

Sharp Teeth or Empty Mouths? European Institutional Diversity and the Sector-Level Minimum Wage Bite

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Abstract

The article explores the link between different institutional features of minimum wage systems and the minimum wage bite. We notably address the striking absence of studies on sectoral-level minima and exploit unique data covering 17 European countries and information from more than 1,100 collective bargaining agreements. Results provide evidence for a neglected trade-off: systems with bargained sectoral-level minima are associated with higher Kaitz indices than systems with statutory floors, but also with more individuals actually paid below prevailing minima. Higher collective bargaining coverage can, to some extent, reduce this trade-off between sharp teeth (high wage floors) and empty mouths (non-compliance/non-coverage).

1. Minimum wages in Europe: Room for debate

On 10 January 2013, Jean-Claude Juncker, at the time Prime Minister of Luxembourg and outgoing president of the Eurogroup (the group of countries belonging to the Eurozone), told the European Parliament that Europe needs ‘a basis of social rights for workers, minimum social rights for workers, including of course one essential thing, a minimum wage — a legally compulsory minimum wage in the Eurozone member states’. The European Commission also issued a series of statements in favour of an EU-wide approach to minimum wages. In April 2012, for example, the EU commissioner in charge of social affairs argued that ‘setting minimum wages help

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prevent a destructive race to the bottom in the cost of labour, and are an important factor in ensuring decent job quality'.¹ Similar arguments were put forward by the Party of European Socialists Congress, which called for 'decent minimum wages' by introducing an 'EU target for the minimum wage in terms of GNP per capita' (Rasmussen and Delors 2006).

The EU, however, has small leverage to implement a European approach to minimum wages because it lacks any official competence to issue directives or regulations concerning wage policies. In this area, the European Commission can only promote its agenda through recommendations and the open method of co-ordination (i.e. by setting objectives that are politically but not legally binding). For example, it has recommended wage floors in order to close the gap between male and female wages in Austria (Hermann 2006). But the main factor that has worked against a European approach is the absence of a clear consensus at the European level concerning whether the benefits of harmonizing minimum wage policies outweigh the costs. The trade unions, for instance, are far from unanimous in their support for European legislation that would impose statutory minimum wages everywhere in Europe. In particular, many countries where there is no statutory minimum wage are against a European scheme. Objections are notably very strong in Austria, Italy and the Nordic countries (Lismoen 2006). On the other hand, trade unions in countries such as Germany and Spain favour a European approach to the issue (Bosch and Kalina 2010; Eldring and Alsos 2012). Unsurprisingly, the European Trade Union Confederation has yet to develop a clear stance on the issue of an EU-wide minimum wage.

The usual argument put forward by both employers and the unions against a statutory minimum wage is that it could undermine the autonomy of the social partners and thereby jeopardize the entire bargaining process. Unions, in particular, fear a weakening of collective bargaining or exposing workers to political arguments in which minimum wages could become one of the adjustment variables. Some unions fear that a statutory minimum wage, which could be close to wages in the lowest paid sector to avoid negative effects on employment, will reduce wages across the entire economy and therefore also in sectors where unions are strong. Some unions, therefore, advocate a minimum wage for workers not covered by collective agreements, but often insist more on the extension of collective bargaining than on statutory minima. The most notable exception is Germany where unions and political forces are discussing the adoption of a statutory minimum wage to counterbalance the effect of decreasing coverage of collective agreements and the increase in mini-jobs (low-wage jobs).²

Much of the antagonism inspired by the idea of a harmonized minimum wage policy in Europe stems from the fact that the current minimum wage arrangements differ widely among European countries (Eyraud and Saget 2005; Grimshaw 2013; Machin and Manning 1997). On the one hand, a European minimum wage is seen as desirable in countries without effective statutory minima and where collective bargaining agreements also fail to provide sufficient protection from wage dumping. On the other hand,

countries with apparently effective collective bargaining institutions perceive a European approach as a threat to an established and functioning system (Eldring and Alsos 2012). What both advocates and opponents of a European minimum wage policy lack is empirical evidence that compares the different national arrangements with respect to their impact on a series of labour market outcomes.

By and large, the academic literature on minimum wages has been dominated by protracted debates on the size of potential employment effects, especially in the United States (Brown *et al.* 1982; Cahuc and Zylberberg 2004; Card and Krueger 1995; Neumark *et al.* 2013). The link between different minimum wage institutions and labour market outcomes has hardly been studied until very recently (Boeri 2012; Grimshaw *et al.* 2013). Despite scarce evidence, some academics have nevertheless started to push for the introduction of a European minimum wage. Most notably, in 2005, a group of eminent scholars on minimum wages signed a public call for a European minimum wage 'of at least 60 percent of the average national wage' (Schulten *et al.* 2005). The possibility of a minimum wage — or at least some common rules — at the EU level has also been raised and discussed by Vaughan-Whitehead (2010) and Grimshaw (2013) without, however, being able to compare the empirical performance of different minimum wage systems in terms of the degree of protection that minimum wages are supposed to provide.

Focusing on the minimum wage bite, the objective of this article is to present empirical evidence on key characteristics of alternative minimum wage systems: first, we are able to verify whether collectively bargained sector-level minima are higher compared with statutory minima at the national level — a claim that is sometimes found in the literature but has so far not been examined with cross-country and cross-sectoral data covering different minimum wage systems (Boeri 2012; Eyraud and Saget 2005; Funk and Lesch 2006; Grimshaw and Bosch 2013); second, we test whether statutory minima tend to have a broader coverage than collectively bargained minima — an intuitive hypothesis based on the observation that the collective bargaining typically does not cover all workers in the sector and that non-compliance might have a lower incidence if it is enforced by law; third, by comparing the bite of minimum wages in different systems, we are able to provide first empirical evidence on the notion that high collective bargaining coverage (CBC) and a national statutory minimum can be considered as 'functional equivalents' (Schulten 2012). While all three hypotheses are highly relevant for European minimum wage policy, our article is the very first to provide empirical evidence on their validity by using a unique dataset that is representative of the institutional diversity of minimum wages in Europe.

The article is structured as follows. Section 2 presents the conceptual framework of our approach by defining the term 'minimum wages' and three complementary measures of the 'minimum wage bite': the Kaitz index, the employment spike and the share of individuals earning wages below

prevailing minima. The section on Institutional Diversity and the Minimum Wage Bite proposes a typology of minimum wage systems, and a set of hypotheses on the link between the minimum wage bite and the main institutional features of these systems, namely the existence of a national statutory minimum wage (NMW) and the coverage of sectoral-level collective bargaining. Section 3 describes the unique dataset including sectoral-level data on CBC and minimum wages that we use in this article. We notably collected information on national-level minima from 11 countries and sectoral-level minima from more than 1,100 sectoral agreements in six countries. Sectoral CBC for all 17 countries has been computed with information from the European Company Survey. The micro-level information on labour force composition and earnings stems from the latest three European Union Statistics on Income and Living Conditions (EU-SILC) waves 2008–2010. Section 4 presents our regression framework, allowing us to exploit the sectoral data in order to test the link between institutional features of minimum wage systems and our three indicators for the minimum wage bite. We also provide a series of robustness tests underlining the stability of our results. The final section concludes.

2. The minimum wage bite

What Are ‘Minimum Wages’?

NMWs have received much attention in labour economics and industrial relations, to such an extent that other types of wage floors are hardly ever analysed in these disciplines. However, when policy makers or trade unionists discuss ‘minimum wages’, they not only refer to statutory wage floors defined at the national level, but also to minimum wages that are defined as ‘base rates’ at the sectoral or occupational level. To give some examples, the collective agreement signed on 27 June 2007 in the Belgian chemical industry refers to a given amount by stating that ‘this hourly minimum wage corresponds to the lowest applicable level, namely to the position of an ordinary manual worker’ (our translation). Also, the administrators of the German *Mindestlohn datenbank* compiled by the Wirtschafts- und Sozialwissenschaftliche Institut (WSI) clearly state that ‘*Tariflöhne sind Mindestlöhne*’ (wages in collective agreements are minimum wages). For the case of Austria, Hermann (2006) calls sectoral-level wage floors ‘minimum wages’ by saying that ‘in Austria the minimum wage represents the lowest pay category in the corresponding collective agreement’ (our translation) (p. 8). As can be inferred from these examples, practitioners and minimum wage experts refer to sectoral base rates as ‘minimum wages’. More precisely, it is the wage assigned to the lowest category in collectively negotiated pay scales that should be interpreted as the relevant minimum wage: for all workers covered by a given agreement, it is in principle not possible to pay any of them below the rate that has been negotiated for the very bottom of the pay scale.

