The Impact of the National Minimum Wage on Industry-Level Wage Bargaining in France*

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Abstract:

This paper examines empirically how industry-level wage floors are set in French industry-level wage agreements and how the national minimum wage (NMW) can interact with industry-level wage bargaining. We use for that a unique data set containing about 48,000 occupation-specific wage floors, in more than 340 French industries over the period 2006-2014. We find that the NMW has a significant impact the seasonality and the timing of the wage bargaining process. Real NMW increases affect the size of wage floor adjustments; the average elasticity is estimated close to 0.25. The elasticity of wage floors with respect to the NMW is heterogeneous along the wage floor distribution but the NMW affects significantly all levels of wage floors.

Keywords: minimum wage, collective bargaining, wages.

JEL Codes: J31, J51, E24

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1. Introduction

Wage setting institutions are often considered as one of the key differences between US and European labour markets. Contrary to the United States, a vast majority of workers in European countries are covered by collective wage bargaining (at the firm- and/or at the industry-levels) which shapes wage setting within firms.[1] In France, as in many other European countries, industry-level representatives of unions and employers bargain on wage floors for a set of representative job occupations specific to the industry. Those wage floors should be higher than the national minimum wage (NMW) which is a legal national wage floor, binding for all workers. To keep wage floors above the NMW, industries may have to revise thousands of industry-level wage floors after an increase of the NMW. Those wage floors are then binding for all firms[2] and are used as references for firms' wage policies. Thus, the NMW is not only a floor for all wages but is also embedded into a complex system of institutions of wage bargaining. Similar patterns are observed in other European countries and a recent growing literature focuses on industry-level wage agreements and how they affect Portuguese and Spanish labor market outcomes (see for instance Díez-Catalán and Villanueva 2014, Guimaraes et al., 2015, Martins, 2014). However, little is known on the determinants of wage floor adjustments and how they interact with NMW increases. In this paper, we investigate how wage floors adjust to shocks in French industry-level agreements using a large and unique data set consisting of more than 48,000 job-specific wage floors over the period 2006-2014.

Our first contribution is to open the black box of industry-level bargaining in France and deepen our knowledge of the functioning of wage bargaining institutions that are widespread in Europe.[3] For that purpose, we collect a large and unique new data set containing all industry-specific scales of wage floors for more than 340 French industries (covering more than 90% of workers of the private sector) over the period 2006-2014. In each industry, wage floors are defined for a specific classification of representative occupations. Those wage floors are then used by firms as a reference to set their wages[4]: André (2012) for instance, finds a significantly positive short-term elasticity of actual wages to wage floors (about 0.1 on average across all categories of workers). In our data set, we are able to follow a wage floor associated with a

[1] For instance, using Belgian data, Lopez-Novella and Sissoko (2013) find that wage increases contained in industry-wage agreements are, on average, fully passed on to actual wages.

[2] Industry-level agreements are quasi automatically extended to all employees in an industry (see Villanueva 2015 for a survey on extension procedures in Europe).

[3] See Boeri (2015) and Visser (2013) for a detailed description of European wage bargaining structures.

[4] Industry level is the dominant level of wage setting for one third of French firms (50% of firms with less than 250 employees) (Luciani 2014).

given occupation within the industry-level job classification, which allows us to compute the size of wage floor adjustments between two wage agreements for this occupation. Overall, our data set contains more than 48,000 wage floors for more than 6,000 different occupations defined in industry agreements. Our paper provides new stylized facts on how wage floors are adjusted in France along two margins: the frequency and the size of wage changes. We first find that the frequency of wage floor adjustments is highly time- and duration-dependent: industry-level wage agreements are much more frequent during the first quarter of the year and the usual duration between two wage agreements (and so, between two wage floor adjustments) is one year. The frequency of wage floor adjustments is also positively affected by variations of macro variables such as inflation and the growth rate of aggregate wages. Concerning the size of wage floor adjustments, we provide evidence that past inflation plays a key role in explaining the size of wage adjustments. Industry-specific shocks contribute to wage floor increases as long as NMW or inflation increases are not binding. Our paper contributes to the empirical literature examining to which extent the level of wage bargaining shapes firms' wage adjustment in different European countries (see Card and de la Rica, 2006, for evidence on Spain, Cardoso and Portugal, 2005, on Portugal, Gürtzgen, 2009, on Germany, Hartog et al., 2002, on the Netherlands or Plasman et al. 2007 for a comparison of three European countries). However, the level of wage bargaining is often considered as exogenous and few details are available on the content of wage agreements. Another literature looks at the determinants of firm-level agreements in Canada or the United States, emphasizing the role played by inflation or indexation clauses on bargained wage adjustments (see for instance, Christofides and Nearchou (2007), Christofides and Stengos (2003), Christofides and Wilton (1983) and Rich and Tracy (2004)). Our contribution is here to focus on a European country and to provide new results on wage floor adjustments contained in industry-level wage agreements.

Our second contribution is to investigate the interactions between NMW adjustments and the setting of industry-level wage floors. A large literature examines the effects of the NMW on other wages or on employment (Neumark and Wascher, 2008). However, in most European countries, the NMW is not only a minimum wage threshold binding for all workers, it also affects wage bargaining at different levels and, in particular, industry-specific wage floors which then shape individual wage adjustment within firms. Our contribution is here to investigate the spillover effects of the NMW to bargained wage floors which are industry- and occupation-specific. In France, the NMW covers between 10 and 15% of the labour force (whereas, in most European countries this proportion is lower than 5%; see Du Caju et al. 2009).

However, if a relatively low proportion of workers are directly concerned by increases in the NMW, there is some evidence that minimum wages have spill-over effects[5] (see for instance, Card and Krueger 1995, Dickens and Manning, 2004, Gregory, 2015, Grossman, 1983, Machin et al., 2003 and Neumark and Wascher, 2004). From a theoretical point of view, three different channels can be highlighted to explain NMW spill-over effects after a NMW increase: first, firms that used to pay higher wages to attract better workers (from low-wage firms) are forced to increase their wages to keep on hiring workers (Manning, 2003); second, firms raise wages of higher-paid workers not to reduce their effort to work and maintain the hierarchy of wages within the firm (Grossman, 1983); third, after a NMW increase, if skilled and unskilled workers are substitutes, the labour demand of relative skilled workers shifts to the right, which results in higher wages for skilled workers. In France, one important channel of transmission of NMW increases into other wages might come from industry-level wage agreements.[6] By law, wage floors cannot be set below the NMW. After a NMW increase, industries have to bargain over new values of wage floors to keep the lowest wage floors above the NMW. For higher wage floors, unions and employers may want to maintain some wage differentials between workers because of fairness or efficiency wage arguments. To assess the impact of the NMW on wage floors variations, we rely on a Tobit model to disentangle the effect of the NMW increase on the frequency of wage agreements and on the size of the wage floor adjustment. However, NMW increases but also inflation are by definition not industry-specific but macro variables, which raises an identification issue. Since industries bargain on wages infrequently, we here assume that bargaining parties incorporate into their updated wage floors, not the change in macro variables at the date of agreement but rather the cumulated changes in macro variables since the last agreement. By considering the cumulative change in the macro variables since the last wage agreement, we are able to widen the support of the distribution of changes in macro variables, which should help us to identify their effects of on wage floors (since cumulated variations are now industry-specific). Our main results are the following. First, we find that the NMW has some significant and positive effect on the frequency of wage agreements: i) we observe that most of wage agreements are clustered around the usual date of the NMW adjustment and that the timing of industry-level wage agreements is modified by the NMW

[5] According to results using survey data, about 50% of French firms report in 2010 that NMW increases are one of the most important criteria for adjusting wages in their firm (Luciani 2014). See also Goarant and Muller (2011) for evidence of spillover effect on French wage data.

[6] Using experimental data, Dittrich et al. (2014) show that wage bargaining is an additional channel through which spillover effects of the NMW might arise whereas Dolado et al. (1997) provide some evidence of spillover effects of sectoral bargained minimum wages on earnings in Spain.

increases; ii) we also find that industries are much more likely to sign a new wage agreement when at least one wage floor is below the NMW; iii) finally, an increase of 1 percentage point (pp) of the NMW in real terms raises by 2 to 3 pp the probability of observing a new agreement in a given industry; this effect is higher for industries where a large share of workers is paid close to the NMW. The NMW also affects significantly the size of wage floor adjustments. On average, an increase by 1 pp of the real NMW raises by about 0.25 to 0.3 pp wage floors. This elasticity is much larger for industries with a high share of minimum-wage workers. Wage floor adjustment is much more responsive to NMW variations when wage floors are close to the NMW. The impact of the NMW variations decreases along the wage floor distribution but only slowly (from 0.4 for lowest wage floors to 0.15 for highest wage floors). One important result is that the real NMW has a significant effect all along the wage floor distribution.

Our results are also relevant to understand why aggregate real wages might be downward rigid in France, in particular during the recent crisis (see for recent evidence on other European countries, Gartner et al., 2013 or Addison et al., 2015). In France, since 2008, real wages have been increasing at a rate close to 1% per year whereas the unemployment rate has also been increasing steadily. An explanation of the small cyclical variations of wages relies on the existence of strong nominal and real wage rigidities which prevent wages from adjusting to shocks in the short run. Le Bihan et al. (2012) provide evidence of wage rigidity using French firm-level wage data and we here investigate the relevance of wage bargaining as one source of potential wage rigidity. Wage bargaining institutions play a role in shaping nominal and real wage rigidity since wage agreements allow firms and workers to incorporate (or not) specific or common shocks into updated wages (see Avouyi-Dovi et al. 2013 for French evidence). We here provide evidence that wage floors present strong downward nominal wage rigidity (there is no nominal wage decrease). Moreover, they also exhibit some degree of real rigidity since decreases of wage floors in real terms are quite rare. Past inflation and the real NMW are the main drivers of nominal changes in wage floors at the industry level, whereas business cycle conditions or local unemployment seem to play a very limited role on wage floor adjustments.

The rest of the paper is organized as follows. Section 2 presents the institutional characteristics of collective bargaining in France. In Section 3, we describe the main stylised facts on the adjustment of industry-level wage floors. The empirical model is presented in Section 4 and results are provided in Section 5. Section 6 concludes.

2. Institutional features of the industry-level wage bargaining in France

Institutions of collective wage bargaining in France are quite similar to the ones observed in other European countries (Du Caju *et al.*, 2009). In particular, wages are bargained at different levels: at the national level, a binding national minimum wage (NMW) is set by the government; at the industry level, employers' organisations and unions bargain on occupation-specific wage floors; and at the firm level, employers and unions bargain on wage increases (see Boeri 2015 for a discussion of the effects of such a two-tier bargaining system). This section presents the main institutional features of the wage floor bargaining process at the industry level.

2.1. Contractual industries and wage floors

Firms classify themselves into different "*contractual industries*" ("*branches conventionnelles"* in French) depending mainly on their activity (possibly combined with a geographical criterion).[7] The definition of a "*contractual industry"* is determined by employers and unions' demands and its existence might depend on historical or geographical reasons. The French Ministry of Labor is in charge of enforcing this system, in particular to ensure that firms classify properly in their actual contractual industry. There are more than 700 different "*contractual industries*" in France. Some of them cover a very small number of employees and bargain on wages very infrequently; only a little more than 300 of them cover more than 5,000 workers.

For each contractual industry, a general collective agreement ("*convention collective*" in French) defines general rules and principles governing industrial relations between employees and employers within the industry, like wage bargaining, working conditions, duration of work, union rights, etc. It defines in particular an industry-specific classification of representative occupations; this classification is generally based on many criteria such as worker skills, job requirements, experience, age or diploma required for the job. All workers in the industry are assigned to one position in this classification. A wage floor is set for every position and workers assigned to a given position cannot be paid below the corresponding industry-specific wage floor[8]. We provide some examples of job classification and corresponding wage floors in 2014 for "hairdressing" and for "manufacture of paper and paperboard", in Table 1.

[Insert Table 1]

[7] Those contractual industries have a different coverage than usual classifications of economic activities (for instance, NACE classification) and cannot be exactly matched with usual classifications of economic activities.

[8] When this wage floor is lower than the NMW, this latter applies.

Contractual industries are entitled to bargain on wage floors every year but there is no obligation to reach an agreement at the end of the bargaining process. One important outcome of wage bargaining is the definition of new values for wage floors and the date at which this new scale should be enforced. In the absence of any agreement, wage floors remain unchanged until the next agreement. Initially, industry-level agreements cover firms that belong to employers' organizations which signed the wage agreement. Then, by decision of the Ministry of Labor, industry-level wage agreements can be extended to all firms belonging to the corresponding contractual industry. Those extensions are quasi-automatic and generally quickly implemented. One consequence is that a large majority of workers are covered by industry-level wage agreements.[9] Finally, contrary to some European countries (like Germany, for instance), there is no opt-out possibilities for French firms and industry-level wage floors are binding for all firms in an industry.

2.2. Timing and magnitude of wage floor adjustments

Two margins of wage floor adjustments can be considered: their timing (i.e. the extensive margin) and their magnitude (i.e. the intensive margin). The timing of wage floor adjustments is directly related to the frequency of wage agreements. Industry level wage bargaining is not a continuous process since it involves costs of gathering and sharing information, coordination of unions and employers for instance.[10] The size of wage adjustments may reflect macroeconomic or sector-specific shocks on different wage floor levels within the same industry. This section presents the main mechanisms linking macro variables and the margins of wage floor adjustments. We focus first on the specific role of the NMW then we discuss the potential effects of other determinants.

a) The role of the NMW

The binding national minimum wage (in French, *SMIC* for *Salaire Minimum Interprofessionnel de Croissance*) is expected to shape the wage floor adjustment process since it defines a legal wage floor for all French workers. About 10 to 15% of workers are directly concerned by NMW increases. The NMW is automatically adjusted every year: on July 1st until 2009 and on January 1st since 2010. This annual frequency of NMW adjustments is expected to induce some

[9] Firm-level wage agreements (which usually contain general or occupation–specific wage increases) cover a smaller share of workers (about 15% of workers) and are mostly observed in very large firms (whereas industry-level agreements might be more binding for smaller firms) (Avouyi-Dovi *et al.*, 2013). We do not examine here firm-level agreements.

[10] Gray (1978) for instance finds a positive relationship between the length of wage contracts and negotiation costs.

synchronization of industry-level wage agreements around the months of NMW increases (in particular in low-wage industries) and should affect the extensive margin of wage floor adjustment. NMW increases are decided by the Ministry of Labour following an explicit and legal rule:

$$\Delta \mathrm{NMW_t} = \max(0, \Delta CPI_t) + \frac{1}{2}\max(\Delta \mathrm{W_t} - \Delta CPI_t, 0) + \varepsilon_t \qquad (1)$$

where ΔNMW_t is the NMW increase over the year, ΔCPI_t is the inflation rate, $\Delta \mathrm{W_t}$ is the increase of blue-collar base wage and ε_t is a possible discretionary governmental additional increase. Such additional increase as well as an inflationary shock[11] may induce an unanticipated NMW increase; in those cases, the formula *(1)* is little adapted. Over the period 2006-2014, only one discretionary increase (+0.6%) was decided in July 2012 (just after François Hollande's election as *Président de la République*).

