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WAGE RIGIDITIES AND BUSINESS CYCLE FLUCTUATIONS: A LINKED EMPLOYER-EMPLOYEE ANALYSIS

by Effrosyni Adamopoulou*, Emmanuele Bobbio*, Marta De Philippis* and Federico Giorgi*

Abstract

This paper analyses wage dynamics in Italy in the last 25 years with special focus on the recent recession. Using linked employer-employee data we document the presence of a trade-off between wage and employment adjustments: firms experiencing more wage rigidities exhibit more employment adjustments. Over time, the average amount of nominal wage rigidities was subdued during the recession years. Most of the adjustments took place through the part of wages that is not negotiated at the national level. In a rather rigid institutional context, a larger share of temporary workers, whose contractual relationship may be terminated without cost and whose wages are more frequently renegotiated, served instead as a significant flexibility enhancing margin. More broadly, we find that larger firms, with a greater share of blue-collar workers or belonging to a sector in which firm bonuses represent a large part of annual earnings, were the ones displaying a higher level of wage flexibility.

JEL Classification: J31, J33.

Keywords: wage dynamics, contractual wages.

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1. Introduction¹

Understanding what drives wage dynamics is important in order to explain why aggregate wages tend to be much less volatile over time than what standard macroeconomic models predict (Figure 1). Moreover, it helps policymakers decide which measures to prioritize during downturns. The relatively flat evolution of aggregate wages is usually explained through (i) the presence of wage rigidities, that is a well-known feature of many labour markets (see for example Kahn, 1997; Devicienti et al., 2007; Dickens et al., 2007), and through (ii) cyclical changes in the composition of the workforce (Lemieux, 2006), since lower-paid workers are usually more severely affected during recessions. Some recent literature (D'Amuri, 2014; Adamopoulou et al., 2016; Daly et al, 2016; Verdugo, 2016) indeed finds that composition effects have driven up aggregate wages, particularly during the recent recession.

This paper focuses on wage rigidities and studies the distribution of wage changes for job stayers over the last 25 years, with a particular focus on the Great Recession. We evaluate the determinants of wage rigidities and we describe how firms, depending on their wage structure and workforce composition, display very different levels of wage rigidity. Moreover, we study how firms reacted differently along the cycle, depending on their historical level of wage rigidity. In particular, we seek to answer whether firms which were structurally less able to adjust wages of job stayers reacted by adjusting employment more and whether these firms, by hiring new workers at a re-negotiated salary which corresponds more to the new cyclical conditions, managed to partially compress their average wage per employee, even in the presence of high levels of wage rigidity for stayers.

To measure rigidities in daily wages we use newly available administrative employer-employee matched data for Italy that cover the years between 1990 and 2014. We rely on measures of wage rigidity based on the asymmetry of the distribution of yearly wage changes for job stayers and we find important adjustments in wages during the recessionary years (2009-2013). These adjustments were mostly driven by large firms and were mainly affecting blue collars. Moreover, using a unique hand-collected dataset on negotiated wages for employees in the metalwork industry and in the wholesale and retail industry, we document that the majority of these wage adjustments were enacted through the part of the wages that excludes changes in nationally negotiated minimum wages as well as wage variations due to lump-sum top-ups in case of delays in the renewal of the

¹ Many thanks to Matteo Bugamelli, Francesco D'Amuri, Raffaella Nizzi, Alfonso Rosolia, Paolo Sestito, Eliana Viviano and seminar participants at the Bank of Italy for useful comments and help. The views expressed in this paper are those of the authors and do not necessarily reflect those of the Bank of Italy.

collective contract. In addition, we show that changes in overtime hours per day do not seem to be the main driver behind our results.

In a second stage, we point out the large heterogeneity in the ability of firms to adjust wages and we study the determinants of this firm-level wage rigidity. We find that larger firms, with a higher share of blue collar workers and which belong to sectors whose wage structure is characterized by a larger amount of bonuses display more flexible wages.

Finally, we show that more rigid firms reacted to the shock by adjusting employment more, but only if they were endowed with a flexible enough workforce, i.e. with a large share of temporary workers before the crisis. In this way they managed, even if rigid, to indirectly adjust their average cost per employee.² This type of flexible workforce enabled firms to deal with the rather rigid institutional setting that characterizes labour relations in Italy.

Several previous studies have documented the existence of wage rigidities before the Great Recession. An important example is Kahn (1997), who uses U.S. data and estimates that employees would experience nominal wage reductions 47 per cent more frequently, absent wage rigidities. Dickens et al. (2007) analyse rigidities in the U.S. and in 15 European countries, and find that the fraction of workers subject to wage rigidity is 28 per cent on average, with very large heterogeneity across countries (from 4 percent in Ireland to 58 per cent in Portugal, Italy is in the middle of the distribution). By analysing wage rigidities during the recent downturn, we complement recent findings for the U.S., the U.K. and Europe that find evidence of increased flexibility during the recent recession (Kurmann, McEntarfer, and Spletzer, 2014; Brandolini and Rosolia, 2015; Elsby, Shin, and Solon, 2016; Verdugo, 2016). We contribute to this literature by investigating more thoroughly which are the main determinants of wage rigidity/flexibility.