The almost exclusive focus on data collected within the group of countries with NMWs is problematic because the labour market consequences of minimum wages might differ depending on whether they are defined at the national or sectoral level, or on whether they are imposed by the government or negotiated through collective bargaining. As a consequence, we know surprisingly little about the consequences of fundamental issues like whether the minimum is defined for the entire labour force (in the case of an NMW with no exemptions) or only a part of it (for instance, by a sectoral minimum that binds only trade union members). The few empirical studies that scrutinize the process through which minima are determined suggest that institutional arrangements matter: Boeri (2012), for example, has shown that national wage floors that are legislated unilaterally by the government are typically lower than those settled with closer involvement of the social partners. Moreover, Schulten (2012) and Grimshaw and Bosch (2013) provide some evidence on the relationship between collective bargaining and the level of minimum wages, but the small samples in these studies do not allow us to draw conclusions about the relative performance of different minimum wage systems.

The Kaitz Index

When scholars or practitioners evaluate the impact of a given wage floor, they frequently refer to this impact as the 'bite' of a minimum wage. This notion is often measured in terms of the 'Kaitz index' (Kaitz 1970). A direct comparison of absolute levels of minimum wages is not meaningful if countries differ in terms of labour productivity, prices or wage levels. The Kaitz index addresses this issue and is defined as the ratio of the minimum wage to the average wage of the working population. The index is, thus, a measure of the 'bite' of the minimum wage: small values indicate that the wage floor is a long way from the centre of the earnings distribution and its impact therefore potentially low; conversely, a high Kaitz index reveals that the minimum wage is close to the centre of the distribution and that it potentially affects a larger number of employees.

Given that this article studies the performance of different minimum wage systems, it is crucial that the Kaitz indices are comparable. In order to ensure their comparability, our indices reflect the following methodological choices. First, our Kaitz indices are based on median wages instead of average wages. The reason for this is that countries with higher wage dispersion also have lower minimum wages (OECD 1998), and that a Kaitz index based on median earnings is less affected by the shape of the overall wage distribution than an index based on average earnings. Second, since we analyse the impact of minimum wages at the sectoral level, we calculate Kaitz indices based on the sectoral-level median wage. In the case of countries in which wage floors are determined at the sectoral level, both the numerator and the denominator include sectoral-level information. Third, we test whether our results are sensitive to the exclusion of young workers, for whom lower minima are

defined in some countries. Fourth, our Kaitz indices use gross earnings, including social benefits and other benefits. This means that our measures yield information on the impact of the relative size of the minimum wage as it is commonly defined (in other words, including benefits) but before taxes. Indeed, the Kaitz index can lead to flawed comparisons if net earnings are used instead of gross earnings: the net index capturing cross-country differences as regards the progressivity of tax systems rather than the relative level of the minimum wage as such. Fifth, Dolado *et al.* (1996) argue that it is more advisable to analyse changes of minimum wages over time, especially in situations of considerable institutional diversity between countries. In order to account for differences between national labour markets, our dataset includes not only cross-country variability, but also within-country variability (between sectors and across time).

The Employment Spike

The Kaitz index alone cannot give a complete picture of the minimum wage bite: a relatively high index does not necessarily mean that many workers are actually paid at or above the minimum wage. A second indicator for the minimum wage bite is the employment spike that measures the proportion of jobs that are clustered at the minimum wage (Teulings 2003). If the wage distribution shows a visible spike at the level of the minimum wage, this is interpreted as a strong bite: the wage floor is high enough to have an actual impact on the shape of the wage distribution.

While the employment spike can be theoretically defined as the proportion of jobs paid exactly at the minimum wage, the measure has to be slightly modified when working with survey data. In this article, we work with data on monthly earnings and monthly work hours so that the variable 'hourly wages', which is the ratio of the two, is subject to some noise. It would not be sensible to define the employment spike as the proportion of employees who are exactly paid at the minimum wage. Instead, we have defined the employment spike as the proportion of employees in the close vicinity of the minimum wage, using alternatively an interval of 1 and 5 per cent above and below the prevailing wage floor.

The Share of Individuals Below the Minimum Wage

Even if a relatively high Kaitz index is combined with a visible employment spike at the wage floor, it does not necessarily mean that the minimum wage bite is always strong: it could still be the case that many workers are actually paid below the minimum wage. There are many factors that could lead to either a substantial fraction of jobs that are not covered by prevailing minimum wage rules or the occurrence of hourly wages that are not compliant with existing legislation or collective agreements. The case study evidence evaluated by Grimshaw *et al.* (2013) documents the extent of non-compliance in several European low-pay sectors, and distinguishes between different

forms of non-compliance ranging from ‘outright noncompliance’ and ‘exploitative wages’ to ‘silent acceptance’ of subminimum pay by weak trade unions (Grimshaw *et al.* 2013, pp. 233–4). Moreover, in countries like Italy, the CBC is so low that the vast majority of workers earn wages that are far below negotiated minima. While it is therefore true that a high Kaitz index and a visible employment spike are like sharp teeth indicating a strong ‘bite’ of the minimum wage, one also has to check whether the mouth of minimum wage rules is not empty due to issues such as non-compliance and/or non-coverage.

A complementary heuristic for the analysis of the minimum wage bite is, therefore, the distribution of workers with respect to the minimum wage. In this article, we use the proportion of jobs below the minimum wage as a third indicator: the more workers are paid below the existing wage floor in each sector, the lower the bite of the minimum wage. In systems with national statutory minima, this share can be interpreted as a measure of non-compliance, whereas for collectively bargained minima it represents both non-compliance and/or non-coverage in the sector at hand. Differences between the two systems in the proportion of employees below the prevailing minima can, therefore, either stem from variations in compliance — for instance, if the enforcement and information on applicable rates was higher in the case of national statutory minima — or the fact that collective bargaining almost always leaves some pockets of uncovered workers.

There is little comparative research on the amount of jobs below prevailing minima; in particular, we are not aware of any research that links the incidence of such jobs to the characteristics of minimum wage systems. For the case of German sectoral agreements analysed by Bosch and Weinkopf (2012), the interviewed experts and companies report incidence of non-compliance in all sectors, but the extent of non-compliance has not been quantified. Figures computed by the US Bureau of Labor Statistics, however, give an idea of the size of the underlying phenomenon in the United States: according to statistics on the distribution of workers paid at hourly rates in 2011 (a group that comprises around 75 million individuals), 1.7 million earned exactly the prevailing federal minimum wage of \$7.25 per hour. The number of workers below the minimum wage was 2.2 million. Together, these 3.8 million workers with wages at or below the federal minimum made up 5.2 per cent of all hourly paid workers (Bureau of Labor Statistics 2012). While the bite of the US Fair Labor Standards Act is, therefore, apparently substantial in light of 1.7 million jobs earning exactly the prevailing minimum wage, the fact that even more workers earn wages below the wage floor qualifies this conclusion.

Institutional Diversity and the Minimum Wage Bite

In this section, we discuss how different institutional features of minimum wage systems might be related to the minimum wage bite. The institutionalist literature on minimum wages so far has focused almost exclusively on systems in which wage floors are defined by NMW legislations. The focus of

this literature has, therefore, been to account for different outcomes (such as the relative level of statutory minimum wages) by looking at differences between statutory systems, either across countries or across time. Existing empirical evidence notably suggests that in countries with statutory minimum wages, a higher level of CBC is associated with relatively higher levels of minimum wages (Boeri 2012; Eyraud and Saget 2005; Funk and Lesch 2006; Grimshaw and Bosch 2013). This might be due to the fact that countries with higher CBC tend to have more egalitarian wage structures in which the median lies closer to the minimum wage, leading in turn to a higher Kaitz index. Another explanation is that a higher level of CBC is associated with stronger trade union influence on the level of the statutory minimum wage (e.g. in negotiations by tripartite commissions).