The NMW can affect wage floor adjustment through different channels. First, when the NMW increases, it can be set above the lowest wage floors in the industry. By law, all wage floors must then be set above the NMW, which provides strong incentives for these industries to bargain on wage floors and adjust them accordingly. When industries have all their wage floors above the NMW, they are said to be in conformity with the NMW. When the lowest wage floors become lower than the NMW, for instance just after a rise of the NMW, unions and firms' representatives receive strong recommendations from the Ministry of Labour to open industry-level wage negotiations and update their lowest wage floors. Conformity with the NMW should mostly affect the decision to reach a wage agreement whereas the size of the NMW increase should affect both the decision to update wage floors and the size of wage floor adjustments.

Second, wage floors above the NMW might also be affected through spillover effects. Different theoretical explanations can help to rationalize these spill-over effects. Manning (2003) shows that if firms used to pay high wages to attract better workers from the low-wage firms; after a NMW increase, those firms have to increase their wages if they want to keep on hiring better workers. Using an efficiency wage model, Grossman (1983) shows that after a NMW increase, the wage differential between skilled and unskilled workers becomes smaller so, firms have to increase wages of skilled (higher-paid) workers in order to avoid a reduction of the skilled workers' effort. A last possible explanation is that a NMW increase might shift the labour demand of relative skilled workers resulting in higher wages for skilled workers. These spill-

[11] During the year, when the inflation rate is higher than 2% since the last NMW adjustment, the NMW is automatically and immediately adjusted.

over effects can be heterogeneous because firms cannot uniformly increase all wages after a NMW increase. In this case, NMW increases may induce a lower dispersion of wage floors. These spill-over effects will mainly concern the intensive margin of wage floor adjustments.

b) Other determinants

Wage floors are set for every occupation in the industry-specific job classification and are constrained by the NMW. Those wage floors can be seen as wages that would be set by a representative firm for some representative occupations. So, wage floor adjustments might depend on the usual determinants of wage inflation that are considered in most macro empirical analyses (see Blanchard and Katz (1999) or more recently Gali (2011) for theoretical foundations), i.e. the inflation rate, the unemployment rate and/or a measure of productivity. However, besides the role played by NMW adjustments on wage floors, the standard wage inflation equation should be adapted to examine the adjustment of industry-level wage floors for at least two reasons: infrequent wage bargaining and possible interactions between wage floors and actual wages.

First, wage floor adjustment is not a continuous process over time since it depends on the infrequent signature of an agreement at the industry-level. Hence wage floor changes are considered with respect to the last date they were modified. Usual determinants of wage adjustments like inflation or variations of productivity should also be introduced with respect to the date of the last wage floor adjustment, and not at a fixed quarterly or annual frequency.[12] Moreover, usual determinants of wage floor adjustments may also affect the timing of wage agreements. For instance, unions are more likely to ask for opening wage negotiations in periods of high productivity gains.

Second, in standard wage inflation equations, one generally considers actual aggregate or individual wages whereas in our case, we examine industry-level wage floors that could interact with actual wages. In particular, the industry-specific past evolution of actual wages may affect wage floor evolutions when they are renegotiated. For instance, a large increase of actual wages in the industry (independent of the previous wage agreement) could lead unions to adjust wage floors upwards. This adjustment would be rationalized by fairness issues (Falk et al. 2006). This increase of industry-level wages can be due to productivity gains in the industry but also related to some exogenous wage increases in the largest firms of the industry (decided by a firm-level

[12] Here for sake of simplicity, we leave aside here considerations related to anticipated or delayed anticipation of inflation or productivity.

agreement for example). In this case, federations of employers might agree with a wage floor adjustment, in particular if they want to prevent potential competitors from maintaining low wages and getting a substantial competitive advantage.

Figure A in Appendix illustrates these two features. The wage floor variations that we are considering are variations between two dates of agreement, *t0* and *t1*, since, by definition, wage floors do not change in between. However, determinants of wage floor adjustments like the NMW or industry-specific wages can evolve between these two dates. Section 4 will present our empirical strategy to estimate the effects of these variables on wage floor changes, and to deal with identification and potential endogeneity issues.

3. Industry wage floors: data and stylised facts

This section describes how we collect and construct the data set of French wage floors, then provides new stylised facts on industry-level wage floor adjustments.

3.1. Data on wage floors

Our main data set contains a little more than 48,000 individual bargained different wage floors (defined at the occupational level) in the 345 biggest "contractual" industries (over a little more than 700 industries in France). For those 345 industries, we have collected all wage agreements over the period 2006-2014 available on a governmental web site (*Legifrance*).[13] This data set is to our knowledge the first one containing such detailed information on wage floors negotiated within industries. Table 2 provides some simple statistics to characterize French "contractual" industries. The number of employees covered by a "contractual" industry varies a lot: in our sample, seven industries cover more than 350,000 employees (for instance, wholesale food industry, hotels and restaurants, or car services), but 25% of industries cover less than 6,500 employees. Overall, industries in our data set cover about 12 millions of employees, i.e., 90% of workers in firms covered by an industry-level wage agreement. Many industries in our data set have a national coverage (195 industries). However, in the metalworking industry, wage floors are bargained at the local level: about 74 local different wage scales coexist at the *département*[14] level but they all use the same classification of job occupations. In public works,

[13] http://www.legifrance.gouv.fr/initRechConvColl.do

[14] A *département* is an administrative area. There are 96 départements in France. Each of them has approximately the same geographical size (6,000 km2), but different populations.

quarry and metal and in construction industries, wage floors are bargained at a regional level (consisting of several *départements*): about 76 regional different wage scales coexist but classifications of occupations are similar.

[Insert Table 2]

The typical wage agreement contains the agreement date (day/month/year), the date at which it is supposed to be enforced, the name of unions that have signed the agreement, and the wage scale (corresponding to wage floors for all occupations in a given industry). Wage floors can be defined as hourly, monthly, or yearly base wages (in euros). They exclude bonuses and other fringe benefits. We also exclude wage levels or planned wage increases that are only based either on seniority or explicit seniority indexation rules defined in the agreement.

Each wage scale is specific to a job classification defined at the industry level. Thus the number of wage floors contained in wage agreements can vary across industries. On average, industry-level wage scales contain 21 different wage floors corresponding to different job occupations. The median is 17 (see Table 2). The average wage gap between two wage floors in a given wage scale is about 5.7%. This average wage differential is much smaller in the first half of the wage scale (close to 2%) whereas the average differential is about 10% at the top of the distribution.[15] In a typical wage scale, there are relatively more wage floors at the bottom of the wage distribution than at the top of this distribution.

In our dataset, the average wage floor over the sample period is about EUR 1,850, whereas the average NMW over the same period is close to EUR 1,400. For the year 2011, we are able to compare for each industry the average wage floor and the actual average wage in the same industry.[16] Figure 1 plots the average wage floor and the corresponding average base wage for all industries of our sample. As expected, we first find that average actual wages are above average wage floors, the average wage differential being about 40%. We also find that wage floors and actual average wages are highly correlated across industries, suggesting that wage floors might affect actual wage differences across industries.[17]

[Insert Figure 1]

[15] The top of the wage scale consists of wage floors above the median of wage floors in a given job classification.

[16] This information is calculated and published by the Ministry of Labour. See http://travail-emploi.gouv.fr/etudes-recherches-statistiques-de,76/statistiques,78/salaires-et-epargne-salariale,86/conventions-collectives-de-branche,2126/conventions-collectives-de-branche,14576.html.

[17] Using firm-level wage data and information on industry-level wage agreements, André (2012b) reports similar correlations and after controlling for some individual characteristics, she finds stronger correlation for wages of blue- and white-collar workers and for wages in small firms.

In the rest of the paper, our main variables of interest are a dummy variable Y_{jt} which is equal to one if there is a wage agreement at date *t* in industry *j* (0 otherwise) and a variable WF_{ijt} which is defined as the wage floor corresponding to occupation *i* in industry *j* at date *t*. In particular, we examine ΔWF_{ijt} which is the log-change in WF_{ijt} for a given occupation between two dates. All dates are expressed in quarter per year.

3.2. Wage floor adjustments: some stylised facts

How are wage floors adjusted? First, using our data set, we are able to compute the aggregate annual growth rate of wage floors stipulated by industry-level wage agreements. For that purpose, we calculate the year-on-year wage change for each wage floor (ΔWF_{ij} for occupation *i* in industry *j*) over the sample period (at a quarterly frequency). We then use information on the number of employees in all industries to obtain an aggregate weighted measure of the year-on-year growth rate of wage floors. Figure 2 plots the average annual growth of wage floors which lies between 1.5% and 2.7% (1.8% on average over the period). When we compare it to the overall base wage increase published by the Ministry of Labour, the aggregate wage floor increase is close but below the aggregate base wage change (2.1% on average) since actual wage changes may also include firm-level and individual wage increases. Second, aggregate variations of wage floors are also quite correlated to the actual aggregate wage increase (the correlation coefficient is close to 0.9). Third, in real terms, the aggregate wage floor increase is +0.4% on average while the output gap is negative since 2008; this positive real growth of wage floors is mainly driven by low inflation periods. Lastly, there is a correlation between the annual growth of wage floors and NMW variations. In particular, when the NMW increased by more than 2% in 2008 and 2012, the gap between the annual growth of wage floors and the actual aggregate wage growth went close to 0.

[Insert Figure 2]

Our data on wage floors and wage agreements allow us to decompose the aggregate adjustment of wage floors into an extensive margin of adjustment (the frequency of wage agreements) and an intensive margin (the size of wage floor adjustment contained in wage agreements). We here provide some stylized facts on these two margins of wage adjustment.

First, we consider the extensive margin of adjustment (i.e., the frequency of wage agreements and the duration between two agreements). Over our sample period, a little less than 75% of workers are covered each year by a new industry-level wage agreement, whereas 77% of

workers are concerned by the enforcement of a new wage floor scale. This proportion varies a little over time. In Figure 3, we report the share of workers covered each year by a new wage agreement or by the enforcement of a new industry wage agreement. This proportion is quite correlated with inflation.

[Insert Figure 3]

Another striking feature is that the frequency of wage agreements is strongly seasonal. In Figure 4, we report the share of wage agreements that are signed in each quarter of the year. Over the period 2007-2014, two thirds of industry-wage agreements are signed during the first or the last quarter of the year. If we look at the date of enforcement of wage agreements, seasonal patterns differ somewhat. About 50% of wage agreements take into effect during the first quarter of the year, a little less than 20% in Q2 and Q3 and about 10% in Q4. This seasonality of wage bargaining can be related to NMW adjustments. As discussed in section 2, a reform of the timing of the NMW adjustments was implemented in January 2010: the month of the usual NMW adjustment was moved from July to January. We find that the seasonality of wage agreements has been modified by this reform: before 2010, most wage agreements were signed in the third and fourth quarters (respectively, 23 and 38% of all wage agreements) whereas since 2010, wage agreements are more frequent during the first quarter (41% of all wage agreements). The impact of this reform is even stronger on the seasonality of enforcement dates: before 2010, 26% of wage agreements are implemented during the third quarter whereas after 2010, most enforcement dates of wage agreements are in the first quarter (about 60%) and less than 10% in the last quarter of the year. This seasonality reflects the relevance of the NMW time schedule for industry-level wage bargaining. The usual date of the NMW adjustment modifies the timing of industry-level wage agreements.[18]

[Insert Figure 4]

The timing of wage bargaining is also related to the conformity of industry-level wage scales with the NMW: industries are more likely to update their wage scales when their lowest wage floors are below the NMW. Figure 5 plots the proportion of industries having at least one wage floor below the NMW over time, the frequency of wage agreements and the NMW increases. On average, the proportion of industries having at least one wage floor below the NMW is about

[18] This seasonality might have large consequences at the aggregate level. For instance, using examples in the United States, France or Japan, Olivei and Tenreyro (2007, 2010) find that seasonality of wage contracts modifies the size and duration of monetary policy effects.

30%[19] with large time variations. As expected, large NMW increases (for instance, in 2007, 2008 or 2012) are associated with increases in the proportion of industries with wage floors below the NMW. However, increases in the frequency of wage agreements are also associated with decreases in the non-conformity rate. In particular, before 2010, the non-conformity rate increased in July when the NMW usually adjusted and then decreased in January when industries signed new wage agreements. After 2010 these two opposite evolutions cancel each other out since both NMW increases and wage agreements occurred mostly in January, which leads to smaller time variations of the non-conformity rate (except in July 2012 which corresponds to a discretionary increase of the NMW).

[Insert Figure 5]

The seasonal effects also reflect the existence of fixed duration contracts equal to one year. Figure 6 plots the distribution of durations between two successive wage agreements or two dates of wage agreement implementation. 40% of durations between two successive agreements are exactly equal to one year. This reflects the obligation to bargain on wages every year. Only one third of industry wage agreements last more than one year. When we consider the duration between two dates of wage agreement implementation, the pattern is similar, except a small peak at 6 months due to multiple wage increases (stipulated in the agreement) within a year. There is no industry-level wage contract with durations of several years, as it is the case in other European countries like Sweden for instance (Du Caju *et al.*, 2009).

[Insert Figure 6]

We then provide evidence on the size of wage floor adjustments contained in industry-level wage agreements. In Table 3, we report simple statistics on wage floor changes contained in industry-level wage agreements (by year). The median wage floor increase goes from 1.1% in 2014 to 2.4% in 2008. If we correct for the duration since the last wage agreement, this median is now going from 1.1% to 2.5%. Variations over time are quite correlated with the aggregate average inflation rate. Note also that the variations of the average duration between two successive agreements is consistent with the over-time variations of frequency of wage agreements (Figure 3).

[Insert Table 3]

[19] The average number of wage floors below the NMW is about 3 and the proportion of workers potentially covered by wage floors below the NMW is close to 10%.

Figure 7 reports the distribution of individual wage floor adjustments decided in industry agreements year by year. First, there is no nominal wage decreases in industry wage agreements. Second, the peak at zero corresponds to industries either where there is no agreement or where some wage floors in the wage scale are not modified; this peak is very close to the percentage of industries where there is no agreement (Figure 3). Third, those distributions exhibit some peaks exactly equal or close to the NMW increase or to past inflation, revealing some real rigidity in wage floor setting. For instance, in 2011, we observe two peaks in the distribution at 1.5 and 2% while the NMW increase in 2011 was about 1.5% and inflation 2%. During the recent low inflation period, the distribution of changes is much less dispersed. In 2014, there is a peak in the distribution at 1% which corresponds to the NMW increase in 2014 (the inflation rate was about 0.5%).

[Insert Figure 7]

4. An empirical model for wage floor adjustment

Our aim is to investigate empirically the main determinants of industry-level wage agreements and wage floor adjustments. These determinants include inflation, NMW increases, overall sectoral wage increase and variables capturing productivity shocks or business cycle position (as mentioned in Section 2).

4.1. Identification issues

We first address two important identification issues: the lack of individual variations of some variables which are macro variables and potential collinearity among them.

Our aim is here to assess the effect of variables (NMW or inflation variations) that are by definition not industry-specific but macro. Thus, the effect of such variables can be identified only on their temporal variability. In our model, industries bargain on wages infrequently. Consequently, we can expect that bargaining parties (workers' unions and employers' associations) incorporate into the updated wage floors, not the change in macro variables at the date of agreement but rather the cumulated changes in macro variables since the last wage industry agreement. Using the cumulative change in the macro variables since the last wage agreement allows us to widen the distribution support of changes in macro variables. This strategy should help us to identify the effects of macro variables on wage floors since cumulated variations are now industry-specific. This line of reasoning is valid for NMW but also for

consumer price index or sectoral actual wages for which we also consider log-variations between two successive wage agreements.