In addition, our paper speaks to the literature on the relationship between wage and employment adjustments. The available literature is much scarcer in this case and the evidence is mixed: Card and Hyslop (1997) find that wage rigidities have small effects on the economy, Devicienti et al. (2007) and Ehrlich and Montes (2015) find instead that wage rigidities are associated to lower employment levels. We contribute to this debate by exploiting the richness of our data in terms of controls and time span and we estimate the relationship between wage rigidity, accessions and separations, as well as with the average wage per employee at the firm level.

² Given that rigid firms may choose to hire more temporary workers as a response to the crisis, we use the firms' stock of temporary workers before the crisis in order to classify them.

The structure of the paper is as follows: Section 2 briefly discusses the Italian institutional setting; Section 3 describes the datasets used for the analysis and Section 4 studies the presence of wage rigidities for job stayers. Section 5 analyses separately the evolution of the nationally-negotiated and the residual part of wages. Section 6 estimates the relationship between wage adjustments, employment adjustments and the average wage per employee at the firm level. Finally, Section 7 concludes.

2. Institutional setting

The evolution of wages in Italy is strictly linked to its institutional setting of labour relations. Although there is no national minimum wage determined by the government, wages are negotiated at the national level setting minima for all employees in each specific sector (CCNL³). During the negotiations social partners take into account the expected inflation and the general economic outlook in order to reach an agreement on nominal wage increases (Rosolia, 2015). This mechanism has been in place since 1993 and inevitably results in some degree of downward wage rigidity as employers are obliged to respect the nationally negotiated minima. These minima differ according to the position of the employee and are valid for 3 years (2 years before 2009). In case of a negative shock in firms' performance, this predetermination of wages over the contractual horizon by itself reduces the possibilities of timely adjustments, at least for the centrally bargained component. However, wages may still be flexible thanks to the part that is not centrally negotiated.⁴ Before 1993 the wage inflation adjustment was practically automatic through an indexation mechanism. The abolition of this mechanism was found to be associated with a decline in downward real wage rigidities (Devicienti et al., 2007).

Moreover, the Italian labour market is dual due to the presence of both permanent and temporary contracts. While the use of temporary contracts was much enlarged since 1997, more than 85 per cent of all employees are permanent ones. Depending upon the size of the firm (below or above 15 employees) there is also a relatively stringent employment protection legislation regarding permanent workers (Cappellari et al., 2012). This limits the ability of firms to fire workers in case of a negative shock. Therefore, wage rigidities and employment protection legislation interact in the evolution of wage and employment adjustments over the business cycle.

³ Contratto Nazionale Del Lavoro.

⁴ In the paper we abstract from firm-level agreements as information is scarce.

3. Data

The source for the data consists of social security payments made by legal entities to the Italian National Social Security Institute (INPS) for all employees with open-ended, fixed-term, and apprenticeship contracts between 1990 and 2014. From this master data, INPS extracts two datasets. The first consists of the universe of firms with at least one employee at some point during a given calendar year – this extraction runs only up to 2013 and provides data at the firm level. The second consists of the employment histories of all workers born on the 1st or the 9th day of each month (24 dates). The firm extraction contains: the fiscal code; information on the average number of employees over the year and the gross wage bill by occupational category – blue collar, white collar, middle and top manager; the two digit sector code (NACE 2002) and the province code; the date of entry and exit (if any). The worker extraction provides information on: demographics; the annual gross wage; the number of days worked; maternity and sick leave as well as short time work benefits (STWB, Cassa integrazione guadagni) but only for the period 2005-2014. We restrict attention to the non-agricultural business sector and workers aged between 20 and 64. We use the fiscal code as the definition of firm. Tables 1 and 2 report the descriptive statistics for the sample of firms and workers respectively. The Tables show that our sample of workers covers about 7% of the total workforce in the non-agricultural business sector and 25% of firms.⁵

4. Rigidities of nominal wages

This Section studies the evolution over time of wage rigidities in Italy in the non-agricultural business sector between 1990 and 2014. In line with the existing literature on wage rigidities (for Italy Devicienti et al 2007), we restrict the analysis to the sample of job stayers in order to analyse wage changes net of composition effects.⁶ Furthermore, we restrict the sample to employees with a strong labour market attachment: we keep only full-time workers aged 20-64, who have worked during the whole year (super-survivors) in the same firm with the same contract (full time/part time) and position (blue-collar/white-collar/middle manager). Since 2005 we also observe maternity and sick leaves, as well as periods of different type of short time work benefits (CIG/ fondo di solidarietà). We drop workers under short term work benefits from 2005 onwards, when the information is available. This is important when analysing the cyclicity of wage changes for stayers as these schemes are strongly anti-cyclical. Some other forms of measurement error in daily

⁵ Small firms are, as expected, less represented in the sample of workers.