In this article, we extend the analysis to countries in which wage floors are determined at the sectoral or occupational level through collective bargaining. Collectively agreed minimum wages at the sectoral level are sometimes considered to be ‘functional equivalents’ of statutory wage floors (Schulzen *et al.* 2006), but unfortunately empirical evidence comparing the two types of systems is extremely rare (Kampelmann *et al.* 2013). Given the importance and interactions between CBC and the type of minimum wage that prevails in a given system (Grimshaw 2013), we therefore propose to distinguish European countries with the help of a typology including both elements:

- CBC: the degree of coverage might influence both the relative level of the minimum wage and the incidence of jobs below and above the wage floor.
- NMW versus sectoral collectively bargained minima: whether minimum wages are determined nationally as statutory wage floors or through collective bargaining at the sectoral or occupational level might also influence the minimum wage bite.

It should be noted that these two features are not entirely independent of each other. Indeed, a range of studies underline that the centralization and coverage of collective bargaining tend to be higher in countries without statutory minima (Eldring and Alsos 2012; Schulzen *et al.* 2006; Vaughan-Whitehead 2010). This observation is confirmed by our data: CBC is 31 percentage points higher in countries in which minimum wages are determined through collective bargaining at the sectoral level (see Section 3). In some cases, statutory minimum wages can be the consequence of low levels of collective bargaining if policy makers see them as an instrument to protect otherwise vulnerable workers. This explanation seems to account for the minimum wage policies adopted by Central and Eastern European countries where collective bargaining institutions were so weak during the transition to capitalist labour markets that almost all countries installed statutory wage floors in order to protect workers against excessive wage dumping.

Some minimum wage experts stress the heterogeneity of ‘a host of different arrangements and national models’ (Eyraud and Saget 2005, p. 2), and it is of course possible to add more features to our typology in order to capture more of the institutional diversity between countries. For instance, one might split

up the group of countries with statutory minimum wages according to the process through which the wage floors are determined (automatic adjustment to inflation, as in Belgium or France; bi- or tripartite negotiations, as in Estonia or Ireland; and determination by the state after consultation with the social partners, as in Portugal). The behaviour of the involved actors might also lead to different outcomes within the same type of minimum wage system. The strategy of some national trade union confederations of defining a universal minimum wage target is a case in point. Even though there is no statutory minimum wage and bargaining takes place at the sectoral level in countries such as Austria and Denmark, national campaigns such as the Austrian ‘*Kampagne 1.000-Euro-Mindestlohn*’ (cf. Hermann 2006) or the Danish union target of 13.80 euros per hour (Westergaard-Nielsen 2008) introduce a degree of centralization into an otherwise decentralized minimum wage system without necessarily changing the institutional set-up. What is more, Bosch and Weinkopf (2012) have analysed the institutional variety of minimum wage effects within the same industrial relations system: comparing the bite of minimum wages differs in eight German sectors; they report for instance strong variations in Kaitz indices ranging from 49 to 109 per cent.

While therefore somewhat desirable on theoretical grounds, taking all the diversity on board leads inevitably to heavy data requirements when it comes to empirical hypothesis testing: the finer the distinctions between national models, the more observations and inter-category variability are required in order to produce statistically sound results. Confronted with this trade-off, we decided to focus on CBC and the opposition between statutory and collectively bargained minima, a distinction that allows us to classify minimum wage systems with respect to the potential minimum wage bite (see Table 1). In particular, we hypothesize that different types of minimum wage systems are associated with varying degrees of minimum wage bite:

TABLE 1
Hypothesized Relationships Between Institutional Features and Their ‘Bite’

	<i>Low bargaining coverage</i>	<i>High bargaining coverage</i>
No statutory MW	<ul style="list-style-type: none"> • Low KI • No employment spike at MW • Many workers not covered by MW <p>Hypothesis: Weak bite Example: Cleaning sector in Germany</p>	<ul style="list-style-type: none"> • High KI • Possible employment spike at MW • Intermediate coverage of MW <p>Hypothesis: Intermediate bite Example: Manufacturing sector in Sweden</p>
Statutory MW	<ul style="list-style-type: none"> • Intermediate KI • Possible employment spike at MW • Intermediate coverage of MW <p>Hypothesis: Intermediate bite Example: Manufacturing sector in Bulgaria</p>	<ul style="list-style-type: none"> • High KI • Visible employment spike at MW • All workers are covered <p>Hypothesis: Strong bite Example: Construction sector in Belgium</p>

MW, minimum wage; KI, Kaitz index.

- Weak bite: a minimum wage system that has neither a statutory minimum wage nor sectoral/occupational agreements that cover most of the workforce is likely to be associated with relatively low minimum wages, no visible employment spike and a considerable proportion of jobs paid below prevailing minima.
- Intermediate bite: statutory minimum wages and sectoral agreements with high coverage are sometimes regarded as ‘functional equivalents’ (Schulten 2012): each of the two features alone is likely to ensure that a substantial share of workers is covered by prevailing minima. Empirical evidence for the equivalence of the two types of minimum wage system is, however, so far not available.
- Strong bite: a combination of a statutory wage floor and wide CBC is likely to be associated with relatively higher minima and fewer uncovered jobs.

In order to be able to compare the minimum wage bite associated with different types of minimum wage systems, the empirical analysis in this article is based on sectors taken from a representative sample of 17 European countries. The country sample has been selected in order to include sectors from (a) countries with and without NMWs; (b) different levels of CBC; (c) countries from different subregions (Northern, Southern, Continental, Central and Eastern European countries); and (d) both small and big countries. The complete sample includes sectors from Austria, Belgium, Bulgaria, Cyprus, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Poland, Portugal, Romania and the United Kingdom.

3. Data sources and descriptive statistics

Statutory and Collectively Bargained Minimum Rates

For all countries with statutory minimum wages except Cyprus, information on the level and evolution of wage floors has been collected from the March 2012 edition of the *WSI Mindestlohndatenbank*.³ The minimum rates have been collected and converted into euro amounts for all years with available micro data (see below). This step leads to 28 country-year observations from countries with statutory minimum wages at the national level.

In light of the institutional set-up of the seven countries in our sample that do not have an NMW (Austria, Belgium,⁴ Cyprus,⁵ Denmark, Finland, Germany and Italy), access to minimum wage data is considerably more problematic. Indeed, this information had to be collected manually from sectoral-level collective bargaining agreements. More precisely, we extracted from each agreement the wage assigned to the lowest category in collectively negotiated pay scales. While this definition of a sectoral minimum wage is straightforward, it should be noted that the elaborate categorizations that are found in many collective agreements render the identification of a given sectoral minimum wage relatively complicated. Indeed, in most agreements,

different pay scales coexist: separate nomenclatures are often defined for blue- and white-collar workers; specific scales are included for apprentices or young workers who enter the labour market; and even where a unique pay scale exists it is often differentiated by variables such as occupational groups, work-post nomenclatures and seniority levels. In order to come closest to the conception of sectoral minimum wages as ‘the pay rate defined for the lowest wage category’, our database contains information on the pay rate of the lowest of any category that figures in all the pay scales in a collective agreement, with the exception of pay scales for apprentices and young workers. In practice, in the vast majority of agreements, this boils down to the pay rate that applies to workers with no seniority and who are classified in low-status occupations at the bottom of organizational hierarchies (*manœuvre ordinaire*, *Hilfsarbeiter* and so on).

It should be noted that the number of collective agreements signed in most countries is substantial: in Germany alone, there are around 64,300 valid agreements, although most of them are signed at the company and not at the sectoral level. We, therefore, decided to collect minimum rates from a representative sample of collective agreements in each country and to use them to compute average minima at the one-digit level of the Statistical Classification of Economic Activities in the European Community (NACE). We notably extracted minimum rates from around 325 collective agreements from Austria (referring to wages in 2009), 150 from Belgium (wages in 2007), 105 from Denmark (wages in 2007, 2008 and 2009), 210 from Finland (wages in 2007, 2008 and 2009), 80 from Germany (wages in 2007) and 240 from Italy (wages in 2007, 2008 and 2009). In order to ensure the representativity of the sectoral-level minima in the final dataset, the calculation of average minimum rates at the one-digit level of the NACE takes into account the relative employment shares of more than 1,100 sampled sectors. This procedure produced 169 sector-year observations from countries without statutory minima. A detailed description of the collection of sectoral minima and the weighting of the sampled bargained agreements is available online (Appendix S1). The sectoral data on CBC and minimum wages can be downloaded from the authors’ website (the URL is omitted to ensure double-blind review).