Another identification issue comes from potential collinearities among macro variables. This might be particularly relevant for inflation and NMW increases: an increase in the inflation rate has necessarily a positive impact on the NMW increase since the formula used to adjust the NMW incorporates past inflation. So, part of the effect of inflation might come through NMW increases. A similar issue can arise from the correlation between inflation and industry-specific wage variations. We here consider a model where all macroeconomic variables are taken in real terms in order to isolate the specific effect of inflation. Secondly, the growth rate of industry-specific wages is taken, in real terms, with a lag of one quarter to control for potential simultaneity bias. However, this variable might also capture spill-over effects of the NMW to industry actual wages (through individual wage increases or firm-level agreements). To control for this, we introduce as covariates the cumulated wage increase in a given industry in real terms and we control for the possible NMW spill-over effects.[20] Here again, the aim of this variable transformation is to isolate the specific impact of each macro variable.

4.2. The empirical model

The estimated model is a Tobit-II type model which takes into account for the discretionary process of wage bargaining. The first equation corresponds to a Probit model where the dependent variable is a dummy variable equal to one if there is a wage agreement in an industry at a given date, 0 otherwise. Our baseline Probit model can be written as follows:

$$Y_{jt}^{*} = \alpha + \beta\Delta_{j,\tau}\pi_t + \gamma\Delta_{j,\tau}NMW_t + \delta\Delta_{j,\tau-1}\overline{W}_t + \theta\Delta_{j,\tau-1}\widetilde{W}_{jt} + \varphi u_{jt} + \omega y_{jt} + \mu x_{jt} + \rho\tau_j + \lambda_t + \varepsilon_{jt} \quad (2)$$

If $Y_{jt}^{*} > 0$ then $Y_{jt} = 1$, otherwise $Y_{jt} = 0$.

where Y_{jt} is a dummy variable equal to one if a wage agreement is signed in industry *j* at date *t* (date in quarter/year format), $\Delta_{j,\tau}\pi_t$ is the cumulated inflation since the last wage agreement, $\Delta_{j,\tau}NMW_t$ denotes the cumulated NMW increase (in real terms) since the last agreement in the industry (τ being the elapsed duration between these two agreements), $\Delta_{j,\tau-1}W_{jt}$ is the cumulated wage increase in industry *j* since the last wage agreement in this industry (minus 1

[20] To obtain a broad estimation of the NMW spillover effects on industry wages, we estimate an OLS equation relating industry wage increases to NMW increases and inflation; estimated coefficients are close to 1 for inflation and 0.5 for NMW.

for limiting the potential simultaneity bias) (this variable is taken in real terms and net of NMW spillover effects). We decompose this variable into an aggregate wage increase common to all industries $\Delta_{j,\tau-1}\overline{W}_t$ (which should be close to the aggregate base wage increase in France) and an industry-specific wage increase (which is calculated as: $\Delta_{j,\tau-1}\widetilde{W}_{jt} = \Delta_{j,\tau-1}W_{jt} - \Delta_{j,\tau-1}\overline{W}_t$), τ_j denotes the elapsed duration since this last wage agreement, x_{jt} a dummy variable capturing conformity of wage floors with the NMW, this variable is equal to one if at least one of the industry-level wage floors is below the NMW (just before the industry-level wage agreement) and 0 otherwise, u_{jt} is a local measure of unemployment, y_{jt} is a measure of industry-level output gap and λ_t are quarter or time fixed effects. We introduce interaction terms between quarter fixed effects with the dummy variable indicating whether the date *t* is before or after January 2010. January 2010 is indeed the date at which the reform modifying the time schedule of NMW increase was implemented (moving from July to January).

Wage indices are not available at the "*contractual*" industry level. To construct W_{jt}, we use hourly wage indices for blue-collar workers and for all workers at the sector-specific level (90 sectors, using the NACE statistical classification source Ministry of Labour) and we compute the average weighted wage index corresponding to each contractual industry using the employment sectoral structure of "*contractual*" industries. By construction, those industry-specific wage indices are corrected for composition effects and reflect the average wage increase in a given industry. To obtain industry-specific measures of unemployment, we use local unemployment rates (at the *département* level, source Insee) and the geographical employment structure of industries. We then compute an industry specific measure of unemployment as the weighted average unemployment rate. For the industry-level output gap measure, we use sectoral statistics on sales ("*indices de chiffres d'affaires*", source Insee), and we compute average weighted sales indices corresponding to each contractual industry using the employment structure of conventional industries. We then calculate the industry-specific output gap as the difference between the observed sales index of the industry and its linear trend.

The second equation of the Tobit model relates wage floor increases to macro variables such as inflation, the NMW increase (in real terms) and the industry-level actual wage increase (in real terms, net of NMW spillover effects) since the last wage agreement. This second equation is the following one:

$$\Delta_{j,\tau}WF_{ijt} = a + b\Delta_{j,\tau}\pi_t + c\Delta_{j,\tau}NMW_t + d\Delta_{j,\tau-1}\overline{W}_t + e\Delta_{j,\tau-1}\widetilde{W}_{jt} + fu_{jt} + gy_{jt} + hMR_j + v_j + L_t + u_{jit} \quad (3)$$

where $\Delta_{j,\tau}WF_{ijt}$ is the change in the bargained wage floor in occupation *i* and industry *j* between two dates (duration τ is measured in quarters), most of independent variables are the same as in the first equation but using estimates obtained in the first equation, we also calculate a Mills ratio which is specific to each industry MR_j. v_j is an industry fixed effect and L_t are date controls.

In our data set, wage scales are specific to each industry and the number of different bargained wage floors can be very different from an industry to another. This raises one potential issue since an industry with a more precise job classification than average will be oversampled (because of many job categories). To control for this issue, we define ten wage categories defined by the ratio of each wage floor to the NMW (wage floors less than 1.01*NMW, wage floors between 1.01 and 1.03*NMW, wage floors between 1.03 and 1.07*NMW, wage floors between 1.07 and 1.13*NMW, wage floors between 1.13 and 1.21*NMW, wage floors between 1.21 and 1.32*NMW, wage floors between 1.32 and 1.48*NMW, wage floors between 1.48 and 1.70*NMW, wage floors between 1.70 and 2.09*NMW, wage floors above 2.09*NMW). Those thresholds are chosen so that we obtain wage categories containing more or less the same number of wage floors. In each category, we select randomly only one wage floor for every industry.[21] The sample then consists of a little more than 17,000 observations (industry × wage category × date) over about 48,000 wage floors. Moreover, we consider specifications where the NMW effect can be different according to the wage floor level. For that purpose, we interact the cumulated NMW variable with dummy variables corresponding to each wage category.

The identification of the model comes from an exclusion restriction: we here assume that quarter effects, and dummy variables for duration equal one year and two years but also the dummy variable indicating that "all wage floors in an industry are in conformity with the NMW" only affect the timing of industry-level wage bargaining process and not the size of wage floor adjustments. Those variables can be related to negotiation costs or legal constraints and would not affect directly the size of the wage changes. The Tobit model is estimated using a two step estimation procedure and standard deviations of estimators are obtained using bootstrap simulations.

[21] Robustness checks have been run using the whole data set and results remain quite similar.

5. Results

This section reports the results of our estimations.

5.1. Frequency of industry-level agreements

Tables 4 and 5 report marginal effects of Probit models in which the dependent variable is a dummy variable for the occurrence of a wage agreement (when the agreement is signed) or for the effect of a wage agreement (when the agreement comes into effect), respectively. We run three different specifications: the first one includes quarter and year dummies as time controls (to capture seasonality in the frequency of wage agreements); the second includes dummy variables by date (our baseline regression) and the last one excludes the dummy "non-conformity with the NMW" (in order to assess the overall effect of the NMW on the frequency of wage agreements).

[Insert Table 4]

First, even after controlling for macro variables, duration effects remain quite substantial and statistically significant: the probability of observing a wage agreement after exactly one year is higher by about 31 percentage points (in all specifications). This effect is substantial since the average frequency of wage agreements by quarter is about 20%. A similar but smaller effect (about 15 pp) is obtained for wage agreements after exactly two years. This reflects the strong time dependence of wage agreements, which might be due to important negotiation costs and can also be related to the obligation for industry to bargain on wages every year.

[Insert Table 5]

Quarter effects are other important factors contributing to variations in the probability of observing a wage agreement. If we consider the first specification where we include year and quarter dummies as time controls, estimates of quarter effects are almost all significant. Before 2010, the differences between quarters are not as strong as those estimated after 2010: before 2010, the probability of a wage agreement is somewhat lower in the second quarter (about -5 pp) whereas since 2010, wage agreements are much more frequent in the first quarter (about +7 pp) and less frequent in the third quarter (-8 pp). The seasonality of the agreement implementations is even more pronounced: before 2010, wage agreements come into force more frequently in the first and third quarters, whereas after 2010 they are enforced more frequently in the first quarter (Table 5). When we consider the specification where we introduce date dummies as time controls, we plot parameter estimates associated with those dummies on

Figure B in Appendix (the last quarter of 2014 is the reference). We find that before 2010, wage agreements seem much more frequent in the third and fourth quarters and in the first quarter after 2010 (an exception is the last quarter of 2012 after the discretionary increase of the NMW in July 2012). The enforcement dates of agreements are staggered before 2010 but quite clustered around the first quarter after 2010. After 2010, all Q1 dates correspond to a higher probability of observing the effect of a wage agreement (about +10 pp). As mentioned earlier, this result can be related to the reform of the timing of NMW increases. Supplementary regressions considering industries with a high and low share of minimum-wage workers do not show large differences in the timing of wage agreements or effects of wage agreements (Table A in Appendix).

In some industries, an increase of the NMW can make it higher than wage floors, which might exert some specific pressures on these industries to update their wage scales. The dummy variable capturing the conformity of wage floors with the NMW has indeed a positive effect on the probability of signing a wage agreement and on the probability that an agreement comes into force. This effect is larger after 2010 (between 5 to 8 pp) than before 2010 but the effect of this dummy variable is significant on both periods. Moreover, the impact of the non-conformity of some wage floors with the NMW is more pronounced for the date of enforcement of agreements than for the dates of agreements themselves; this can be explained by the fact that industries update their wage scales so that they are in conformity with the NMW when those wage scales come into effect. If we exclude this dummy variable, the marginal effect of the cumulated NMW increases by 0.3 to 0.7 pp., suggesting that we capture here a specific channel for the transmission of NMW on the frequency of wage agreements. When considering different types of industries (low vs high share of minimum-wage workers), we do not find substantial differences (Table A in Appendix).

The NMW can affect directly the probability of a wage agreement since it is an important reference for low-paid workers. Thus, increases in the NMW might have a positive impact on the probability of revising the wage scale. However, the empirical effect of the cumulated real NMW increase on the probability of a wage agreement is found to be rather limited: it lies between 2.5 and 3 pp. This effect is heterogeneous among industries: the impact of a real NMW increase is higher for industries with a high share of minimum-wage workers (3.5 pp) than for industries with a low share of minimum-wage workers (between 0 and 2) (Table A in Appendix).

Cumulated increases in the inflation rate and in the aggregate base wage have both a larger effect than the real NMW increase on the probability of an industry-level wage agreement. The marginal effects associated with inflation or aggregate base real wage are similar, between 7 and 8 pp (Tables 4 and 5). This result is consistent with the fact that workers are more likely to claim for opening a new negotiation if they observe a higher level of inflation (which reduces the workers' purchasing power) or an increase in average aggregate wages (which might induce a decrease in industry-relative wages of workers). When we consider different types of industries, inflation seems to have a larger effect on the probability of wage agreements in industries with a higher proportion of minimum-wage workers and in metalworking industries (Table A in Appendix).

An industry-specific real wage increase seems to have a small and non-significant effect on the probability of a wage agreement and only a small and barely significant effect on the enforcement dates of agreements. This result suggests that industry-specific productivity developments (that would have been captured by this variable) have no impact on the occurrence of a wage agreement. Similarly, the sectoral output gap and the local unemployment rate have no significant effect on the occurrence of a wage agreement.

5.2. The size of wage floor changes

Table 6 reports parameter estimates of the second equation of our Tobit model which defines the size of wage floor adjustments. The first column reports results for all industries, the second one for national industries with a high proportion of minimum-wage workers, the third one for national industries with a low proportion of minimum-wage workers and the last one for local metalworking industries (where the proportion of minimum-wage workers is usually very low). All variables are considered in real terms to identify the impact of inflation, and real aggregate base wage variations are corrected from possible NMW spill-over effects so that the cumulated increase in real NMW will capture the overall impact of the NMW on wage floor adjustments.

[Insert Table 6]

First, the Mills ratio has a small but significant negative effect. The selection effect is not very large, which confirms that time-dependent factors (independent of macro variables) are quite important in the selection equation. This negative sign has the following interpretation: if an exogenous shock affects the probability of a wage agreement, it has a negative effect on the size of the wage adjustment, all things being equal.

The most important determinant of the size of wage floor adjustments is the cumulated inflation. The elasticity of wage floor adjustments with respect to cumulative inflation is close to 0.6 (Table 6). This result suggests that wage floors are partly indexed to past inflation. Here, part of this indexation might come either from a "direct" inflation effect, or from more 'indirect' effects coming through NMW indexation to past inflation or through aggregate base wage indexation to past inflation. Our model cannot fully disentangle between those channels of indexation. The elasticity of 0.6 should be interpreted as the overall impact of inflation on nominal variations of wage floors. Moreover, we find that this degree of indexation to inflation is much larger in industries with a high proportion of minimum-wage workers (elasticity of 0.57) than in industries with a low proportion of minimum-wage workers (0.37). In metalworking industries, there seems to exist a strong indexation mechanism since the elasticity of wage floor adjustments to inflation is close to 0.8.

Second, the cumulated real NMW variation has a positive and significant effect on the size of wage floor adjustments; on average, in a given industry, an increase of 1% in the NMW (in real terms) will increase wage floors by 0.25 to 0.3 pp. When we consider the heterogeneity of the effect across industries, as expected, the NMW has a larger effect on wage floors in industries with a high proportion of minimum-wage workers (elasticity of 0.34) than in industries with a low proportion of minimum-wage workers (elasticity of 0.27), and in metalworking industries where the proportion of minimum-wage workers is close to 0 (elasticity of 0.14). However, in all groups of industries, the effect of the NMW is significant even when the proportion of minimum-wage workers is very low; this result suggests the existence of some NMW spill-over effects across industries.

Contrary to what we observe for the occurrence of wage agreements, the cumulative aggregate real wage variation seems to play a limited role on the size of wage floor adjustments. Its effect is significant but small (less than 0.15). Industry-specific real wage variations have a larger impact on the size of wage floor changes, with an elasticity close to 0.3. This result would suggest that industry-specific actual wage variations play a role in determining a new scale of wage floors. For instance, sectoral productivity gains that would have been incorporated into sectoral actual wages are also incorporated in the new industry-level scale of wage floors. Looking at the heterogeneity of those effects across industries (Table 6), we observe that the effect of industry-specific wage developments is larger for industries with a low or a very low proportion of minimum-wage workers. The elasticity of wage floor changes with respect to sectoral wage changes is 0.3 for industries with a low proportion of minimum-wage workers

and 0.8 for metalworking industries, whereas it is 0 for industries with a high proportion of minimum-wage workers. In the same way, aggregate cumulative wage change plays a larger role in industries with a high share of minimum-wage workers than in other industries. This result might suggest that industries where the NMW is less binding have much more leeway to take into account the industry-specific wage or productivity developments. Lastly, the sectoral output gap measure and local unemployment have no significant effect on the size of wage floor changes. This finding suggests that business cycle conditions play a very limited role on industry-level wage adjustment but might also be due to measurement errors in our proxy for business cycle conditions of "contractual" industries.