⁶ In line with the predictions of existing models (Postel-Vinay and Robin, 2004, Gertler and Trigari 2009) we observe that wages of job movers and new entrants respond more to the cycle. In the rest of the Section we focus on job stayers who, in general, renegotiate their wages less often.

wage (level and/or change) remains inevitable, for instance because of episodes of maternity or sick leave or because of adjustments in overtime hours. As long as this measurement error is not correlated with the business cycle, it should not pose a serious concern for our analysis. We further show in a robustness exercise that changes in overtime hours, that are likely to be correlated with the cycle, do not affect our results.

We construct the daily wage for each worker by dividing the total annual wage⁷ by the number of days worked during the year and we calculate the percentage change in daily wages for the sample of workers defined above. We exclude the outliers of the percentage change in daily wages (1st and 99th percentile).

The upper panel of Figure 2 plots the distributions of the annual change in daily wage for 2006 (before the first part of the recession) and 2009 (during the first part of the recession). Each plot includes a solid vertical line at 0 to denote the threshold for nominal wage rigidities, a dotted vertical line at the inflation rate to denote the threshold for real wage rigidities and a dashed one that is a proxy of aggregate productivity developments (annual percentage change of value added per worker). We observe that in 2006 the distribution is skewed to the right, suggesting that the mass of employees who experienced a wage change above the median is larger than the mass of those who experienced a wage change below the median. The peak of the distribution is around the inflation rate and there is an “excessive” concentration between zero and the inflation rate. Moreover the share of employees who received a daily wage cut is extremely low. Asymmetry in the distribution of wage changes is usually interpreted as a sign of wage rigidities (see Goette et al., 2007). Observing spikes around 0 or around the inflation rate allows the distinction between nominal and real wage rigidities, respectively. Given that the inflation was not so high in these years it is hard to distinguish between the two in our case. We observe that in 2009 the distribution shifts to the left, becoming much more symmetric. This points towards a partial increase in wage flexibility during the recent crisis and is in line with the findings of Brandolini and Rosolia (2015) and Verdugo (2016) for the EU and the ones of Kurmann et al. (2014) for the US. Such a flexibility was not reflected in aggregate wages possibly because composition effects have dominated. The lower panel of Figure 2 presents the distributions of the annual change in daily wage for 2010 (a period of slight recovery) and 2013 (during the second part of the recession). We observe that the mass of the distribution shifted to the right as soon as there was a slight recovery in 2010 but shifted again to the left in 2013. The skewness ranged from 0.7 in 2006 to 0.2 in 2009, then up to 0.6 in 2010 and again down to 0.4 in 2013. Overall, wage rigidities seemed to be subdued during the period 2009-2013 compared to the pre-recessionary years.

⁷This is the annual total gross wage, net of firms’ social contributions.

We now provide a more formal description of the presence of wage rigidity, using three alternative measures proposed by the existing literature. All measures are based on the asymmetry of the distribution of percentage wage changes and rely on the fact that observing a missing mass below 0 (or below the inflation rate) implies higher level of wage rigidities. First, we use the skewness of the distribution. Second, we compute the so-called Kelley's skewness. This alternative measure of the asymmetry of a distribution relies on the quantiles of the distribution and it has the advantage of being robust to extreme observations (See Guvenen et al., 2014 and Verdugo, 2016). It is computed as the relative difference between the upper and lower tail inequalities $(L90-50 - L50-10)/L90-10$. A negative number indicates that the lower tail is larger than the upper tail, and vice versa for a positive number. This measure can possibly account for measurement error or changes in hours worked that may emerge as outliers in the data.

Finally, we calculate the percentage of employees with a recorded negative wage change. While the first two measures are positively related to both nominal and real rigidity (i.e a distribution of delta wages skewed towards the left), the last one is negatively related to nominal rigidity.