The absolute levels of average minimum wages in each country are summarized in Table 2. We observe a wide span ranging from less than 2 euros per hour in the six Central and Eastern European countries in our sample to minima that are more than five times higher in Denmark and Italy. Table 2 also shows the average Kaitz index in each country over the period 2007–2009. The average levels of Kaitz indices are closer to each other than the absolute minima: the majority of national Kaitz indices lie between 45 and 55 per cent. We also observe that the Central and Eastern countries have the lowest minimum wages in both absolute and relative levels (Kaitz indices often below 50 per cent), but the regional differentiation is less clear than for the absolute levels given that Poland and Hungary have somewhat higher levels, whereas Portugal displays a value below 50 per cent. All observations from countries without statutory minimum wages lie above 50 per cent,

TABLE 2
Descriptive Statistics of Main Variables at the Country Level (2007–2009)

Observations per year	SILC waves used in empirical analysis	National statutory minimum wage	Collective bargaining coverage	Average minimum wage	Average Katz index	Share of workers earning less than 75% of the minimum wage	Share of women	Blue collar (ISCO 11–34)	White collar (ISCO 41–52)	Managers (ISCO 61–93)	ISCED levels	ISCED levels	ISCED levels
5,409	2010	No	0.76	7.67	0.59	0.06	0.47	0.35	0.33	0.32	0.15	0.65	0.19
5,438	2008	Yes	0.64	9.32	0.63	0.06	0.44	0.40	0.31	0.30	0.21	0.37	0.42
5,399	2008–2010	Yes	0.33	0.63	0.42	0.01	0.50	0.35	0.28	0.37	0.14	0.55	0.31
3,429	2008–2009	No	0.23	4.65	0.52	0.05	0.23	0.41	0.28	0.31	0.17	0.40	0.43
10,744	2008	No	0.56	7.61	0.60	0.12	0.48	0.47	0.27	0.26	0.10	0.54	0.36
4,373	2008–2010	No	0.52	14.21	0.65	0.08	0.47	0.43	0.24	0.33	0.22	0.46	0.32
5,453	2008–2010	Yes	0.10	1.61	0.43	0.01	0.56	0.49	0.20	0.31	0.09	0.50	0.41
9,399	2008–2010	No	0.79	8.92	0.59	0.03	0.51	0.45	0.26	0.29	0.13	0.47	0.41
9,863	2009–2010	Yes	0.48	8.63	0.71	0.08	0.47	0.43	0.25	0.32	0.20	0.44	0.36
7,690	2008–2010	Yes	0.26	1.52	0.54	0.02	0.49	0.37	0.26	0.37	0.13	0.61	0.27
3,681	2008–2009	Yes	0.34	8.48	0.54	0.04	0.44	0.40	0.31	0.29	0.24	0.37	0.39
13,450	2008–2010	No	0.82	10.50	0.90	0.19	0.45	0.35	0.29	0.36	0.34	0.48	0.17
5,644	2008–2010	Yes	0.30	1.30	0.41	0.03	0.55	0.45	0.22	0.33	0.12	0.55	0.34
10,730	2008–2010	Yes	0.23	1.66	0.53	0.04	0.52	0.41	0.24	0.34	0.07	0.62	0.31
4,216	2008–2010	Yes	0.78	2.57	0.48	0.02	0.49	0.27	0.30	0.43	0.59	0.22	0.19
5,269	2008–2009	Yes	0.14	0.75	0.45	0.01	0.46	0.38	0.26	0.36	0.11	0.63	0.25
6,866	2008–2010	Yes	0.28	6.90	0.57	0.03	0.46	0.41	0.31	0.28	0.13	0.53	0.35
8,052	—	No	0.78	9.54	0.65	0.13	0.48	0.39	0.27	0.34	0.22	0.48	0.30
Countries without a national minimum wage	—	Yes	0.47	3.39	0.50	0.06	0.49	0.34	0.26	0.40	0.20	0.52	0.29
Countries with national minimum wage	—	—	0.56	5.21	0.55	0.08	0.48	0.35	0.26	0.38	0.20	0.51	0.29
Total	—	—	0.56	5.21	0.55	0.08	0.48	0.35	0.26	0.38	0.20	0.51	0.29

Sources: EU-SILC waves 2008–2010, ECS, WSI Mindestlohn datenbank and authors' calculations. ISCED, International Standard Classification of Education; ISCO, International Standard Classification of Occupations; SILC, Statistics on Income and Living Conditions.

including an extremely high value for Italy. In fact, the high Kaitz indices for Italy indicate that sectoral minima appear to lie relatively close to the corresponding median wages.

Collective Bargaining Coverage

Since our dataset includes information on minimum wages at the sectoral level, it was also necessary to collect data on CBC at the same level. While data on country-level coverage is widely available (see Robustness Tests section), we had to compute comparative sectoral CBC from survey data. For this purpose, we used the 2009 wave of the European Company Survey, a large-scale organizational survey carried out by the European Foundation for the Improvement of Living and Working Conditions (Eurofound) every five years. The survey contains on average 905 company-level observations from 30 countries. In order to estimate sectoral CBC in the 17 countries in our sample, we used the information on (a) the proportion of employees within companies covered by collective bargaining; (b) whether collective bargaining refers to the company, sectoral or national level; and (c) whether employers are able to pay salaries below the levels fixed by collective bargaining agreements. We then used this information to calculate averages at the one-digit NACE level of the proportion of employees who are covered by sectoral or national bargaining agreements.

The national averages of this variable are listed in Table 2. The CBC is 31 percentage points higher in countries in which minimum wages are determined through collective bargaining at the sector level, probably reflecting the co-evolution of the two features (cf. Grimshaw 2013). But even if coverage and statutory floors may be historically related, over short time periods they can arguably be treated as being independent since it is costly and politically difficult to switch from one system to another (witness the slow progress towards implementation in the German debate on the introduction of a national minimum wage since the mid-2000s). This short-run exogeneity is relevant for this study because the regressions presented in Section 4 include both the coverage rate and the existence of a national minimum rate as explanatory variables. Since our sample includes three years (2007–2009), the potential long-run interdependence between coverage rates and statutory minima is less of a concern in our case.

Earnings and Individual Characteristics

The representative micro-level data we used stem from the harmonized survey of European Statistics on Income and Living Conditions (SILC). For the 17 countries in our sample, we used the available waves collected in 2008, 2009 and 2010 containing information on income variables for the years 2007–2009. The EU-SILC data contain labour market information for a range of European countries and are designed as a household-level survey allowing one to calculate inequality and poverty indicators, in particular the

so-called Laeken indicators, such as the poverty rate, in-work poverty or the Gini index (see Atkinson *et al.* 2002). The EU-SILC data contain detailed information on job characteristics such as earnings, employment type and employer characteristics. On average, the micro-level information in our sample is based on 6,792 individual observations per country and year (for the number of observations per country, see Table 2).

The income variable used in the regression analysis is gross hourly wages. The latter have been calculated at the individual level by dividing gross monthly income — that is, monthly income before the deduction of taxes and including social contributions paid by the employee — by the working hours the individual declared for the corresponding income period. We calculated this variable for all workers in the SILC except for individuals who declared themselves self-employed; our analysis, therefore, includes individuals working part-time and all salaried employment. This is slightly different from other studies on minimum wages, which look only at full-time workers or focus exclusively on individuals paid hourly wages as opposed to monthly salaries (Bureau of Labor Statistics 2012; Schulten *et al.* 2006; Vaughan-Whitehead 2010).