[Insert Figure 8]

Finally, we test whether the impact of NMW increases varies along the wage floor distribution and examine the NMW spillover effects along this distribution. Figure 8 reports estimated parameters associated with the variables representing interactions between cumulated real NMW variations and dummy variables capturing the different effects along the wage floor distribution. As expected, these parameter estimates are decreasing along the wage floor distribution, from 0.4 for wage floors close to the NMW to 0.1 for wage floors above twice the NMW. One interesting result is that the NMW effect is significant all along the wage floor distribution. It decreases quickly from the lowest wage floor to wage floors equal to 1.1*NMW. However, we obtain a positive effect of NMW real variations on wage floor adjustments for all levels of wage floors.

We then test whether other macro variables have such heterogeneous effects along the wage distribution and we find that only inflation has such an heterogeneous effect. Figure 9 reports elasticities of wage floor variations obtained with respect to both real NMW variations and inflation along the wage floor distribution. In particular, we find that the elasticity of wage floor changes with respect to inflation is very high for wage floors close to the NMW (close to 0.8) and then decreases steadily (0.6 for wage floors close to 1.1*NMW, about 0.4 for wages above 2*NMW). This elasticity is positive and significant for all levels of wage floors. This decreasing slope is very similar to the one obtained for the NMW.

[Insert Figure 9]

Some separate regressions run on the different groups of industries (high proportion of minimum-wage workers, low proportion of minimum-wage workers, and metalworking) show some heterogeneity across industries (Figure C in Appendix). All along the wage distribution,

the NMW effect is a little larger in industries with a high share of minimum-wage workers than in industries with a low proportion of minimum-wage workers or in metalworking industries. Another result is that the NMW effect is positive and significant all along the wage floor distribution not only in industries with a high proportion of minimum-wage workers but also in industries with a low proportion of minimum-wage workers, and until wage floors equal to 1.1*NMW in metalworking industries. Concerning the elasticity of wage floor changes with respect to inflation, differences are much larger, this elasticity is close to 1 for low wages in industries with a high proportion of minimum-wage workers and the slope is slightly decreasing to 0.7 for higher wage floors. A similar pattern appears for metalworking industries with still a high elasticity (close to 0.5) for wage floors above 1.1*NMW. In industries with a lower proportion of minimum-wage workers, the elasticity of wage floors with respect to inflation is close to 0.7 for wage floors close to the NMW and decreases to 0.3 for highest wage floors.

As robustness check, we test whether determinants of wage floor variations differ before and after 2010. For that purpose, we interact macro variables of our Tobit model with a dummy variable “before 2010” and a dummy variable “after 2010”. Results are reported in Table B in Appendix. Elasticities with respect to inflation and with respect to NMW increases are slightly modified whereas some important changes appear for the effect of sectoral and average aggregate wage variations. Before 2010, the industry-specific wage effect dominates the aggregate wage effects (0.6 versus 0.2) whereas after 2010, the impact of sectoral wage variations becomes non-significant for all specifications and for all industries. The aggregate wage effect remains significant but small, especially for industries with a high share of minimum-wage workers. This result might suggest that after 2010 (which also corresponds to a recession and low inflation period), industry-level wage agreements might be more constrained by indexation and NMW real increases and are less likely to adjust industry-specific wage floors to industry-specific conditions.

6. Conclusion

Industry-level agreements cover a large majority of French workers in the private sector. Each industry defines a specific classification of occupations and set wage floors associated with each position in this classification. Each year, unions and federations of employers bargain over the level of wage floors and may reach a wage agreement which updates the scale of wage floors. How are those wage floors adjusted? This paper investigates the main determinants of wage floor adjustments. Using a detailed data set containing about 50,000 wage floors by

occupation for 345 industries over the period 2006-2014, we provide empirical results on the frequency of wage agreements and on the size of wage floor adjustments. Since all wage floors should be higher than the NMW set by the Ministry of Labour according an explicit formula, we also examine possible interactions between the wage floor adjustment process and increases in the NMW.

Results can be decomposed according the two margins of the wage floor adjustment, namely the frequency and the size of wage floor adjustments. First, we find that the occurrence of a wage agreement depends a lot on the duration since the last wage agreement and on seasonal effects. The typical duration between two agreements is exactly one year and industry-level wage agreements are much more frequent in the first quarter of the year (in particular since 2010). Beyond these temporal effects, we find that macroeconomic variables play a more limited role in the variations of the frequency of wage agreements at the industry level. However, when inflation aggregate base wages increase, the probability of reaching a wage agreement increases by 7 to 8 pp. This suggests that a reduction of workers' purchasing power or a drop in industry wages relative to aggregate wages leads to a higher probability of obtaining an industry-level wage agreement. The NMW has also an impact on the frequency of wage agreements through different channels. First, we provide evidence that part of the seasonality of wage agreements can be linked to the automatic adjustment of the NMW every July until 2009 and every January since 2010. Second, when some wage floors are below the NMW in a given industry, the probability of reaching a wage agreement is higher. Finally, the cumulative NMW increase has a small but positive impact on the probability of observing a wage agreement (even in industries with a low proportion of minimum-wage workers).

When we consider the determinants of the size of wage floor adjustments, we find that macro variables all play a significant role. Variations of wage floors are first closely related to inflation (elasticity of 0.6). This indexation parameter is larger for industries with a high of proportion of minimum-wage workers and metalworking industries. We also obtain that the effect of inflation is heterogeneous along the wage floor distribution: the elasticity of wage floors with respect to inflation is close to 0.8 for wage floors close to the NMW and then decreases steadily to reach 0.4 for wage floors above twice the NMW. The NMW is also an important determinant of the size of wage floor adjustment. When the real NMW increases by 1%, wage floors increase on average by 0.25%. This elasticity is heterogeneous across industries: 0.34 for industries with a high proportion of minimum-wage workers versus 0.27 for industries with a low proportion of minimum-wage workers and 0.14 for metalworking industries where the proportion of

minimum-wage workers is close to 0. The elasticity of wage floors with respect to real NMW variations is also decreasing along the wage floor distribution but only slowly decreasing from 0.4 for the lowest wage floors to 0.15 for the highest wage floors. One important result is that the real NMW has a significant effect all along the wage floor distribution. A last important determinant is the industry-specific actual wage variation. This variable is supposed to capture industry-specific productivity gains and has a positive and significant effect on the size of wage floors (elasticity of 0.25). This effect is larger in industries with a low proportion of minimum-wage workers, suggesting that they have more leeway to incorporate industry-specific wage developments on top of increase in the NMW or in the inflation rate.

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Table 1: Examples of minimum wage scales contained in industry-level wage agreements

a) Manufacture of paper and paperboard (30,000 workers)

Salaires mensuels minima conventionnels (SMMC)

(En euros.)

NIVEAU	ÉCHELON	COEFFICIENT	SMMC (au 1er mars 2014)
I	1	125	1 446
	2	130	1 457
	3	135	1 469
II	1	140	1 489
	2	150	1 509
	3	160	1 534
III	1	170	1 568
	2	185	1 601
	3	195	1 635
IV	1	215	1 782
	2	235	1 929
	3	260	2 091
V	1	285	2 276
	2	315	2 508
	3	350	2 773

b) Hairdressing (100,000 workers)

(En euros.)

NIVEAU	ÉCHELON	CLASSIFICATION	SALAIRE minimal
I	1	Coiffeur(se) débutant(e)	1 470
	2	Coiffeur(se)	1 475
	3	Coiffeur(se) confirmé(e)	1 480
II	1	Coiffeur(se) qualifié(e)	1 500
		ou technicien(ne)	1 530
	2	Coiffeur(se) hautement qualifié(e) ou technicien(ne) qualifié(e)	1 620
	3	Coiffeur(se) très hautement qualifié(e) ou assistant(e) manager ou technicien(ne) hautement qualifié(e)	1 740
III	1	Manager	1 895
	2	Manager confirmé(e)	2 270
		ou animateur(trice) de réseau	2 680
	3	Manager hautement qualifié(e)	2 840
		ou animateur(trice) de réseau confirmé(e)	2 890

Notes: "Niveau" = Category of workers, most frequently: "I" for routine task occupations or low skilled workers, "II" for higher skilled workers (technicians for instance)… Higher levels usually represent "managers". "Echelons" are sub categories within a category of workers and "Coefficient" can be used to calculate the wage rate. Classifications of occupations are specific to each industry. The NMW was set at EUR 1,446 in 2014 (1st Jan.).

Table 2: Descriptive statistics on industry wage scales

	Mean	Q1	Median	Q3
Number of employees	34,585	6,295	12,665	30,099
Number wage levels	20.73	12.00	17.00	25.00
Average Wage Floor (in euros)	1,858	1,476	1,661	2,080
Average wage differential (in %)	5.65	3.52	5.40	7.26
Average wage differential (in %) (at the bottom of the wage scale)	2.05	0.35	1.00	2.98
Average wage differential (in %) (at the top of the wage scale)	9.46	5.75	8.77	11.36
Maximum/minimum wage ratio within industry	2.55	1.86	2.37	3.16
Average gross wage / average wage floor (weighted)	1.408	1.340	1.382	1.477

Notes: The "Number of employees" is calculated using the DADS data set which reports the number of employees in each firm and the contractual industry covering the firm. The number of wage levels is calculated as the number of different wage floors reported in wage agreements; the statistics are weighted by the number of employees in industries. The average wage floor is calculated for every industry and then statistics are computed across industries and weighted by the number of employees. The average wage differential is calculated as the log difference (in %) between two successive wage floors in the wage scale of an industry; the average wage difference is computed for each industry. Statistics are then weighted by the number of employees. Average wage differential "at the bottom of the wage scale" is calculated using only the first half of the wage scale whereas 'at the top of the wage scale' we use the second half of the wage scale. Max/min ratio is calculated as the ratio between the minimum of wage floor in a given industry and the maximum of wage floors in a given industry. "Average gross wage / average sectoral wage" is calculated as the ratio between the actual average gross wage in a given industry (as reported by the Ministry of Labour in 2011) and the average weighted wage floor in the same industry (in 2011). Weighted statistics use the number of employees in each industry.

Table 3: Average growth rate of wage floors by year

Year	Wage floor variations (in %)				Duration (in years)	Wage floor variations / duration (in %)	Inflation (year-on-year variation ,in %) (Insee)
	Mean	Q1	Q2	Q3	Mean	Median	
2007	2.27	1.68	2.17	2.93	0.45	2.43	1.5
2008	2.41	1.83	2.39	3.05	0.72	2.51	2.8
2009	2.01	1.19	1.5	2.83	0.68	1.97	0.1
2010	1.68	0.81	1.28	1.98	0.82	1.29	1.5
2011	1.9	1.45	1.78	2.23	1.14	1.58	2.1
2012	2.03	1.62	2.09	2.37	0.94	2.09	2
2013	1.69	1.29	1.73	2.09	1.03	1.53	0.9
2014	1.34	0.99	1.1	1.42	1.13	1.1	0.5

Note: Statistics are calculated using all non-zero wage floor changes over the period 2007-2014. Statistics are weighted using the number of workers by job occupation in the industry specific classification.

Table 4: Marginal effects of covariates in the Probit model for the occurrence of wage agreements

Dependent variable - *Dummy variable for wage agreement*	(1)	(2)	(3)
Cumulated inflation	7.438***	7.646***	8.631***
	(0.559)	(0.612)	(0.600)
Cumulated real NMW	3.410***	2.722***	3.020***
	(0.538)	(0.607)	(0.622)
Cumulated real aggregate wage change	6.857***	7.682***	8.248***
	(0.926)	(1.137)	(1.096)
Cumulated real industry wage change	0.900	0.847	0.930
	(1.723)	(1.736)	(1.777)
Local unemployment rate	0.032**	0.024	0.030
	(0.014)	(0.018)	(0.019)
Output gap	-0.259	-0.030	0.052
	(0.309)	(0.345)	(0.342)
Duration			
1 year	0.316***	0.316***	0.319***
	(0.014)	(0.014)	(0.014)
2 years	0.144***	0.145***	0.147***
	(0.033)	(0.033)	(0.033)
3 years	-0.009	-0.019	-0.025
	(0.048)	(0.047)	(0.047)
Before 2010			
Q1	0.022*		
	(0.012)		
Q2	-0.048***		
	(0.009)		
Q3	-0.016*		
	(0.010)		
Q4	ref		
Non-conformity with the NMW	0.014**	0.012	
	(0.008)	(0.008)	
After 2010			
Q1	0.066***		
	(0.009)		
Q2	0.007		
	(0.007)		
Q3	-0.081***		
	(0.006)		
Q4	ref		
Non-conformity with the NMW	0.057***	0.053***	
	(0.007)	(0.007)	
N	9 771	9 771	9 771
Year / Dates dummies	Year	Date	Date
Industry dummies	Yes	Yes	Yes

Note: This table reports marginal effects estimated with Probit models. Standard errors are obtained using bootstrap methods and are reported in brackets. The dependent variable is the dummy variable equal to 1 if there is a wage agreement in industry *j* at date *t* (quarter-year). Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table 5: Marginal effects of covariates in the Probit model for the enforcement dates of wage agreements

Dependent variable - *Dummy variable for enforcement dates of wage agreements*	(1)	(2)	(3)
Cumulated inflation	5.531***	6.061***	7.740***
	(0.575)	(0.648)	(0.658)
Cumulated real NMW change	2.463***	1.780***	2.431***
	(0.567)	(0.688)	(0.726)
Cumulated real aggregate wage change	6.529***	7.326***	8.659***
	(0.971)	(1.151)	(1.151)
Cumulated real industry wage change	3.761*	3.532*	3.859*
	(2.046)	(2.059)	(2.180)
Local unemployment rate	0.054***	0.020	0.024
	(0.013)	(0.017)	(0.017)
Output gap	-0.005	0.271	0.282
	(0.327)	(0.384)	(0.393)
Duration			
1 year	0.311***	0.311***	0.325***
	(0.015)	(0.016)	(0.016)
2 years	0.155***	0.153***	0.156***
	(0.033)	(0.033)	(0.033)
3 years	0.026	0.013	-0.001
	(0.049)	(0.048)	(0.046)
Before 2010			
Q1	0.069***		
	(0.012)		
Q2	-0.047***		
	(0.010)		
Q3	0.019*		
	(0.010)		
Q4	ref		
Non-conformity with the NMW	0.037***	0.033***	
	(0.009)	(0.010)	
After 2010			
Q1	0.129***		
	(0.011)		
Q2	0.013		
	(0.009)		
Q3	-0.031***		
	(0.009)		
Q4			
Non-conformity with the NMW	0.081***	0.074***	
	(0.008)	(0.009)	
N	9 777	9 777	9 777
Year / Dates dummies	Year	Date	Date
Industry dummies	Yes	Yes	Yes