Before describing the evolution over the last 25 years of wage rigidity, we discuss which other factors, apart from the actual flexibility of hourly wages, may lie behind the observed changes in daily wages. To clarify things, total daily wages can be decomposed into:

$$\Delta \text{daily } w = \Delta n \text{ hours per day} * (\Delta \text{negotiated part} + \underbrace{\Delta \text{residual part}}_{\text{bonuses+residual}}).$$

If the flexibility comes exclusively from changes in hours per day (for example through overtime hours), this would mean that hourly wages remained unaffected and our results are driven by the artefact of observing just daily wages. Otherwise, if the flexibility comes from the second term of the equation, this would point towards a flexibility of wages. If most of the action comes from bonuses that are linked to productivity or sales, this would mean that wages are procyclical because of the ways the contracts were already designed inside the firms. Unfortunately, we do not have information on hours worked that would allow us to verify whether the decrease in daily wages has been accompanied by a decrease in hourly wages.⁸ Moreover, INPS wage data include bonuses but lack separate information on the various components of wages in order to understand whether the flexibility comes from bonuses or from the actual ability of firms to renegotiate the wage structure of job stayers when hit by a shocks. We therefore seek information from external sources. First we evaluate the importance of overtime pay on total wages, using the Structure of

⁸ Kurmann et al. (2014) show that adjustments in hours were relevant in explaining adjustments of daily wages, at least in the US.

Earnings Survey in 2006. We find that overtime pay accounted for a relatively low portion (around 4 per cent) of monthly earnings in the industrial sector, excluding construction. Moreover, in Section 6.1 we use data on the universe of workers employed in a sub-sample of firms⁹ for which we observe the average overtime and total hours at the firm level, and we find that overtime hours are not significantly related to the degree of wage rigidity. For what concerns bonuses the Structure of Earnings Survey shows they accounted for almost 10 per cent of annual earnings in 2006. This suggests that bonuses and the part of the wage related to decentralized bargaining may be an important factor behind the observed changes of wages, which is in line with the finding that more wage adjustments are performed by larger firms (see also Adamopoulou et al., 2016). In the next Section we shed more light on the residual part of wages by focusing on a case study. Regarding instead the negotiated part of wages, our definition includes both the negotiated minimum wages and lump-sum top-ups in case of delays in the renewal of the collective contract (*una tantum*). These payments that range between a few hundred up to more than one thousand euros, could result in a fictitious negative wage change since they would appear as a peak in one year and disappear in the following one. In the next session we explicitly discuss this issue using external information on all *una tantum* payments to understand whether it affects our findings. We show that the increased wage flexibility in 2009 is not affected by this negotiated top-ups.

With the caveat of not observing hours worked in mind we now move to a discussion of wage rigidities over time. Figure 3 reports the evolution of the three different measures of rigidity in the last 25 years for employees in the private sector excluding agriculture. Both the first (solid line) and the second (dotted line) measure display a drop after 2009, showing that the distribution of annual wage changes became less asymmetric to the right. The percentage of employees with a recorded negative wage change (dashed line) mirrors these measures by featuring an increase after 2009. Almost 30 per cent of job stayers have a recorded negative wage change in 2009 while this figure is around 20 per cent in normal times. The large drop observed in 1993 is likely to be due to the abolition of the wage indexation mechanism (see the next section and Devicienti et al, 2007 for more details).¹⁰ Given the frequent presence of outliers in wage changes, in the rest of the paper we report only the Kelley's skewness and the share of employees with recorded negative wage change. Results with skewness are available upon request.

⁹ These are firms belonging to the Bank of Italy INVIND sample, of 20 or more employees.

¹⁰ The excess growth observed in 2008 partially reflected the renewal of several major collective contracts that also involved one-off payments in order to compensate for unusually long delays in their renewal (e.g. around 300 euros to metalworkers).

These measures of skewness for the overall private non-agricultural sector may mask considerable heterogeneity across different types of workers or firms. Figure 4 shows the evolution of Kelley's skewness for employees in different positions: blue-collar, white-collar and middle-managers. We observe that the skewness decreased more for the blue-collar (dashed line). White-collar and middle-managers were affected to a lesser extent. Moreover, the percentage of employees with a recorded negative wage change rose after 2009 especially among middle managers (Figure 5). This may be due to the high incidence of bonuses for this particular category of workers. Figure 4 points towards a large drop in the skewness among blue collar while Figure 5 points towards smaller drops among middle managers that were distributed in a more homogeneous way (in this way we observe an increase in the share of middle managers with a recorded negative wage change but no change in their skewness).

Regarding differences across sectors, we observe that employees in the industrial sector excluding construction experienced more wage cuts during the recessionary years, and the largest drop in the skewness of the distribution of wage changes (Figure 6 and 7).¹¹ Lastly, we observe important differences between firms of different size (Figures 8 and 9) in line with the findings of Adamopoulou et al., 2016. In particular, medium-sized and large firms managed to reduce wages more than small firms, possibly due to the larger share of bonuses related to firms' performance.¹² This result is consistent with what found with the skewness measure with the exception of very large firms (with 250 employees or more). These firms usually display a higher level of flexibility, but their distribution of wage changes experienced a smaller drop in the skewness during the crisis. The discrepancy between the evolution of the skewness and of the percentage of employees with a recorded negative wage change in very large firms may be due to the fact that large firms were able to adjust wages more homogeneously among employees resulting in a high fraction of recorded negative wage changes while leaving the skewness unaffected.