The precision of our earnings measure, therefore, depends on the quality of both the income and the hours measures. In the context of minimum wage research, especially the imperfect measurement of working hours has received particular attention (Hermann 2006). In the SILC, both numerator and denominator of the wage variable are self-reported survey data and therefore subject to the usual disclaimers. While sometimes criticized as being less precise than administrative data collected from company records or fiscal authorities, our earnings measure taps into the information of the individuals actually working on the job and who therefore have knowledge on unrecorded working hours that by definition is not available in administrative records. In the context of research on minimum wages, an important advantage of survey data is that employers may have incentives not to disclose if they pay wages that are below prevailing minimum rates. For instance, the case studies in Grimshaw (2013) suggest that employers in the security sector circumvent minimum wage legislation by declaring artificially low working hours so that monthly full-time wages appear to be compliant with existing minima. This means that non-compliance is arguably much more difficult to measure with company records or payroll figures communicated to tax authorities than with survey data. Table 2 shows the national averages for the share of workers below minimum wages defined as individuals earning less than 75 per cent of the prevailing wage floor (the impact of alternative thresholds is discussed in the Robustness Tests section). There is no clear regional stratification with respect to this variable.

4. Regression analysis

We now turn to the description of our baseline regression models. The dependent variable in our first model is $KI_{i,j,t}$, the Kaitz index in sector i of

country j in year t , equation (1); the second model explains the employment spike around the minimum wage in sector i of country j in year t , equation (2); and the dependent variable in the third model is the share of workers earning less than 75 per cent of the prevailing wage floor in sector i of country j in year t , equation (3):

$$KI_{i,j,t} = \beta_1 NMW_{i,j,t} + \beta_2 CBC_{i,j,t} + \beta_3 [NMW_{i,j,t} * CBC_{i,j,t}] + \beta_4 NACE_{i,j,t} + \beta_5 YEAR_t + X_{i,j,t} \delta + \varepsilon_{i,j,t} \quad (1)$$

$$Spike\ around\ MW_{i,j,t} = \beta_1^{\circ} NMW_{i,j,t} + \beta_2^{\circ} CBC_{i,j,t} + \beta_3^{\circ} [NMW_{i,j,t} * CBC_{i,j,t}] + \beta_4^{\circ} NACE_{i,j,t} + \beta_5^{\circ} YEAR_t + X_{i,j,t} \delta^{\circ} + \varepsilon_{i,j,t}^{\circ} \quad (2)$$

$$Below\ MW_{i,j,t} = \beta_1^* NMW_{i,j,t} + \beta_2^* CBC_{i,j,t} + \beta_3^* [NMW_{i,j,t} * CBC_{i,j,t}] + \beta_4^* NACE_{i,j,t} + \beta_5^* YEAR_t + X_{i,j,t} \delta^* + \varepsilon_{i,j,t}^* \quad (3)$$

The main explanatory variables on which we will focus in the discussion are the two key features of minimum wage systems, namely the existence of a national statutory minimum wage ($NMW_{i,j,t}$) and the degree of collective bargaining coverage at the sectoral level ($CBC_{i,j,t}$).

All three indicators of the minimum wage bite are defined as proportions: the Kaitz index is defined as a percentage of the median wage, and the employment spike at and the share of employment below the prevailing minimum wage are defined as shares of the total employment in the sector. Proportions are bounded between 0 and 1 and give rise to specific measurement problems. In this article, we use the method proposed by Papke and Wooldridge (1996), and implement a maximum likelihood estimator with logit link function and a Bernoulli distribution that takes the nature of fractional response variables into account. It should be noted, however, that the Kaitz index is not necessarily bounded below 1 because the minimum wage can exceed the median wage. This is, for instance, the case in several sectors in Italy in which CBC is extremely low and trade unionists are able to negotiate wage floors for unionized workers who are actually above the median wage. As a consequence, we have dropped all values above 1 so that the sample is reduced from 533 to 520 observations when using the Kaitz index as dependent variable. Results from ordinary least squares (OLS) regressions, not reported here due to space constraints, underline the robustness of the signs, sizes and significance of the Papke–Wooldridge marginal effects, and suggest that the small reduction of the sample used for the estimation of equation (1) does not bias our results.

We are able to control for some of the cross-country differences that are not captured by the distinction between minimum wage systems and the variables $NMW_{i,j,t}$ and $CBC_{i,j,t}$ by including the vector $X_{i,j,t}$. It contains the composition of the labour force in terms of occupational composition and educational attainment, which is likely to be related to the dependent variables in equations

(1–3) and not controlled for in some recent empirical studies due to lack of data (e.g. in the cross-country analysis conducted by Boeri 2012). More precisely, our regressions control for variations in the respective shares of blue-collar workers, white-collar workers and managers based on International Standard Classification of Occupations (ISCO) categories, and three levels of educational attainment based on International Standard Classification of Education (ISCED) categories (for the definitions, see Table 2). In light of the fact that many minimum wage-earners are women (see Rycx and Kampelmann 2012), it is also important to account for intra-European variations in the share of women within the labour force, a measure that ranges in our sample from 44 per cent in Ireland to 56 per cent in Estonia (see Table 2). Other compositional factors that vary across countries and for which we control in the regression analysis in the next section are the share of the public-sector employment in the country, the share of fixed-term contracts, the age composition (we distinguish between six age groups: 15–24 years, 25–29, 30–34, 35–44, 45–59 and above 60 years) and variations in the national share of jobs with less than 35 working hours per week. The models including control variables also contain sector dummies ($NACE_{i,t}$) and year dummies ($YEAR_t$) in order to capture structural and business cycle effects.

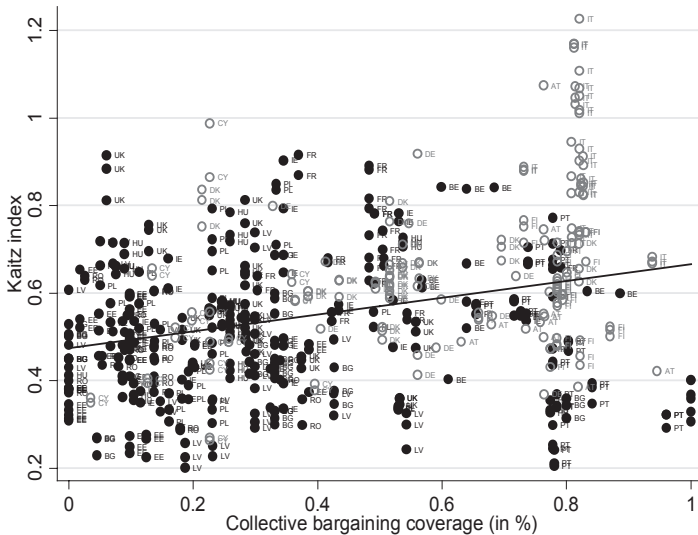
The Minimum Wage Bite I: Kaitz Index

Many practitioners would argue that the Kaitz index is likely to be positively correlated with the extent of CBC (see Table 2). It should be noted, however, that it is unclear whether CBC affects the numerator or the denominator of the index: on the one hand, higher coverage is likely to be associated with higher bargaining power and more favourable terms in collective agreements defining sectoral bargaining; in some countries with statutory minima wider bargaining, coverage might also improve trade union power in the process of setting the national minimum wage. But higher coverage also increases the share of workers falling under collective agreements and therefore leads to a more compressed wage distribution in general.

Another common hypothesis among many trade unionists and scholars is that the Kaitz index tends to be lower in systems with an NMW. The underlying reasoning is that the wage structure in these systems tends to be less compressed compared with systems in which minima are defined in collective bargaining, an argument that is backed up by the empirical literature (Autor *et al.* 2010; Brown 1999), but also that the setting of a higher minimum wage itself can contribute to a more compressed wage structure in systems with collective bargaining. In this section, we provide empirical evidence that allows for testing the relationships between the Kaitz index on the one hand, and institutional features (existence of statutory minimum wage and CBC) on the other.

Figure 1 suggests a positive relationship between CBC and the sectoral Kaitz index. But the figure also reminds us that the countries without statutory minimum wages (hollow dots on Figure 1) have generally higher level of

FIGURE 1
Collective Bargaining Coverage and Average Kaitz Indices by Industry Across Countries and Years.