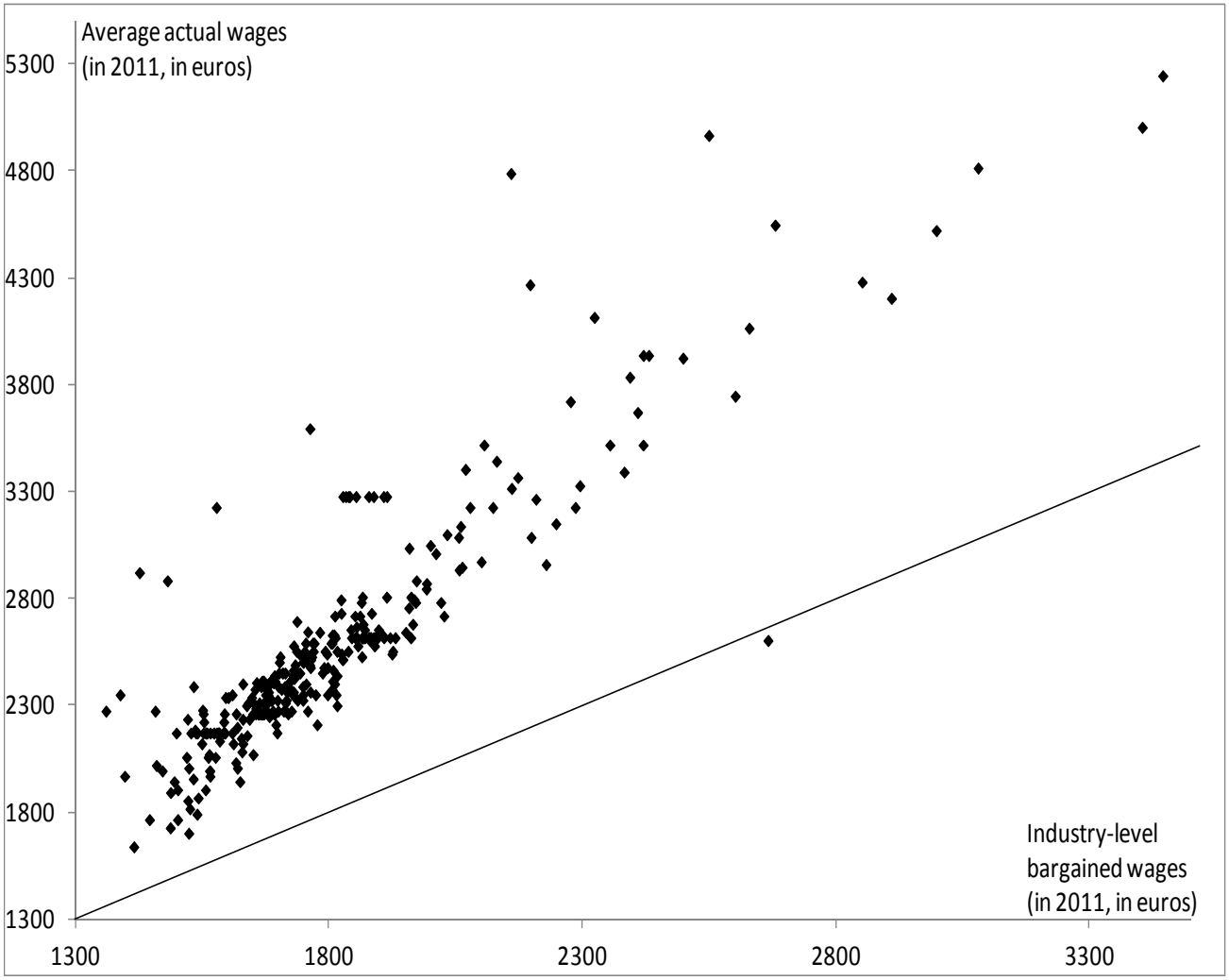
Note: This table reports marginal effects estimated with Probit models. Standard errors are obtained using bootstrap methods and are reported in brackets. The dependent variable is the dummy variable equal to 1 if there is a wage agreement in industry *j* at date *t* (quarter-year). Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table 6: Parameter estimates of the Tobit model – Wage floor changes

Dependent variable : Nominal wage floor changes	All	High prop. of NMW workers	Low prop. of NMW workers	Metalworking
Cumulated inflation	0.586*** (0.039)	0.568*** (0.055)	0.373*** (0.067)	0. 772*** (0.062)
Cumulated real NMW change	0.248*** (0.031)	0.336*** (0.059)	0.267*** (0.070)	0.135*** (0.048)
Cumulated real aggregate wage change	0.140*** (0.053)	0.194*** (0.072)	0.106 (0.111)	0.076 (0.120)
Cumulated real industry wage change	0.261*** (0.093)	-0.026 (0.109)	0.287* (0.156)	0.827*** (0.292)
Local unemployment rate	0.001 (0.001)	0.012*** (0.003)	0.002 (0.075)	0.001 (0.075)
Output gap	0.004 (0.013)	-0.046*** (0.022)	-0.032 (0.075)	-0.010 (0.049)
Mills Ratio	-0.002*** (0.000)	-0.001*** (0.001)	-0.005*** (0.001)	0.001 (0.001)
R^2	0.603	0.571	0.604	0.666
N	17 064	5,460	4,337	4,637
Time dummies	Date	Date	Date	Date
Industry dummies	Yes	Yes	Yes	Yes

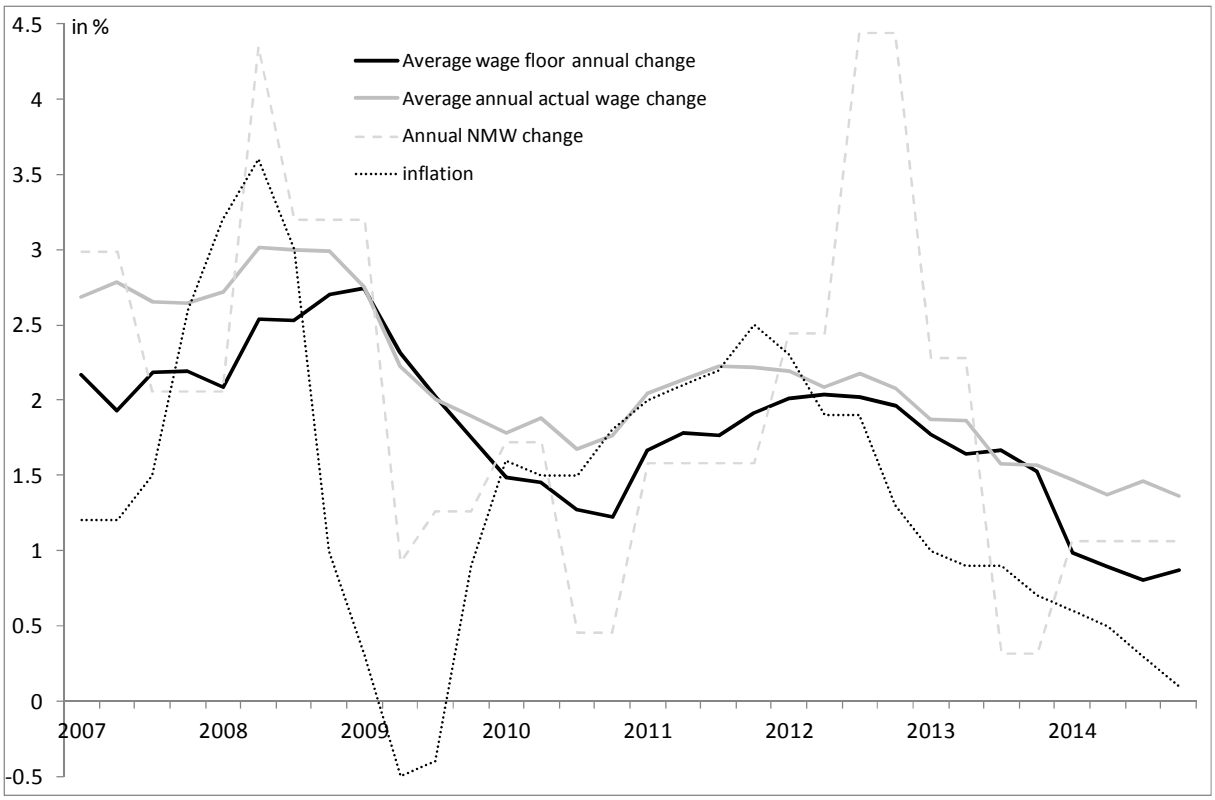
Note: The dependent variable is the nominal (or real) wage floor change between two effects of wage agreements in a given industry. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Figure 1: Average wage floors versus average actual wages (2011)



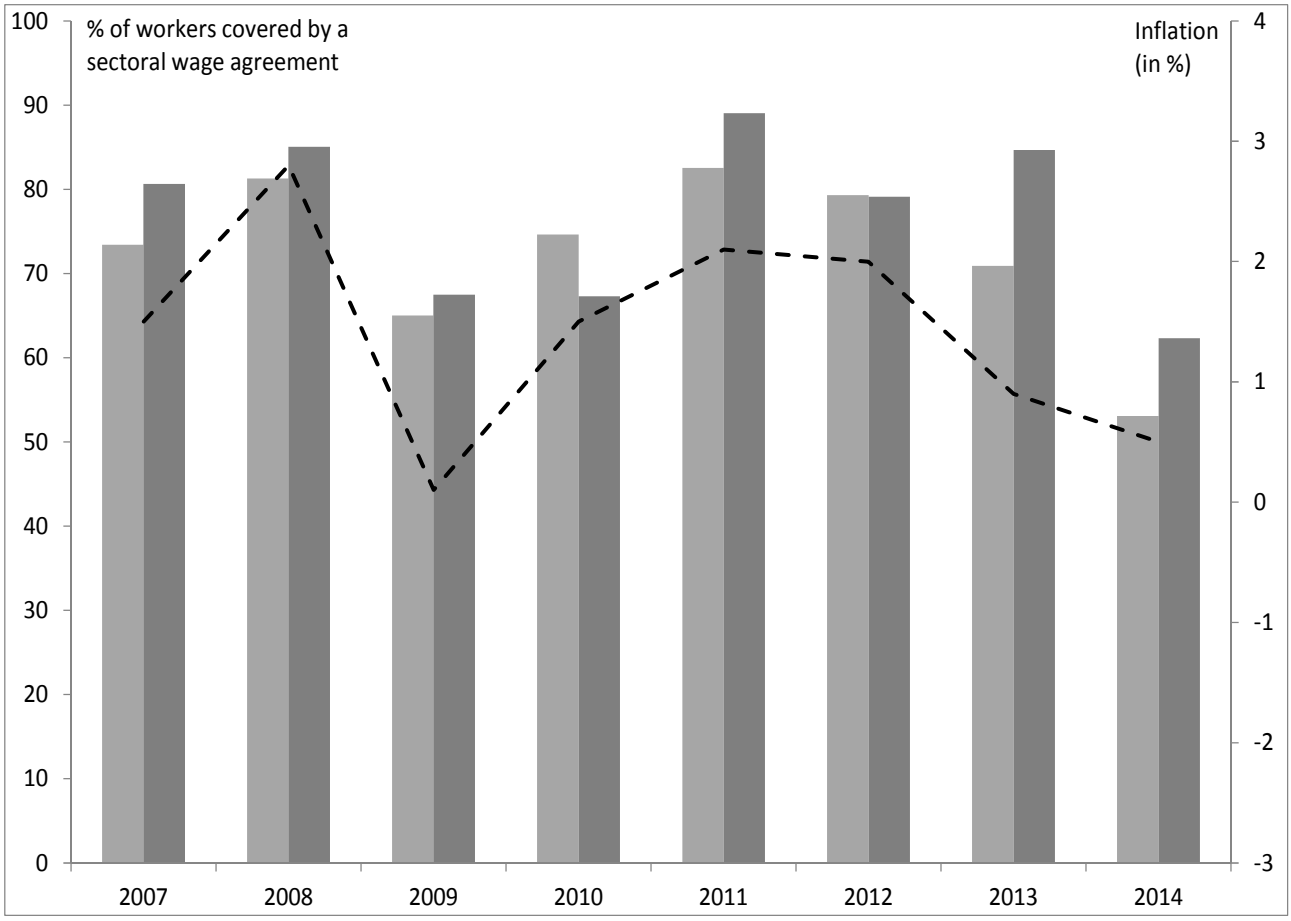
Notes: Actual average gross wages are collected and published by the Ministry of Labor for the year 2011 (in euros). Using our data, we calculate the weighted average wage floor for each industry in year 2011. Each point represents a given industry whereas the dark line is the line where y=x.

Figure 2: Average size of wage changes in industry-level wage agreements (2007-2014)



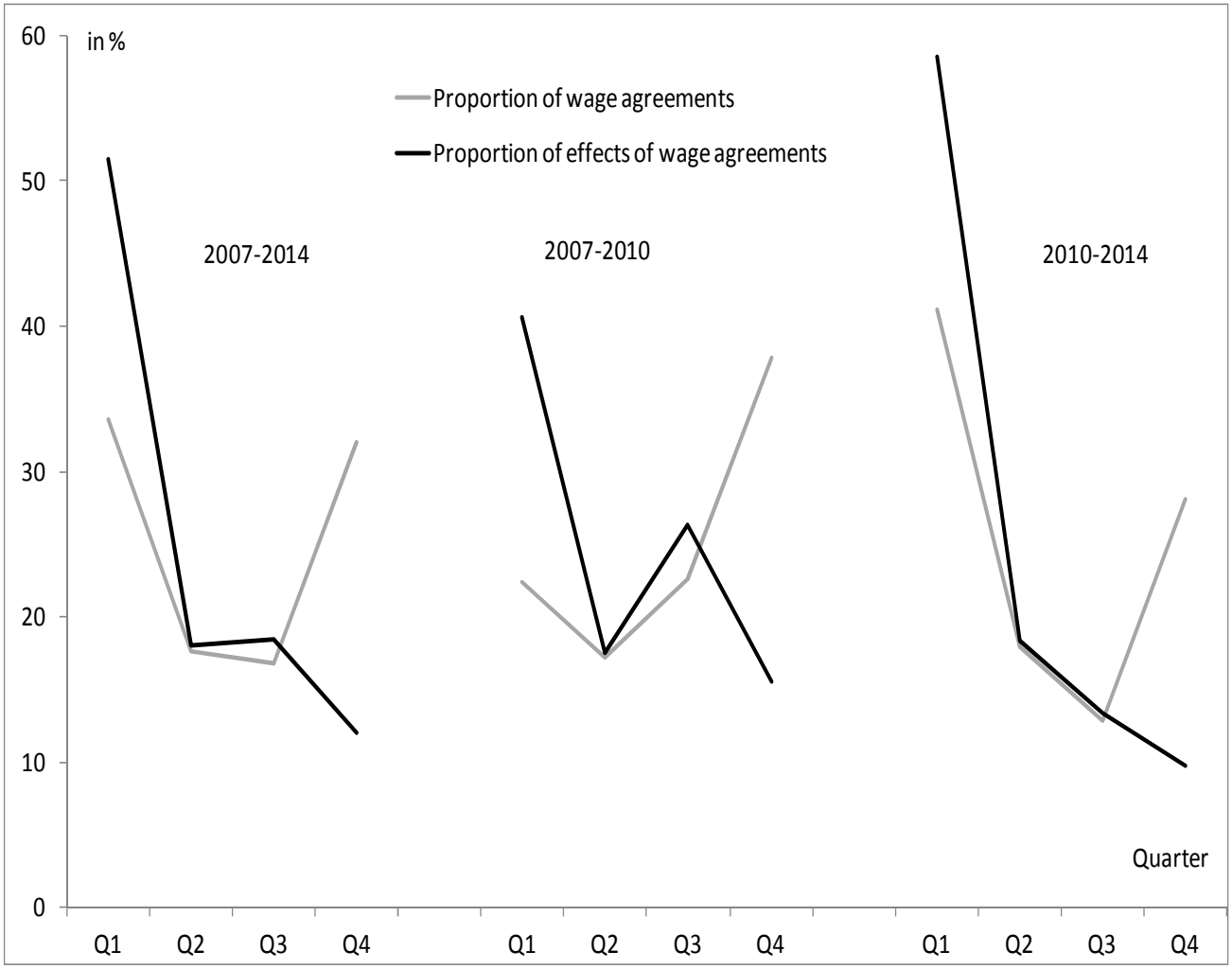
Notes: The average wage increase in industry agreement is computed as a weighted (by the number of employees) average of all wage increases stipulated in industry agreement coming into effect at a given date (year/quarter). The overall wage increase is the annual increase in the aggregate actual wage index (SMB – source: DARES). NMW is the NMW increase at an annual frequency (source: INSEE). Inflation is the overall CPI annual growth (source: INSEE).