All in all, we document the presence of some degree of higher wage flexibility during the recent recession even in a context like the Italian one where some institutional features of the labour market, like the way wages are bargained at the national level, may make wages rather rigid. In the next Section we focus on a case study in order to understand better how wages were adjusted in such an institutional environment.

¹¹ The large drop in the skewness observed in 1998 for the construction workers may be related to the introduction of apprenticeships.

¹² Bonuses of this type are usually determined through firm-level bargaining that is not widespread among smaller firms.

5. Wage drift

This section studies the different behaviour of the nationally-negotiated and the residual part of daily wages¹³, as well as the way they interact with each other, to pin down possible mechanisms behind the higher flexibility for different types of workers and firms. Moreover this exercise is useful as a robustness check: in case of delays in the renewal of the collective contract, employees sometimes receive a lump-sum payment (*una tantum*) on top of the negotiated wage that may generate unusual changes of the average daily wages that is not related to cyclical conditions and may generate a measurement error.¹⁴ Since many contracts were renewed in 2008, one may worry that our measure of wage rigidity is affected by these one-off payments. Figure 10 shows that the distribution of wage changes remains practically unaffected in 2009 and in 2006, once we exclude these top-ups in all considered years. This is because such lump-sum payments, although sometimes of substantial size at an annual basis represent only a very small fraction of the daily wage.

We separate the two parts using a unique dataset that has been hand-collected¹⁵ and provides us with information over time about negotiated wages for two national contracts: metalwork industry and wholesale and retail trade. These national contracts cover respectively around 25 and 15 per cent of all employees in the private non-agricultural sector in Italy. As described in Section 2, negotiated wages set minima for workers according to their sector and contractual position. In the INPS data we identify blue-collars, white-collars and middle managers. Since in the national contracts these categories are finer (there are three categories for blue-collars, four categories for white-collars and two for middle managers), we need to aggregate them in order to match them with the social security data. Although this aggregation may result in some measurement error, this is less of a problem when we look at wage changes instead of wage levels, since the agreed percentage changes are usually similar across broad positions.

Figures 10 and 11 show the evolution of the part of the wage that excludes the nationally negotiated minima in each sector by the employees' position (black line). Among metalworkers we observe a large drop in 2009, i.e. at the onset of the crisis, for blue-collars and white-collars while middle managers were only mildly affected. In 2014 there is another drop, but only for blue-collars. By contrast, those that suffered mostly in 2009 among the employees in the wholesale and retail trade were the middle managers. Blue-collars and white-collars experienced instead a large drop in

¹³ On average they account for about 80% of total wages.

¹⁴ Like in 2008, for example. Since these are lump-sum payments they may result in fictitious negative wage changes and if they are not proportional to the base wage they may also change the shape of the distribution of wage changes.

¹⁵ Source: Diritto & Pratica del Lavoro and www.cnel.it.

2014. These different reactions in the residual part of wages may reflect sectorial differences in the structure of wages (bonuses) and/or overtime hours. The non-negotiated part of wages is larger for large firms, for workers in the metalwork industry and for middle managers.

We then repeat the exercise of the previous section and calculate measures of skewness using the part of the wage that is not negotiated at the national level rather than the total wage. As expected, the residual part of the wage is on average, more flexible (the level of skewness associated with it is lower and the share of wage cuts is higher). In particular, in 2006 the Kelley's skewness in the wholesale and retail trade sector was 0.07 for the residual part and 0.31 for the overall wage (0.02 and 0.14 for the metalwork industry). Moreover, in line with our previous graphs, we observe that the skewness of the residual part of wages decreases, even towards negative values, in 2009, especially among blue-collar workers in the metalworkers contract and among middle-managers in the wholesale and retail trade sector.

The information on the negotiated and residual part of the wage also allows us to investigate whether an increase in the nationally negotiated wage induces firms to adjust the other component of the wage. The red line in Figures 11 and 12 represents the negotiated part of wages. Note that due to the institutional setting the evolution of the nationally negotiated part of the wages is sticky as it is usually predetermined for 3 years. As a result the negotiated part of the wages continued to rise even during years of economic downturn (grey area).¹⁶ However, a simple graphical inspection of the evolution of the nationally negotiated (red line) and residual (black line) part of the wages shows that in 2009 and in 2014 firms compensated for the increase of the nationally negotiated part of the wages by reducing the residual component.¹⁷

6. Wage rigidities, employment adjustments and firms' average employee compensation

Nominal wage rigidities may induce firms to perform adjustments at the employment margin as an alternative way to react to shocks. Devicienti et al. (2007) find that in the 1990's firms with higher downward rigidities in Italy tended to display higher worker reallocation rates in terms of turnover. In this Section we study whether firms that are historically characterized by high wage

¹⁶ Both contracts were renewed in 2008, before the hit of the crisis.