Note: Full circles represent sectors in countries with a statutory minimum wage, and open circles represent sectors in countries without a statutory minimum wage.

Sources: SILC waves 2008–2010, ECS, WSI Mindestlohn datenbank, authors' calculations.

CBC. We used a simple regression framework to isolate the two effects; the dependent variable in this model is the Kaitz index at the sectoral level, and the main independent variables are the existence of an NMW and CBC (see Table 3). Regression results indicate that sectoral Kaitz indices are negatively related to the existence of an NMW: statistically significant marginal effects are equal to -0.11 in models 1 and 2. Higher CBC is associated with higher Kaitz indices in model 1 excluding the set of control variables. Model 2, however, includes all control variables, and the corresponding marginal effect is positive but not statistically significant.

Models 1 and 2 do not account for the potential interaction between an NMW and CBC. Models 3 and 4 address this issue by including a corresponding interaction variable (the chi-squared statistic (Wald test) suggests that model 4 improves the estimation of model 3; a formal test comparing the coefficients of determination of the corresponding OLS estimates suggests that this improvement is statistically significant).

Changes in marginal effects, when moving from models 1–2 to models 3–4, are quite intuitive: first, the dummy variable for the NMW becomes insignificant, and the negative effect of the national minimum wage is captured by a large and significantly negative marginal effect associated with the interaction variable; second, the marginal effect measuring the impact of CBC is now significant and much higher than in models 3 and 4 (a formal test rejects

TABLE 3
Sector-Level Regressions With Kaitz Index as Dependent Variable, Fractional Logit Results
(Marginal Effects)

	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>
National minimum wage (NMW)	-0.11*** (0.02)	-0.11*** (0.01)	-0.01 (0.04)	0.01 (0.03)
Collective bargaining coverage (CBC)	0.06* (0.03)	0.03 (0.03)	0.20*** (0.06)	0.18*** (0.04)
Interaction NMW × CBC			-0.19*** (0.07)	-0.23*** (0.05)
<i>Control variables:</i>				
Sex ratio	No	Yes	No	Yes
Part-time ratio	No	Yes	No	Yes
Share of public employment	No	Yes	No	Yes
Age composition	No	Yes	No	Yes
Educational composition	No	Yes	No	Yes
Occupational composition	No	Yes	No	Yes
Sector dummies	No	Yes	No	Yes
Year dummies	No	Yes	No	Yes
Observations	520	520	520	520
Log pseudo-likelihood	-243.1	-228.7	-242.7	-228.3
Chi-squared statistic (joint significance)	84.2	937.1	90.3	1,013.7
<i>p</i> -value (associated with chi-squared statistic)	0.00	0.00	0.00	0.00

Sources: SILC waves 2008–2010, European Company Survey 2009 for collective bargaining coverage at the sector level, WSI Mindestlohn datenbank for statutory minimum wages and authors' calculations. All regressions include NACE 1-digit sectors from 17 European countries. Heteroskedasticity and autocorrelation consistent standard errors are reported in parentheses.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

the equality of the collective bargaining coefficient and its interaction term at the 1 per cent significance level). We interpret these results as indicators for (a) a much stronger link between CBC and the sectoral Kaitz index in systems without an NMW, and (b) the claim that at equal levels of CBC, systems with national statutory minima are associated with lower Kaitz indices (e.g. in the case of a coverage rate of 50 per cent, model 3 suggests that the difference is equal to $-0.105 = -0.01 - 0.19 \times 0.5$).

The negative relationship between higher levels of CBC and sectoral Kaitz indices in systems with statutory minima, suggested by model 4, can be interpreted in terms of union behaviour: once a statutory wage floor is established, unions appear to bargain for wages above the minimum. If successful, this strategy could create a kind of 'ripple effect' in which statutory floors are related to higher wages in the upper parts of the wage structure, leading in turn to a relative decrease of the minimum wage with respect to the median wage (i.e. a reduction of the Kaitz index).⁶

The Minimum Wage Bite II: Employment Spike

A higher Kaitz index is often interpreted as indicating that the underlying minimum wage has a higher bite. The information on the relative size of the

minimum wage should, however, be compared with information on the employment spike at the minimum wage. The higher this share, the deeper the minimum wage bites into the wage distribution.

We define the employment spike as the proportion of employment clustered within an interval of ± 5 per cent around the minimum wage. In our sample, average sectoral spikes lie between 4.2 and 4.5 per cent in systems without statutory minima, and between 3.0 and 4.1 per cent in systems with statutory wage floors.

The regression results are presented in Table 4. The relationship between the CBC and the employment spike seems to be very small, if existent at all. The marginal effect for CBC is not significant in any of the models; only the interaction effect between the presence of a statutory wage floor and CBC is negative and statistically significant.

A stronger and consistently significant effect appears to be related to the sector-level Kaitz index. In model 7 without interaction effects, a 10

TABLE 4
Sector-Level Regressions With the Employment Spike (i.e. The Share of Workers Receiving Wages in the Interval of ± 5 Per Cent Around the Minimum Wage) as Dependent Variable, Fractional Logit Results (Marginal Effects)

	<i>Model 5</i>	<i>Model 6</i>	<i>Model 7</i>	<i>Model 8</i>	<i>Model 9</i>
National minimum wage (NMW)	-0.01*	-0.00	0.01***	-0.02***	-0.02
	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
Collective bargaining coverage (CBC)	0.01	0.00	-0.00	-0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Interaction NMW \times CBC					-0.03***
					(0.01)
Kaitz index (KI)			0.11***	0.09***	0.08***
			(0.01)	(0.01)	(0.01)
Interaction NMW \times KI				0.05***	0.06***
				(0.01)	(0.01)
<i>Control variables:</i>					
Sex ratio	No	Yes	Yes	Yes	Yes
Part-time ratio	No	Yes	Yes	Yes	Yes
Share of public employment	No	Yes	Yes	Yes	Yes
Age composition	No	Yes	Yes	Yes	Yes
Educational composition	No	Yes	Yes	Yes	Yes
Occupational composition	No	Yes	Yes	Yes	Yes
Sector dummies	No	Yes	Yes	Yes	Yes
Year dummies	No	Yes	Yes	Yes	Yes
Observations	533	533	533	533	533
Log pseudo-likelihood	-69.0	-65.9	-64.3	-64.2	-64.1
Chi-squared statistic (joint significance)	5.76	406.8	964.8	1,189.2	1,263.8
<i>p</i> -value (associated to chi-squared statistic)	0.06	0.00	0.00	0.00	0.00

Sources: SILC waves 2008–2010, European Company Survey 2009 for collective bargaining coverage at the sector level, WSI Mindestlohn datenbank for statutory minimum wages and authors' calculations. All regressions include NACE 1-digit sectors from 17 European countries. Heteroskedasticity and autocorrelation consistent standard errors are reported in parentheses.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

percentage points increase in the Kaitz index is associated with an increase of 1.1 percentage points (i.e. $0.11 \times 0.10 = 0.011 = 1.1$ percentage points) in the employment spike in the vicinity of the minimum wage (fourth column in Table 4). Adding the interaction term to the model shows that the relationship between the Kaitz index and the employment spike is significantly stronger in systems with statutory minima.

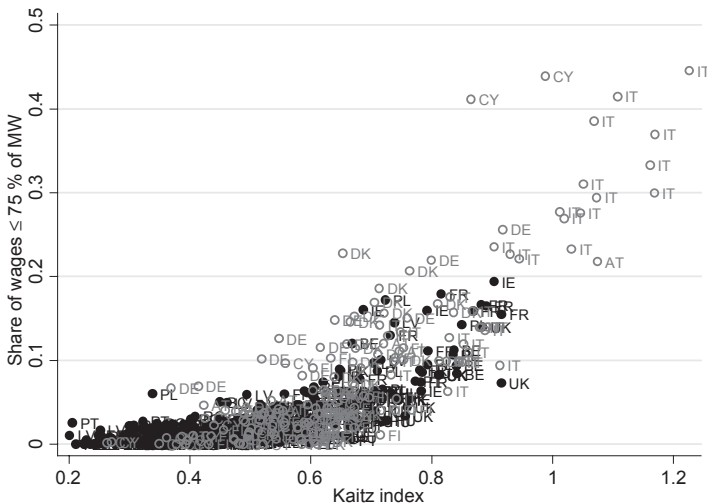
The employment spike appears to be higher in systems with statutory minima. The marginal effect of the NMW is not consistently positive in all models so that the relationship is mainly captured through the positive interaction term between the statutory minimum wage and the Kaitz index. However, the latter effect could be offset in some sectors given that the interaction effect between NMW and the CBC points in the opposite direction (model 9 in Table 4).