Figure 3: Percentage of workers covered by a new industry-level wage agreement in a given year



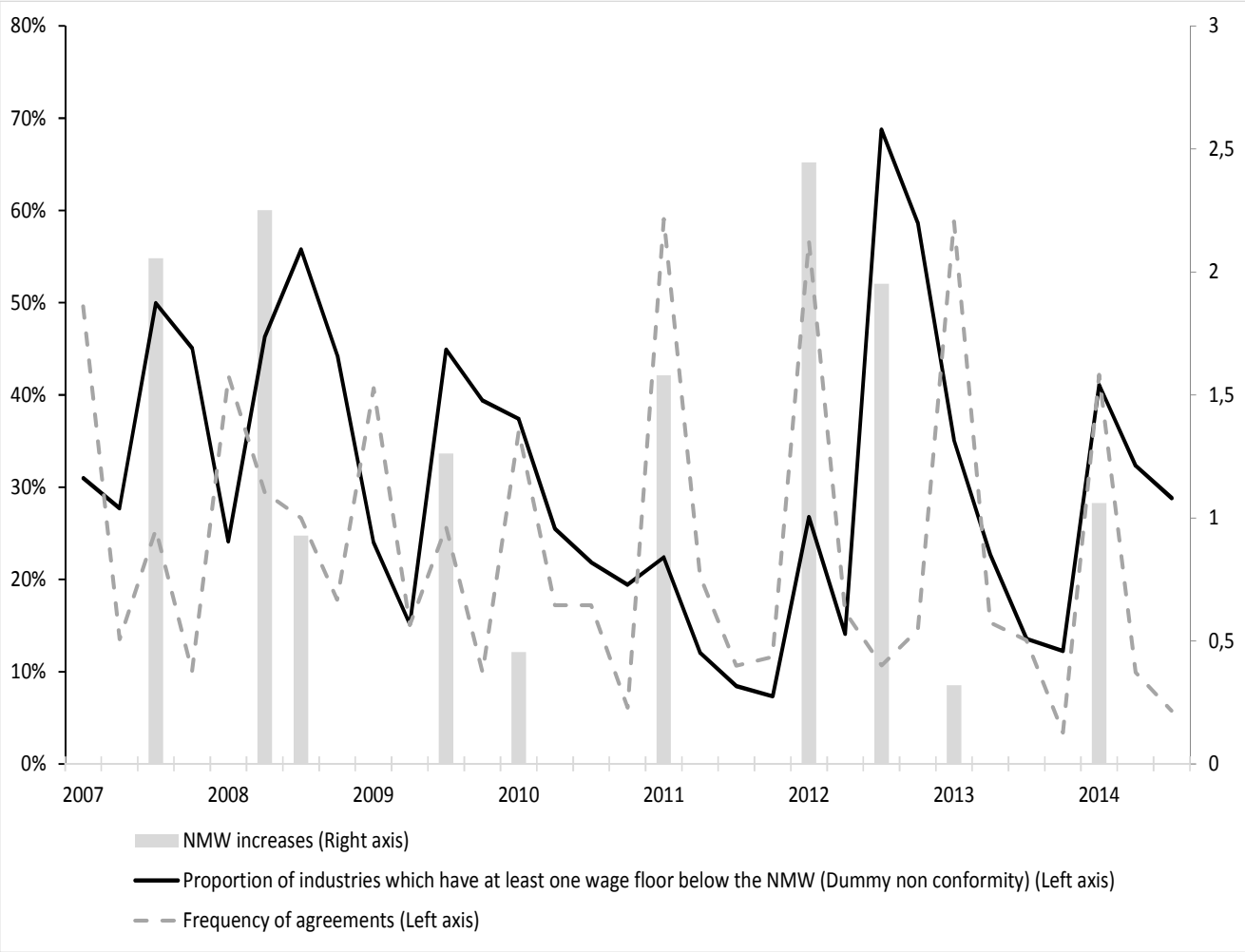
Notes: The light grey histogram is the percentage of industries (weighted by the number of employees) which sign a wage agreement in a given year. The dark grey histogram is the percentage of industries (weighted by the number of employees) when wage agreements come into effect in a given year. The dotted line is the annual average inflation rate in France (Insee).

Figure 4: Proportion of industry-level wage agreements (in percent) in a given month



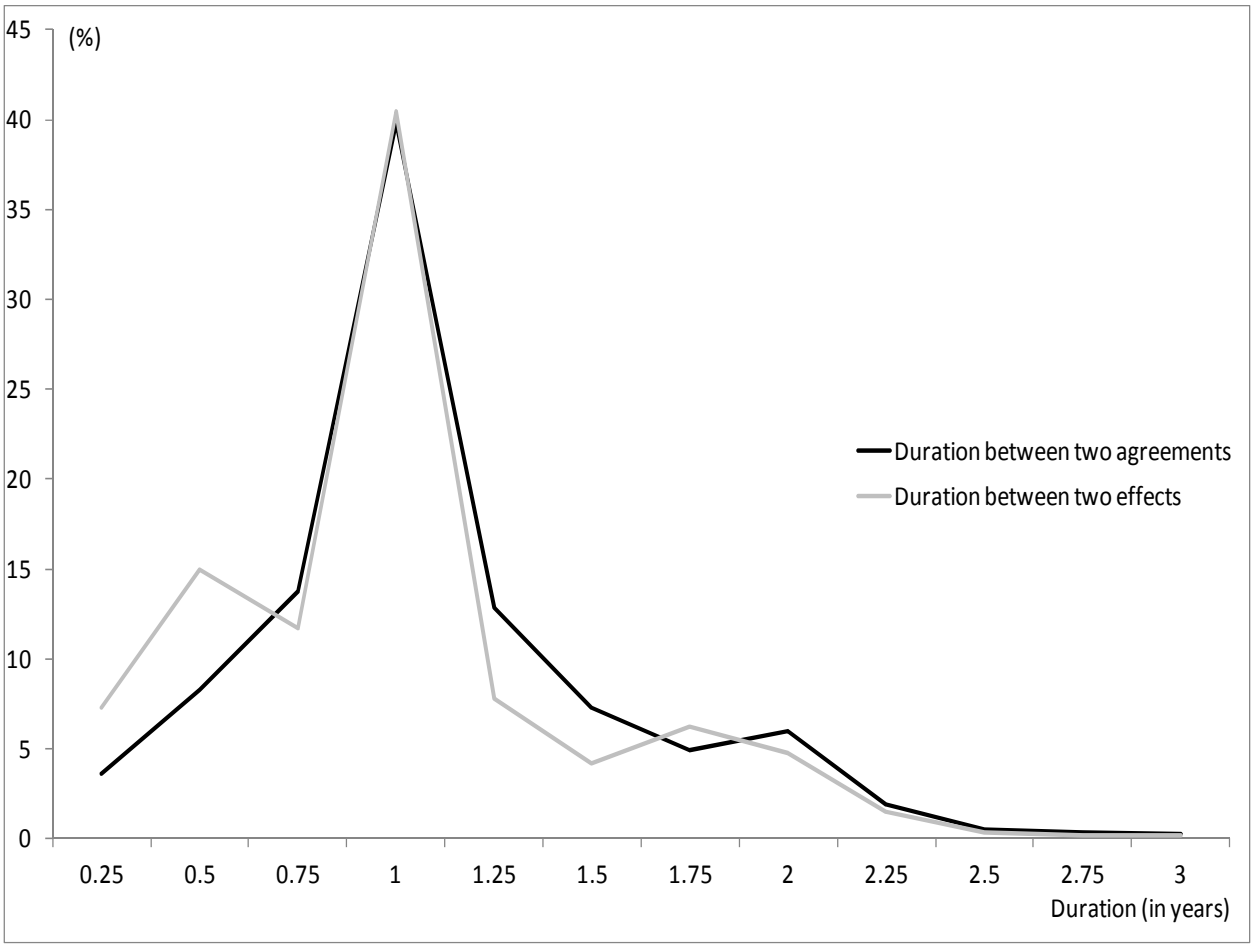
Notes: The light grey line is the weighted proportion of agreements that are signed in a given quarter and the black line is the same proportion but for the effects of agreements. We compute those statistics for three periods: 2007-2014, 2007-2010 where the NMW was usually adjusted in Q3 and 2010-2014 where the NMW was usually adjusted in Q1.

Figure 5: Proportion of industries with at least a wage floor below the NMW over time



Notes: grey histogram: NMW increases (in percentage) (right axis). Dark solid line: proportion of industries with at least one wage floor below the NMW (in percentage) calculated as the ratio of the total number of employees in non-conform industries over the total number of employees. Grey dashed line: the proportion of industries (weighted by the number of employees) when wage agreements come into effect in a given date (quarter-year).

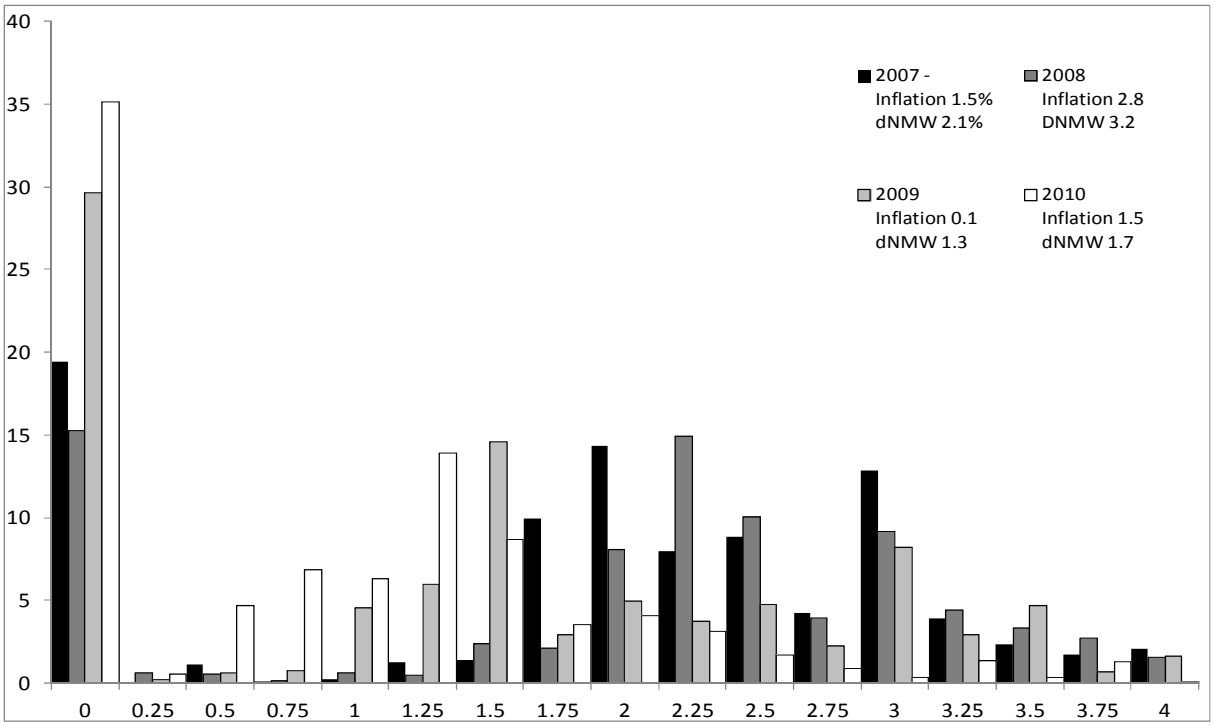
Figure 6: Distribution of durations (in years) between two successive wage agreements (or two dates of effect of wage agreements)



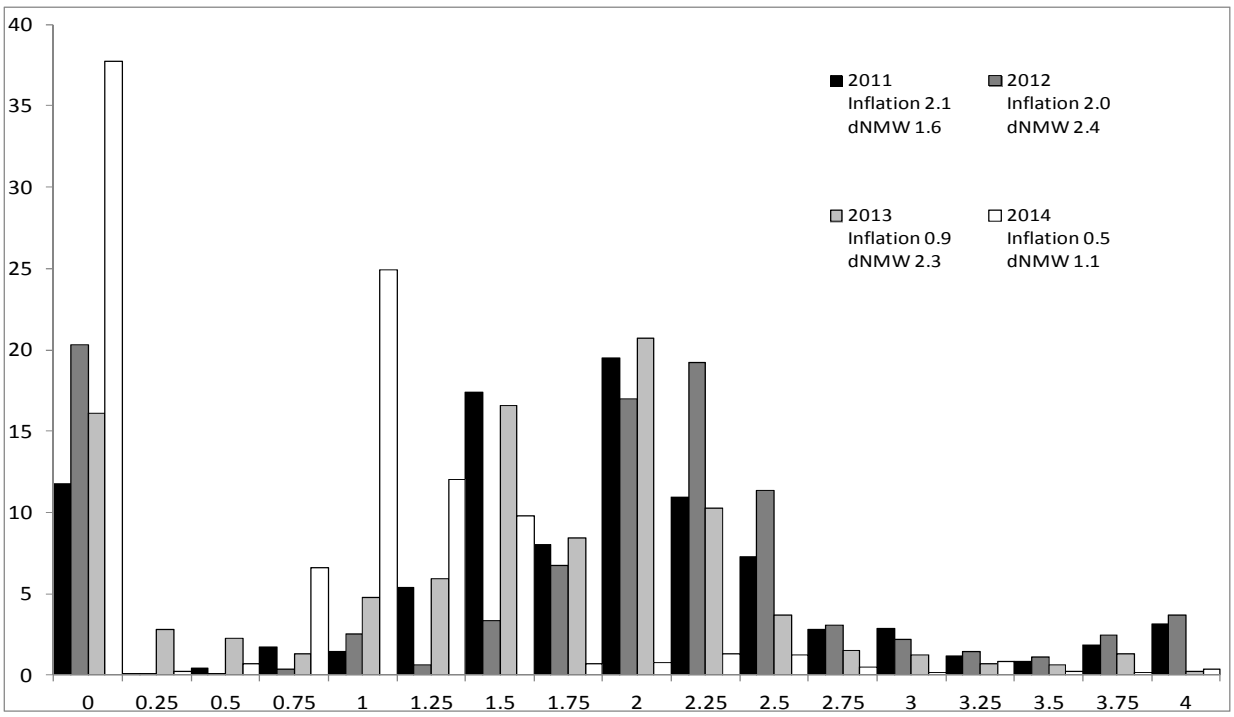
Notes: durations are computed as the difference between two dates of successive agreements (or two dates of effects of agreements). All industries are considered over the period 2007-2014.