¹⁷ Even before 1993, when the indexation mechanism was in place, there was evidence of the existence of a compensating differential between the indexed and the non-indexed part of the wage (See Manacorda, 2004).

rigidities adjusted employment more during the recent recession and whether in this way they managed to contain the average wage per employee.

To do so, we make use of an alternative dataset that covers the universe of employees for a sample of firms with more than 20 employees. Observing the universe of employees in each firm is crucial in order to define an accurate measure of wage rigidities at the firm level. These data come from INPS as well, and refer to the universe of employees in the firms that belong to the Bank of Italy's yearly survey on industrial and non-financial service firms (INVIND), and consist of around 4000 firms per year. Another advantage of using this dataset of employees is that we can enrich it with extra variables at the firm level that come directly from the INVIND survey. For example, INVIND allows us to separately observe accessions and separations that could only indirectly and partially be proxied by monthly employment changes in the INPS-firm data. Moreover, INVIND provides us with additional information, like total sales (in euros) that can serve as a demand-shift control. There is also information on per capita overtime hours that can help us verify that the wage adjustment is not operated through this channel only.¹⁸

6.1 Wage rigidity: Firms' heterogeneity

We now dig into the determinants of wage rigidity. In particular, we study how the degree of wage rigidity differs among firms and which characteristics of the firm determine such heterogeneity. We first compute a measure of wage rigidity at the firm level, based on the asymmetry of the distribution of wage changes for each firm. We aim to construct a measure that summarizes the firms' ability to adjust wages when hit by a shock and that more closely resembles a "structural feature" of the firm wage structure and ability of renegotiating wages of incumbents and does therefore not vary over time.¹⁹ In particular, for each firm belonging to the INVIND sample we plot the distribution of wage changes for job stayers in the years 2003-2008, and we use the Kelley's skewness of that distribution as a measure of rigidity. Again, when the skewness is equal to 0 the distribution of wage changes is symmetric, i.e., the mass of wage changes below the median is equal to the mass of wage changes above the median. Positive values of skewness are associated with high rigidities, while values close to 0 point towards wage flexibility. We excluded all firms with very few job stayers (less than 80 in the period 2003-2008), because the skewness measure would not be reliable if the number of observations in the distribution of wage changes is

¹⁸ Ideally, we would like to observe hourly wages and not just daily wages. In absence of hours worked, controlling for overtime hours allows us to partially exclude the possibility that the adjustment of daily wages is operated exclusively through the adjustment of overtime hours.

¹⁹ Performing the analysis using the panel dimension produces similar results. However, the variability of skewness over time is limited.

too small.²⁰ Figure 13 shows how our firm-level measure of wage rigidity is distributed. As expected, the mean is larger than 0 (it is 0.13) and there is a high level of heterogeneity (the standard deviation is 0.19). Moreover, our measure is significantly related to the measure of wage rigidity during the crisis, in 2009.

We interpret this measure as a structural indicator of the firms' ability to adjust wages of the job stayers that depends on the firms' wage structure. In particular, we think at three main factors behind differences in wage rigidity: the presence of a large component of bonuses, i.e. variable top-up of wages; the extensive use of overtime hours, which are easier to adjust during downturns and the actual ability to adjust the base salary of job stayers, due to high bargaining power, for instance. Figure 14 shows how our measure of rigidity is correlated with the amount of bonuses (over annual earnings) at the sector level. The Figure displays on the x-axis the share of bonuses over earnings as obtained from the Structure of Earning Survey in 2006 and on the y-axis our measure of wage rigidity averaged at the sector level. There is a negative correlation: those sectors whose wage structure is on average characterized by a high share of bonuses are the ones that according to our measure of wage rigidity are more flexible.

Table 3 shows the determinants of our measure of wage rigidity. Column 1 shows that larger firms, whose average wages are less often flattened upon the national contractual wages, tend to be less rigid, which is in line with the results of Adamopoulou et al. 2016 and with those in Section 4. Again in line with the results of our previous Section, Column 2 shows that firms are less rigid if they are characterized by a high share of blue collars. Column 3 shows instead that our measure of wage rigidity is not related to the amount of overtime hours employed by each firm: this suggests that wages are not flexible simply because of the firms' ability to adjust overtime hours. Column 4 shows that flexibility is very much related to average firms' productivity: more productive firms are probably characterized by a larger residual part of wages, and Section 5 showed that most of the flexibility comes from it. Finally, Column 5 shows that firms with a high share of temporary workers tend to be more rigid: we interpret this as a sign that rigid firms, envisaging their difficulty in adjusting wages of job stayers, react by hiring a large share of temporary workers, easier to fire.