The Minimum Wage Bite III: Share of Subminimum Workers

Even if many workers are clustered around the minimum wage, the bite of the latter would have to be relativized if a substantial number of employees actually earn wages below prevailing wage floors. Indeed, the higher this share, the lower is the effective bite of the minimum wage.

How is this third indicator of the minimum wage bite related to the Kaitz index? Figure 2 plots the shares of employees with wages below 75 per cent of

FIGURE 2
Sector-Level Shares of Workers Earning Less Than 75 Per Cent of Prevailing Minimum Wages and Sector-Level Kaitz Indices.



Note: Full circles represent sectors in countries with a statutory minimum wage, and open circles represent sectors in countries without a statutory minimum wage.

Sources: SILC waves 2008–2010, WSI Mindestlohndatenbank, authors' calculations.

the corresponding minimum wage against the Kaitz index in each sector. We observe a positive relationship between the two variables. This suggests that a higher relative level of the minimum — an outcome typically favoured by trade unions — might have a downside if it is systematically associated with a higher share of individuals who are paid below the minimum wage. Moreover, Figure 2 indicates that the incidence of below-minimum wages is higher in countries without national minima (hollow dots on Figure 2) — again an expected result. Surprisingly, the trade-off between a higher relative minimum wage and higher *effective* coverage is hardly ever discussed by either practitioners or scholars, arguably because data on this phenomenon were so far not available. We believe that this is a serious shortcoming and could lead to flawed policies: indeed, the graphical relationship in Figure 2 suggests a substantial trade-off.

Turning to our regression results, Table 5 shows estimations for models with the share of individuals earning less than 75 per cent of prevailing minima

TABLE 5
Sector-Level Regressions With the Share of Workers Earning Less Than 75 Per Cent of
Prevailing Minimum Wages as Dependent Variable, Fractional Logit Results
(Marginal Effects)

	<i>Model 10</i>	<i>Model 11</i>	<i>Model 12</i>	<i>Model 13</i>	<i>Model 14</i>
National minimum wage (NMW)	-0.05*** (0.01)	-0.04*** (0.01)	-0.01*** (0.00)	-0.03*** (0.01)	-0.03*** (0.01)
Collective bargaining coverage (CBC)	0.03*** (0.01)	0.00 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.02** (0.01)
Interaction NMW × CBC					0.03*** (0.01)
Kaitz index (KI)			0.12*** (0.01)	0.12*** (0.01)	0.13*** (0.01)
Interaction NMW × KI				0.01 (0.01)	0.00 (0.01)
<i>Control variables:</i>					
Sex ratio	No	Yes	Yes	Yes	Yes
Part-time ratio	No	Yes	Yes	Yes	Yes
Share of public employment	No	Yes	Yes	Yes	Yes
Age composition	No	Yes	Yes	Yes	Yes
Educational composition	No	Yes	Yes	Yes	Yes
Occupational composition	No	Yes	Yes	Yes	Yes
Sector dummies	No	Yes	Yes	Yes	Yes
Year dummies	No	Yes	Yes	Yes	Yes
Observations	533	533	533	533	533
Log pseudo-likelihood	-76.7	-68.8	-66.0	-65.9	-65.9
Chi-squared statistic (joint significance)	122.2	1,018.9	2,435.6	2,442.3	2,552.4
<i>p</i> -value (associated to chi-squared statistic)	0.00	0.00	0.00	0.00	0.00

Sources: SILC waves 2008–2010, European Company Survey 2009 for collective bargaining coverage at the sector level, WSI Mindestlohn datenbank for statutory minimum wages and authors' calculations. All regressions include NACE 1-digit sectors from 17 European countries. Heteroskedasticity and autocorrelation consistent standard errors are reported in parentheses.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

as dependent variable. In light of the apparent link between the Kaitz index and non-coverage/non-compliance suggested by Figure 2, models 10 and 11 might suffer from an omitted variable bias. Indeed, adjusted R-squares in OLS specifications including the Kaitz index among the explanatory variables (i.e. OLS versions of the Papke–Wooldridge estimates of models 12 through 14 in Table 5) are at least 20 percentage points higher than in the models excluding the Kaitz index as explanatory variable. Models 13 and 14 also allow for the effect of the Kaitz index to differ among countries with and without a national minimum wage. The inclusion of the Kaitz index raises of course the concern that the results suffer from multicollinearity given that we have shown in the previous section that the Kaitz index is correlated with the other explanatory variables. This issue does not appear to be problematic in model 14 because the potentially collinear explanatory variables are all statistically significant. This suggests that the respective effects of the national minimum wage, CBC, the Kaitz index and the interaction variables are to some extent correlated but nevertheless correspond to distinct and identifiable relationships with the dependent variable.

Another estimation issue relates to the potential endogeneity of the CBC. For example, the high proportion of uncovered workers in certain German sectors motivated the German Ministry of Employment to install mandatory extensions of collective bargaining agreements, which would therefore increase the CBC variable. However, while such endogeneity cannot be excluded over long periods of time, circumstantial evidence suggests that the CBC can be treated as exogenous in our sample covering a shorter interval of only three years. In the German case, the occurrence of subminimum employment in several sectors has triggered years of policy discussions and has so far only led to extension policies in a small number of sectors via the *Arbeitnehmer-Entsendegesetz*.

Overall, our preferred specification is model 14, which also accounts for the potential interaction effect between the presence of an NMW and the degree of CBC at the sectoral level. Due to the presence of interaction variables, the interpretation of the explanatory variables is not straightforward; in order to clarify our results, we will discuss each of the main variables in turn.

As for the existence of an NMW, the net effect on the share of below-minima earners is negative in all models. Models 10 and 11 suggest that this share is around 4–5 percentage points lower in countries with statutory minimum wages; in model 12, this effect drops to 1 percentage point. In models 13 and 14, the marginal effect of NMW is statistically significant and equal to -0.03 . In model 14, the marginal effect for the interaction between NMW and the CBC equals 0.03 . Given that the marginal effect of CBC is -0.02 , this means that the level of CBC has only a small influence on the proportion of below-minimum earners in systems with statutory national minimum (the null hypothesis that the sum of the regression coefficients associated to CBC and the interaction between CBC and NMW is equal to zero can actually not be rejected at the 10 per cent significance level). The

interaction between NMW and the Kaitz index is not statistically significant in models 13 and 14.

Looking at the net effect of all three variables containing the NMW dummy, our preferred specification confirms that the share of individuals earning wages below prevailing minima tends to be lower in countries with statutory minima. If we suppose, for example, CBC of 70 per cent and a Kaitz index of 50 per cent, the marginal effect on the proportion of subminimum workers would be $-0.03 + (-0.02 + 0.03) \times 0.7 + (0.13 + 0.00) \times 0.5 = 0.042$; the corresponding proportion in a system without national wage floor would be $-0.02 \times 0.7 + 0.13 \times 0.5 = 0.051$. We, therefore, estimate that in this case subminimum employment is around 0.9 percentage points higher in systems without a national minimum wage (one could repeat this numerical example with other sensible rates of CBC and the Kaitz index and reach the same conclusion).

A corollary conclusion that can be drawn from Table 5 is that CBC is a functional equivalent to NMW in that it decreases the proportion of individuals below prevailing minima (the significant marginal effect equals -0.02 in model 14). As mentioned above, this effect of CBC is only observed in systems without an NMW, which is quite intuitive.

Finally, a higher Kaitz index is positively related to non-coverage/non-compliance in both types of systems: in model 14, a 10 percentage point increase in the Kaitz index is associated with a 1.3 percentage points increase in the share of below-minimum earners.