Figure 7: Distribution of wage floors variations between two wage agreements

2007-2010

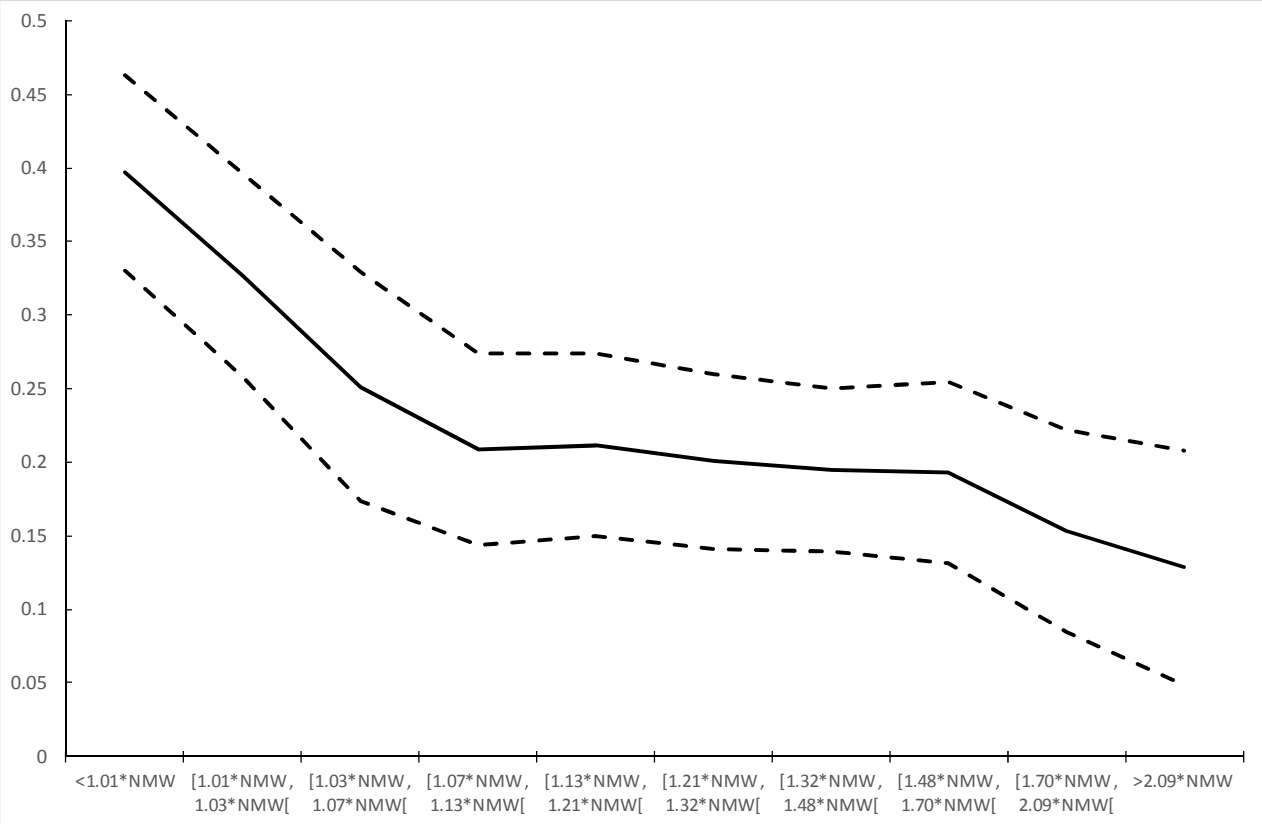


2011-2014



Notes: this figure plots the distribution of wage changes between two dates of effect of industry-level agreements for all industries in our sample. Annual wage variations are calculated during the last quarter of a given year. Distributions are weighted by the number of employees.

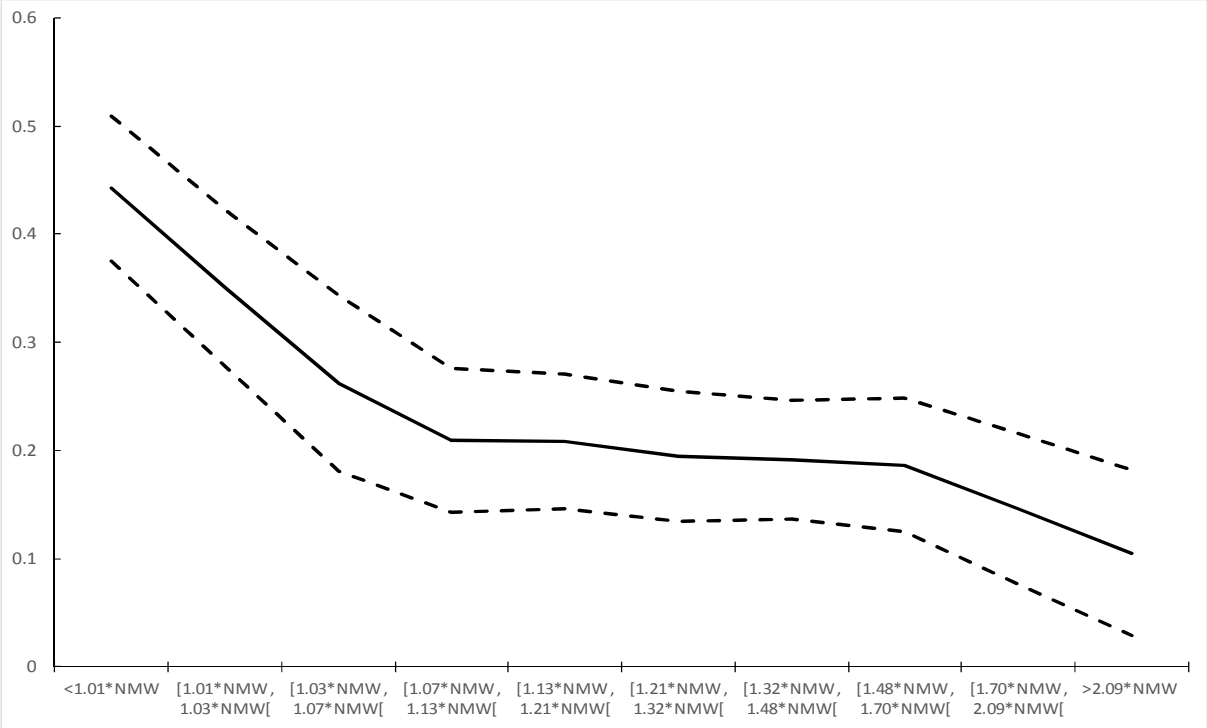
Figure 8: Elasticity of wage floor increases with respect to the real NMW increases along the wage floor distribution



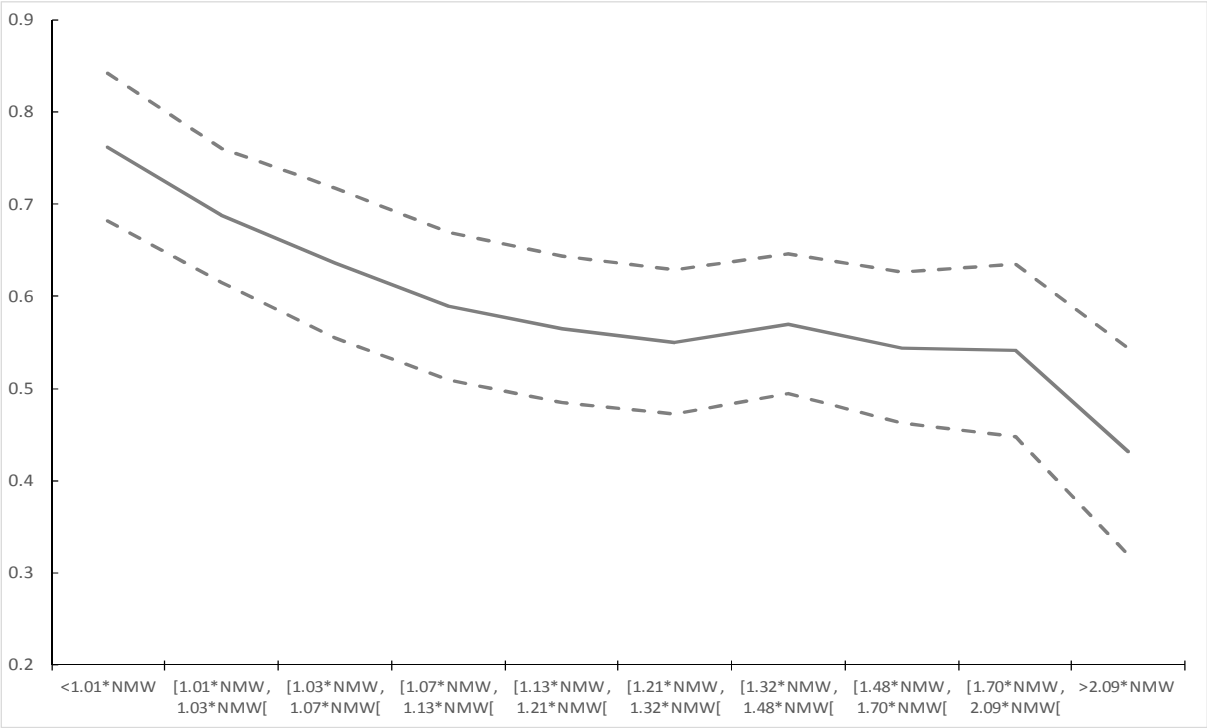
Notes: this figure reports parameter estimates obtained by adding to our baseline Tobit model interaction terms (dummy variables) which capture the relative position of a wage floor along the wage distribution. This relative position is calculated with reference to the NMW level. The black line reports elasticities of the nominal wage floors with respect to NMW increases (in real terms); the dashed lines represent the 95%-confidence interval.

Figure 9: Elasticity of wage floor variations with respect to real NMW increases and with respect to inflation along the wage floor distribution

a) Real NMW



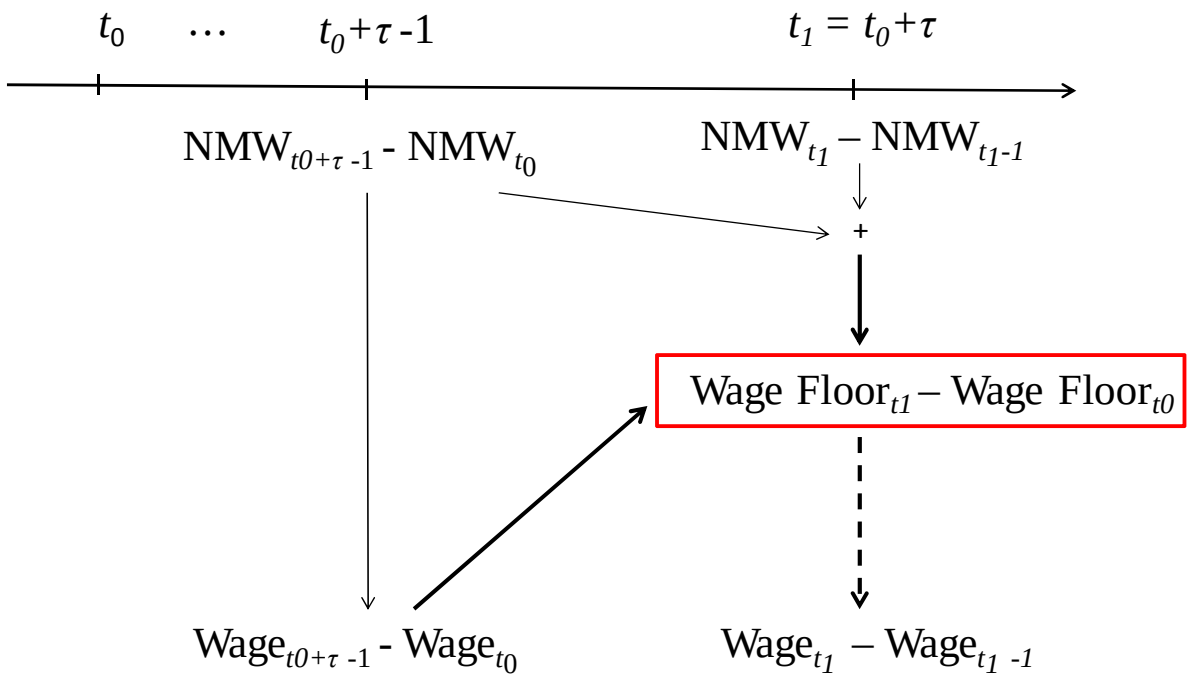
b) Inflation



Notes: this figure reports parameter estimates obtained by adding to our baseline Tobit model interaction terms (dummy variables) which capture the relative position of a wage floor along the wage distribution. This relative position is calculated with reference to the NMW level. The black line reports elasticities of the nominal wage floors with respect to NMW increases (in real terms). The grey lines report elasticities of nominal wage floors with respect to inflation. The dashed lines represent the 95%-confidence interval.

APPENDIX (not intended to be published)

Figure A: Timing of wage floor adjustments



2

Notes: t0 and t1 correspond to dates of wage agreements. “NMW” is the national minimum wage that can be modified at all dates. “Wage” correspond to actual individual wages that can be adjusted by different factors including NMW and wage floors. “Wage Floor” are wage floors that are adjusted at each wage agreement. They can impact actual wages and are impacted by past evolution of actual wages in a given industry but also by modifications in the NMW.

