly minimum wage
Median wage: Median value of the average gross monthly earnings including non-standard payments (industry and services excluding public administration).
Source: EUROSTAT.

Slovak Republic
Minimum wage: minimum monthly wage.
Median wage: median gross monthly earnings of full-time workers.
Source: OECD Minimum Wage Database.

Slovenia
Minimum wage: Monthly minimum wage
Mean wage: Mean value of the average gross monthly earnings of full-time and part-time workers, including 13th month payments (industry and services excluding public administration).
Source: EUROSTAT.

Spain
Minimum wage: Salario minimo interprofesional per month (Ptas) for workers aged 18 and over.
Median wage: Median gross annual earnings of full-time workers.
Source: OECD Minimum Wage Database.

Sweden
The average hourly minimum wage divided by an average hourly wage.
Source: Dolado et al. (1996).

Turkey
Minimum wage: Minimum daily wage (TL) for workers aged 16 and over.
Mean wage: Mean daily earnings of manufacturing workers.
Source: OECD Minimum Wage Database.
**United Kingdom**

**Before 1994:**
The average hourly minimum wage divided by an average hourly wage.
*Source:* Dolado et al. (1996).

**From 1999:**

*Minimum wage:* national minimum hourly wage.

*Median wage:* median hourly earnings of full-time adult employees.
*Source:* OECD Minimum Wage Database.

**United States**

*Minimum wage:* Federal minimum hourly wage rate (US$).

*Median wage:* Median usual weekly earnings of full-time employees.
*Source:* OECD Minimum Wage Database.
REFERENCES