Robustness Tests

We have run a large number of robustness tests and alternative specifications that cannot be all reported here; especially the number of plausible combinations of control and interaction variables is quite large. None of these tests modifies substantially the estimation results presented above. In this section, we focus on what are arguably the most relevant robustness tests and examine whether our conclusions are modified: if regressions are estimated without countries with outlying values or systems; if we use alternative thresholds to measure the employment spike and subminimum employment; once apprentices and very young workers are excluded from the sample (Section 1 in online Appendix S2); and, finally, if we use alternative data on CBC (Section 2 in online Appendix S2). The estimation results presented in the preceding section are fairly insensitive to all four tests.

(a) Exclusion of outlying observations

Some of the sectors in our sample display levels of the Kaitz index that exceed 90 per cent. This is notably the case of single sectors in Austria, Cyprus, France, Germany and the United Kingdom, and for several Italian sectors. Given that the average Kaitz index in our sample is 55 per cent, we have tested whether our estimations are sensitive to the exclusion of these outliers

(models 2b and 4b in Table A1 and model 14b in Table A2 in online Appendix S2). The results of this test show that the estimated marginal effects are almost not altered if we eliminate Kaitz indices above 90 per cent from the sample.

A second set of outlying observations concerns the case of Belgium. The specificity of this country's minimum wage system is that it combines a national statutory minimum with high levels of CBC and binding wage floors defined in sectoral agreements. While the French system also combines a national minimum with sectoral bargaining, collective agreements in France often fail to increase the minima above the national level — indeed, many collective agreements include wage floors *below* the SMIC that are therefore not relevant minima (Gautié 2010). The interpretation of the Belgian figures on sectoral minima is therefore slightly different compared with other countries in our sample, a difference that makes it worthwhile to test whether our conclusions change if Belgium is dropped from the sample. The results of this test correspond to models 2c and 4c in Table A1 and model 14c in Table A2 in online Appendix S2. As can be seen, the estimated marginal effects are clearly not sensitive to the exclusion of Belgium as none of them deviates substantially from the values in the baseline model.

(b) Alternative thresholds for employment spike and proportion of subminimum workers

The second robustness test reported here is concerned with the validity of our additional indicators for the minimum wage bite, namely the employment spike and the share of subminimum workers. To the extent that both income variables and the hours measure are prone to measurement errors, it might be worthwhile to assess whether our results are sensitive to alternative definitions of these indicators.

To address this issue, we have experimented with alternative thresholds for both indicators. For the case of the proportion of subminimum workers, our baseline threshold of 75 per cent allows for an error margin of 25 per cent before workers are falsely counted as being not covered and/or not compliant with existing minima. An alternative threshold of 85 per cent below the prevailing sectoral minima allows for a smaller error margin of only 15 per cent (model 14e in Table A2 in online Appendix S2). The estimated marginal effects of this robustness test do not differ much from our baseline model. To assess the robustness of our definition of the employment spike, we have re-estimated our baseline regressions (using an interval of ± 5 per cent around the minimum wage) with a smaller interval of ± 1 per cent around the minimum wage (models 7b and 9b in Table A3 in online Appendix S2). Model 7b confirms the small positive marginal effect of NMW on the employment spike. The positive effect of the Kaitz index is also shown by model 7b, even if the magnitude of the latter is reduced with the narrower definition of the interval around the minimum wage. Like in the baseline model 9, model 9b including interaction effects suggests that the positive

effect of higher Kaitz indices on the employment spike is relatively higher in systems with NMWs (but again at a smaller magnitude using the narrower definition).

5. Conclusion

This article is an empirical and theoretical contribution to relatively recent debates on minimum wage policy in Europe (Grimshaw *et al.* 2013). We add to the theoretical literature in this field by proposing a straightforward typology that distinguishes European minimum wage systems with respect to two key institutional features, namely (i) the existence of an NMW and (ii) the degree of CBC at the sector level. This typology is a useful tool to generate hypotheses about the relationships between different institutional configurations and the ‘minimum wage bite’. While commonly associated with the size of the minimum wage relative to the median wage, we argue that cross-country analysis of minimum wage institutions requires that the Kaitz index has to be complemented with two additional heuristics in order to obtain a nuanced picture of the ‘bite’. We advocate using the employment spike at the minimum wage and the proportion of workers earning wages below the prevailing minima as complementary indicators: having sharp teeth (i.e. a high Kaitz index) is clearly not enough to have a strong ‘bite’ in empty-mouthed system (i.e. few workers actually earn minimum wages and/or many are even paid below).

The empirical contribution of the article addresses the almost complete absence of comparative data on sector-level minima. This absence renders the policy discussion in Europe prone to flawed assumptions about the performance of different minimum wage systems. We have overcome this gap through extensive data collection combining micro data from household and company surveys with institutional information, and created a unique database with minimum wages collected from more than 1,100 collective bargaining agreements. By analysing the outcome of key labour market institutions across Europe, the article therefore adds to the institutional literature by not only arguing that ‘institutions matter’: we use comparative sector-level data from a wide range of European countries to show how and which institutions matter.

Several important conclusions emerge from our analysis. First, our regression results provide empirical backing for the standard narrative put forward by trade union representatives, according to which (i) relatively higher levels of minimum wages can be obtained by boosting the coverage of collective bargaining and (ii) national statutory minima are associated with relatively lower minimum wages. Second, our results suggest a policy trade-off that has so far been almost completely neglected: in our data, higher Kaitz indices are significantly associated with a higher proportion of individuals who actually earn wages below the prevailing minimum — an observation that we attribute to non-compliance in systems with statutory floors and non-compliance

and/or non-coverage in systems with sectoral collective bargaining. The upshot is that the negative side effect of higher Kaitz indices can be attenuated either by installing an NMW or higher levels of collective bargaining, a finding that confirms the 'functional equivalence' of these institutions (Schulten 2012). Third, pulling the evidence for all three indicators of the minimum wage bite together, our analysis can be used to render European policy discussions more intelligible. For instance, most sectors in Scandinavian countries (but also a few highly unionized sectors in Germany) are situated in the upper right corner in Table 1, in which the absence of statutory minima is combined with high CBC. Introducing a statutory wage floor in these sectors would probably not improve the minimum wage bite and could even lead to a decrease in the Kaitz index. Unsurprisingly, the Scandinavian trade unions are extremely critical regarding the prospect of a European statutory minimum wage. By contrast, an increasing number of sectors in Germany, but also in Italy and Austria, have lost CBC and moved from the upper right to the upper left corner of Table 1. Our evidence suggests that a statutory minimum wage is likely to improve the minimum wage bite in these sectors.

The data, therefore, show that the new minimum wage debate reflects to a large extent institutional diversity, both between and within European countries: depending on the health of collective bargaining, a statutory minimum wage is likely to strengthen the bite in some sectors at the risk of weakening it in others. As is often the case, the policy challenge is to find a compromise between these conflicting interests.

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Notes

1. Brussels to push for EU-wide minimum wage policy, 17 April 2012, <http://www.euractiv.com/social/europe/brussels-push-eu-wide-minimum-wa-news-512189>

2. Notably the German Socio-Democratic Party (SPD) recently issued statements in favour of introducing a statutory minimum wage of 8.50 euros. Mindestlohn, 27 March 2013, <http://www.spdfraktion.de/themen/mindestlohn>
3. See http://www.boeckler.de/wsi-tarifarchiv_7052.htm
4. Belgium actually has a national minimum wage, but in addition to this statutory floor the collectively bargained minimum wages constitute the relevant minimum for most workers. We have thus collected information on both the interprofessional and the sectoral-level minima and matched each individual to the minimum rate that corresponds to his or her profile. The inclusion of this special case in our sample has no consequences for the conclusions drawn from our empirical analysis (see robustness test in the Exclusion of Outlying Observations section).
5. Cyprus is a special case in that the minimum wage is not defined at the sectoral, but at the occupational level. For the period under analysis, a single rate applied to around 10 occupational groups in Cyprus. We used data on these rates for 2007 and 2008 from EIRO country reports.
6. We are grateful to an anonymous referee for suggesting this interpretation.

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Appendix S1

Collection of Minimum Rates from Sectoral Bargaining Agreements.

Appendix S2

Additional Robustness Checks.