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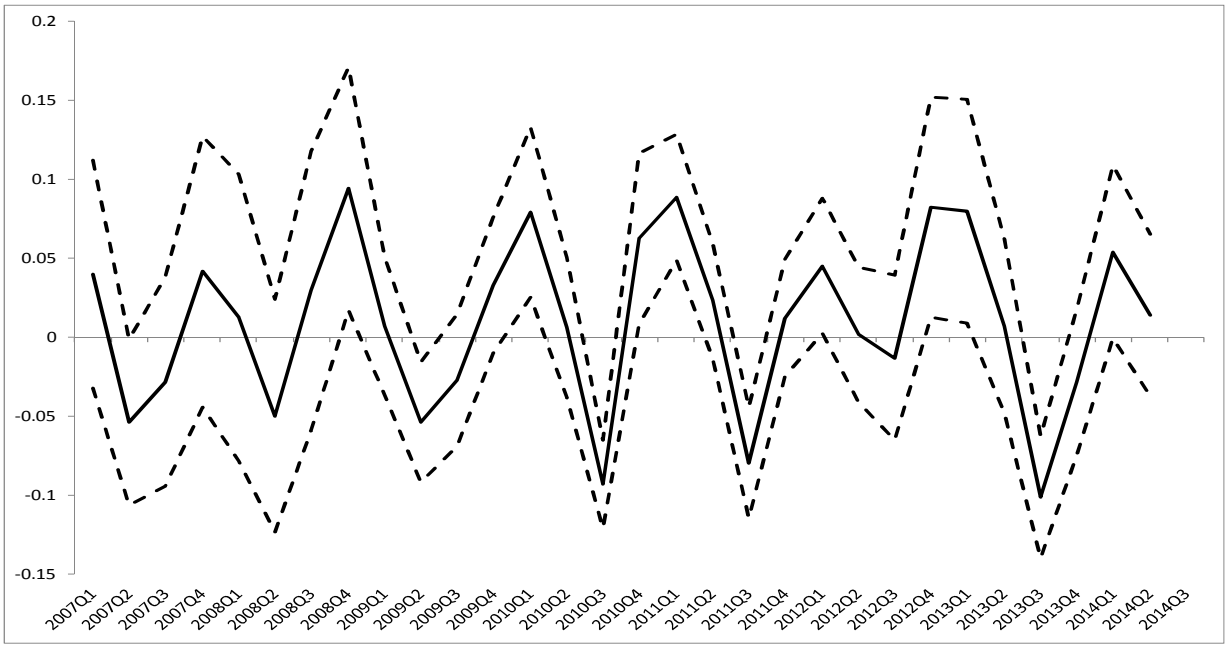
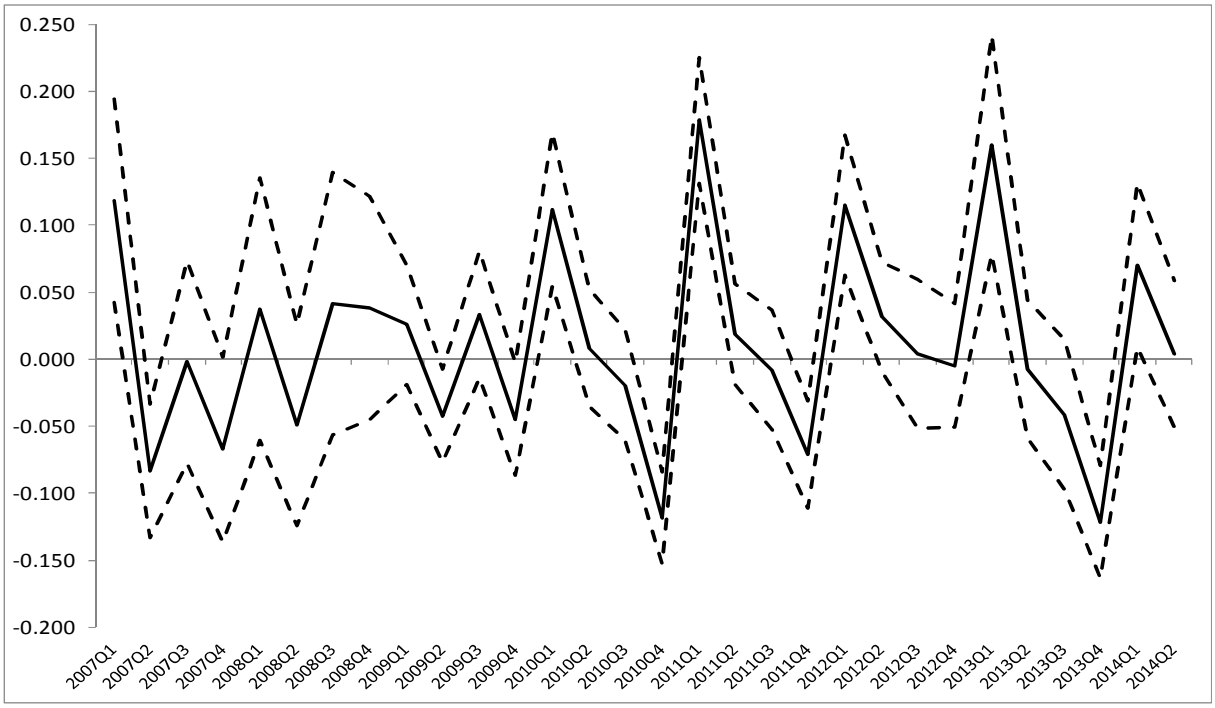
Figure B: Estimations of time effects in Probit regressions using date controls:

a) Agreement dates of wage agreements



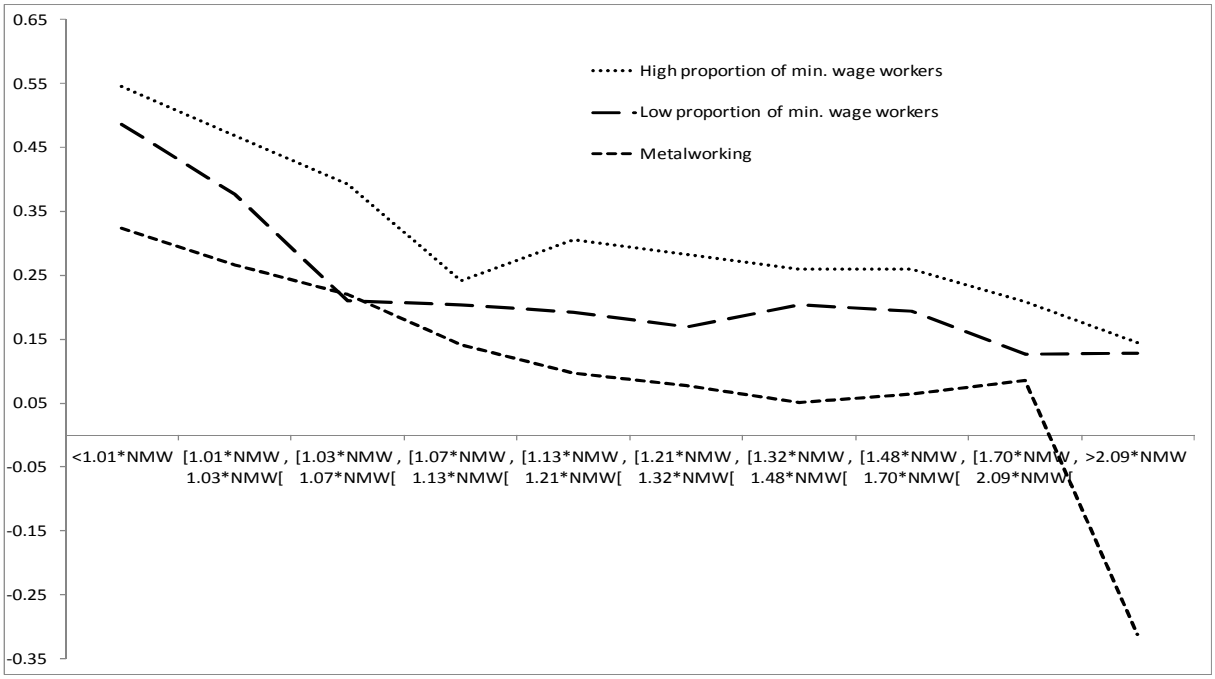
b) Enforcement dates of wage agreement



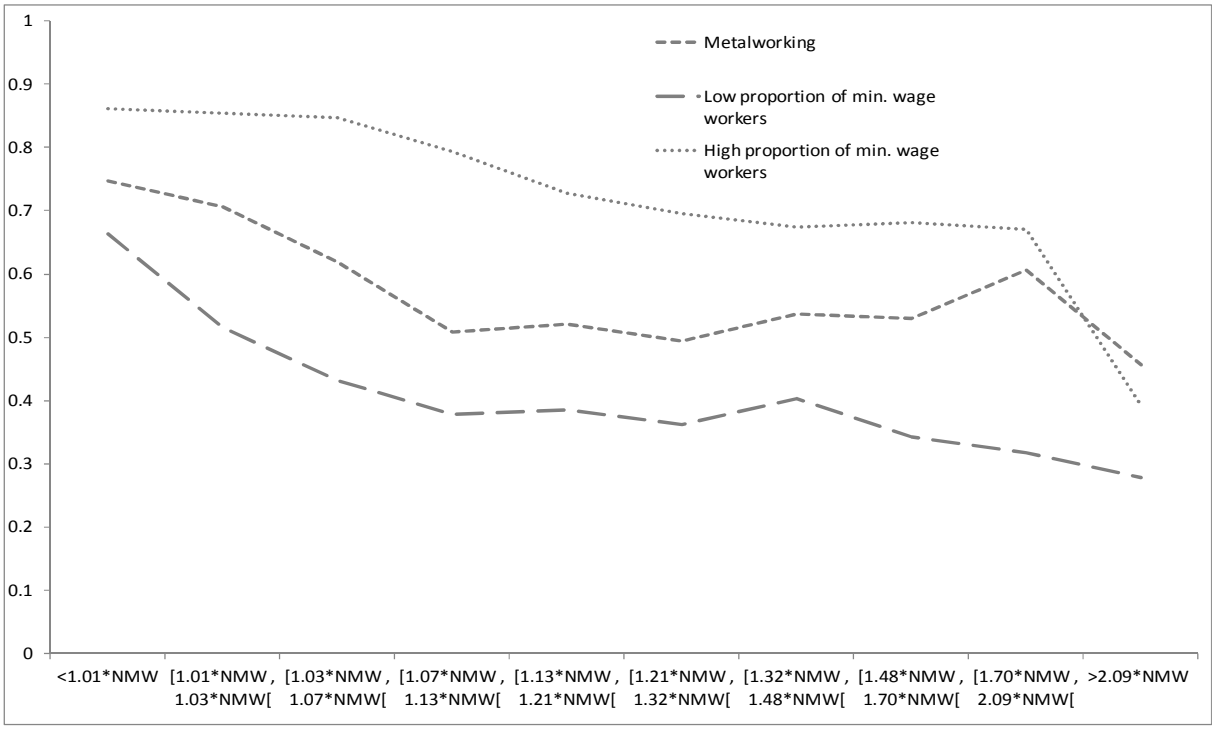
Notes: these figures report parameter estimates (black solid line) and 95%-confidence interval (black dashed lines) associated with date dummies used as time controls in Probit regressions (equation (2)). Q42014 is chosen as reference.

Figure C: Elasticity of wage floor variations with respect to the real NMW increases and inflation along the wage floor distribution (industry heterogeneity)

a) Real NMW



b) Inflation



Notes: this figure reports parameter estimates obtained by adding to our baseline Tobit model interaction terms (dummy variables) which capture the relative position of a wage floor along the wage distribution. This relative position is calculated with reference to the NMW level. The black line reports elasticities of the nominal wage floors with respect to NMW increases (in real terms). The grey lines report elasticities of nominal wage floors with respect to inflation. The dashed lines represent the 95%-confidence interval.

Table A: Marginal effects of covariates in the Probit model for the dates and enforcement dates of agreements (Industry heterogeneity)

	Agreements			Effects		
	National		Metalworking	National		Metalworking
	High prop. of min wage workers	Low prop. of min wage workers		High prop. of min wage workers	Low prop. of min wage workers	
Cumulated inflation	8.512***	6.171***	7.642***	6.176***	4.227***	7.520***
	(1.342)	(1.060)	(1.356)	(1.369)	(1.129)	(1.297)
Cumulated real NMW change	3.671**	1.972*	3.616**	3.564**	0.024	3.181***
	(1.086)	(1.100)	(1.302)	(1.728)	(0.822)	(1.239)
Cum. real aggregate wage change	8.969***	5.503***	9.996***	5.936**	5.987***	9.432***
	(2.742)	(1.898)	(3.054)	(2.752)	(1.996)	(2.902)
Cum. real industry wage change	1.891	-2.895	2.891	-0.493	1.260	5.153
	(2.476)	(2.373)	(6.271)	(2.390)	(2.692)	(6.561)
Local unemployment rate	0.102	-0.026	0.014	0.018	0.000	0.027
	(0.105)	(0.039)	(0.30)	(0.110)	(0.038)	(0.028)
Output gap	0.458	0.149	-0.124	0.019	1.267*	0.037
	(0.607)	(0.623)	(1.544)	(0.610)	(0.704)	(1.585)
Duration						
1 year	0.223***	0.324***	0.300***	0.234***	0.329***	0.312***
	(0.029)	(0.021)	(0.028)	(0.031)	(0.025)	(0.030)
2 years	0.056	0.224***	0.061	0.089*	0.185***	0.061
	(0.055)	(0.046)	(0.064)	(0.058)	(0.050)	(0.070)
3 years	-0.185**	0.111*	-0.098	-0.115	0.090	-0.078
	(0.037)	(0.063)	(0.337)	(0.093)	(0.068)	(0.333)
Before 2010						
Non-conformity with the NMW	0.018	0.008	0.091*	0.038*	0.052***	0.081
	(0.018)	(0.015)	(0.055)	(0.022)	(0.019)	(0.052)
After 2010						
Non-conformity with the NMW	0.034***	0.027*	0.116***	0.066***	0.058***	0.126***
	(0.012)	(0.015)	(0.020)	(0.014)	(0.017)	(0.019)
Nobs	2984	3169	2291	2984	3169	2291

This table reports marginal effects estimated with Probit models. Standard errors are obtained using bootstrap methods and are reported in brackets. The dependent variable is the dummy variable equal to 1 if there is a wage agreement in industry *j* at date *t* (quarter-year). Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table B: Parameter estimates of the Tobit model – Wage floor changes – Before / after 2010

Dependent variable : Nominal wage floor changes					
		All	High prop. of min wage workers	Low prop. of min wage workers	Metalworking
Before 2010	Cumulated inflation	0.578*** (0.050)	0.566*** (0.073)	0.362*** (0.109)	0.725*** (0.085)
	Cumulated real NMW change	0.212*** (0.035)	0.349*** (0.078)	0.198*** (0.067)	0.174*** (0.058)
	Cum. real aggregate wage change	0.201*** (0.074)	0.116 (0.098)	0.279* (0.170)	0.274 (0.182)
	Cum. real industry wage change	0.607*** (0.195)	0.172 (0.174)	0.899*** (0.246)	1.904*** (0.670)
After 2010	Cumulated inflation	0.590*** (0.039)	0.554*** (0.067)	0.463*** (0.062)	0.711*** (0.094)
	Cumulated real NMW change	0.256*** (0.041)	0.230*** (0.076)	0.284*** (0.083)	0.201*** (0.077)
	Cum. real aggregate wage change	0.163** (0.067)	0.227* (0.125)	-0.043 (0.122)	0.036 (0.189)
	Cum. real industry wage change	0.107 (0.097)	-0.080 (0.167)	-0.021 (0.137)	0.147 (0.329)
	Local unemployment rate	0.001 (0.001)	0.011*** (0.004)	0.006 (0.005)	0.001 (0.001)
	Output gap	0.015 (0.015)	0.029 (0.022)	-0.047 (0.033)	-0.012 (0.048)
	Mills Ratio	-0.002*** (0.000)	-0.003*** (0.001)	-0.004*** (0.001)	0.000 (0.001)
	R^2	0.599	0.547	0.611	0.667
	N	17,064	5,460	4,337	4,637
	Time dummies	Date	Date	Date	Date
	Industry dummies	Y	Yes	Yes	Yes

Note: The dependent variable is the nominal (or real) wage floor change between two effects of wage agreements in a given industry. Significance levels: *** p<0.01, ** p<0.05, * p<0.1