Lastly, we conducted a robustness check in order to verify that observing daily instead of hourly wages does not undermine our results of Section 4. We use the information provided by the INVIND survey on the amount of overtime hours per capita in 2008 (i.e. before the crisis) at the

²⁰ We performed various robustness exercises around the absolute and relative threshold of the number of job stayers in the window [60, 100] (and [60%, 80%]) and the results were very similar.

firm level and we classify firms into more and less overtime-intensive (above and below the median). We then compute the skewness of the distribution of annual changes of daily wages for all workers belonging to each group of firms for the years 2006 and 2009. We find that for both groups the skewness was almost identical in 2006 and it declined sharply in 2009 by almost the same amount (Figure 15). Therefore, we conclude that overtime hours do not seem to drive the observed increase in wage flexibility in 2009.

In the next section we study how firms characterized by different levels of wage rigidity respond to the recent recession. In an attempt of isolating the role of rigidities from the role of its determinants, we will include variables used in Table 3 as controls for our regression specification.

6.2 Firms' wage rigidity and employment adjustments

We perform regressions at the firm level to evaluate the relationship between the measure of wage rigidity described above and firms' adjustments in the employment margin and in their average wage per employee during the recent recession.

We estimate the following equation:

$$\Delta y_{i,t-08} = \beta \text{skewness}_i + \gamma X_i + \varepsilon_i$$

where $y_{i,t-08}$ are flows of the outcome variables during the recent recession (between 2008 and $t=2009, 2011$ and 2013), in particular we look at: turnover ($\frac{\text{accessions}_t + \text{separations}_t}{\text{employment}_{2008}}$); accessions ($\frac{\text{accessions}_t}{\text{employment}_{2008}}$); separations ($\frac{\text{separations}_t}{\text{employment}_{2008}}$);²¹ variations in the average wage per employee ($\frac{\text{av wage}_t}{\text{av wage}_{2008}} - 1$) and the probability of exiting the market. skewness_i is the Kelley's skewness measure that refers to the six years before the recession, as described in Section 6.1.

Since we want in principle to isolate the effect of wage rigidity from the effect of other factors such as productivity that may be associated with both a less flexible wage structure and different dynamics of our dependent variables, we control in all specifications for: firms' value added per worker, firms' age, size, level of overtime hours per employee, share of temporary workers, province and sector of activity. All controls refer to the year 2008, i.e. right before the

²¹ Where accessions and separations are computed as the sum of all accessions that took place between 2008 and t .

arrival of the crisis, in order to exclude endogenous changes of these variables correlated with the effect of interest. Moreover, in some specifications we include the variation of total sales during the recession as additional control, in order to correct for the heterogeneity of the shocks across firms. Standard errors are clustered at the firm level.²²

Therefore, the β coefficient of our regressions measures the relationship between wage rigidity at the firm level and employment adjustments, net of the effect of other potential (observable) factors that may spur our estimate.²³

Table 4 displays the main descriptive statistics. Firms in the INVIND sample mostly belong to the industrial sector and are of rather large dimension. Temporary workers represent on average 7 per cent of their workforce. Average turnover in 2009 was 20 per cent with respect to the number of employees in 2008 and separations were slightly larger than accessions.

Table 5 presents our main results on turnover. In line with Devicienti et al. (2007) we find that firms with higher wage rigidities are characterized by higher turnover in 2009 (column 1). In particular, an increase in the firm-level skewness by one standard deviation (0.16) is associated with a turnover rate in 2009 of almost 0.7 percentage points higher. One may worry about possible omitted variables in this regression. In particular it may be that more rigid firms may be hit differently by the crisis. Column 2 shows that the results are robust to the inclusion of the percentage change of sales, our proxy for the size of the firm-level shock. However, this control of the demand shock is potentially endogenous, as it refers to 2009 and may be considered as an outcome itself. We therefore exclude it from our preferred specification. We also examine whether the effect of wage rigidities persists over time by considering turnover in 2011 and in 2013 (computed as the cumulative rate of accessions and separations with respect to 2008). Indeed, the effect is still present and increasing both in 2011 and 2013. This may be reconciled with a delayed employment adjustment for firms that start exhausting any margin of wage adjustment.

At this point it is crucial to understand the nature of this increased turnover. In particular it is interesting to explore whether it is mainly driven by separations or accessions and which may be

¹⁸ We start with a sample of around 4,000 firms in 2009 and we are left with less than 2,000 firms for which the skewness, the turnover measures and all the controls are not missing. This reduction in the sample is mainly due to the fact that we lose quite a few observations by restricting the sample to firms that we observe both in the period 2003-2008 and in all the years between 2009 and 2013. Moreover, we dropped around 60 firms that we could not match with the INPS data and around 60 firms for which the employment data from INPS and INVIND displayed great discrepancies.

²³ Given that the dependent variable is a time variation, our specification is very similar to a specification where we regress the level of the dependent variable on the interaction between our rigidity measure and the post 2008 dummy and we include firms specific fixed effects and all our controls interacted with the post 2008 dummy. In this case, however it would be more difficult to evaluate how the effect evolved over time.

the channel behind it. One possible mechanism acts through the increased turnover of temporary workers (see Bulligan and Viviano, 2016). Firms that are constrained by wage rigidities may exploit the turnover of temporary workers whose contracts can be easily renegotiated, in order to adjust their average labour cost.

The INVIND data allow us to distinguish whether the effect on turnover is driven by accessions, separations or both. Tables 6 and 7 present separately the results for accessions and separations as a share of employment in 2008. We distinguish between firms with high and low share of temporary workers in 2008 in order to understand whether the proposed mechanism may be at work. We find that firms that are characterized by higher wage rigidities tend to hire but also to fire more in 2009 as well as in 2011 and 2013. Moreover, we find that this effect comes mostly from firms with a high share of temporary workers (columns 2, 4, and 6) than from firms with a low share of temporary workers (columns 1, 3, and 5), even if very rigid.²⁴ Note that the coefficient of skewness related to the accessions is larger than the one related to separations. This may be because separations do not include only firings but also voluntary quits or other types of job termination. If wage cuts operated by less rigid firms led to voluntary quits of workers who did not want to accept them, then overall separations should be large in flexible firms as well. Since our coefficient compares the effect of more and less rigid firms on overall separations, the difference may be smaller for separations exactly because flexible firms display larger quit rates during the recession as well. Once we will obtain the information on separations net of voluntary quits, then we will be able to verify this explanation and to compare the coefficients of accessions and separations.

Lastly, we use information on the average wage per employee paid by the firm (available in the INPS data for the universe of firms) to test whether in the presence of wage rigidities the temporary-workers channel allowed firms to decrease the average wage indirectly. Table 8 shows the results. As expected, more rigid firms (with higher value of skewness), adjusted their average wage less: the changes in average wage are more positive for rigid firms during the recession. However, firms with a higher share of temporary workers managed to adjust wages more. This is true both in 2009 and 2011. In 2013 the signs are reverted. We believe this is due to sample selection/survivor bias that spurs our results.²⁵ We conclude that firms managed, through the use of temporary workers, to partly contain their labour cost per employee even in the presence of wage rigidities.

²⁴ Firing is very difficult for firms with more than 15 employees in Italy.

²⁵ Additional estimates (available upon request) indicate that more rigid firms have a higher probability of exiting the market in 2013. This would entail that the samples of more rigid firms with and without temporary workers are not fully comparable in 2013.

7. Conclusions

In this paper we document the evolution of wage rigidities over time in Italy and we find that during the recent recession wage flexibility has increased. We study the various channels through which daily-wage adjustments were enacted and we reveal that the part of the wages that is not nationally negotiated responded more to the adverse cyclical conditions. Other main determinants of wage flexibility are the incidence of bonuses over total earnings, the share of blue-collar workers, and the firm size. Although we only observe daily and not hourly wages, overtime hours did not seem to be the main driver behind the observed wage developments.

We also conduct an analysis at the firm level and we identify firms that were historically characterized by different levels of wage rigidities in order to study their behaviour during the crisis. We find that there is a wage-employment trade-off also as far as their adjustment is concerned: firms structurally characterized by higher wage rigidity adjusted more often along the employment margin, by increasing their turnover in the period 2009-2013. These larger employment adjustments were mostly driven by rigid firms with a high enough share of temporary workers, easier to fire. Moreover, we find that the average wage per employee of rigid firms adjusted less during the crisis but that those firms endowed with a larger portion of temporary workers managed to partly compress their average labour cost in any case. Our conjecture is that these firms managed to deal with the challenges of the recessionary conditions not by directly reducing wages of job stayers but by indirectly containing the labour cost through firing of temporary workers and hiring of new ones with lower salaries. This source of flexibility through temporary workers allowed firms to survive in a rigid institutional setting. Reforms of the latter may reduce the need of using temporary workers as a flexibility margin during downturns.

Our study provides some evidence on wage adjustments in Italy during the Great Recession and on the way firms reacted differently to the crisis. However, it does not quantify how much this increased flexibility contributed to help firms absorb the negative shocks and its overall implications for the economy. We leave this question, of high policy relevance but which requires additional assumptions in order to construct a proper counterfactual, to future research.

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Tables

Table 1: Descriptive statistics, universe of firms paying contribution at INPS

Year	% of firms in Industry	% of firms in Manufacturing	Wage per employee		Firm size		N Firms	N Employees (1000)
			mean	sd	mean	sd		
1990	0.49	0.32	1102	457	7.96	182.3	1,116,992	8891
1991	0.48	0.32	1217	495	7.96	181.0	1,120,621	8920
1992	0.48	0.31	1288	539	7.86	188.1	1,122,468	8823
1993	0.47	0.31	1334	556	7.80	184.2	1,084,614	8460
1994	0.47	0.31	1382	579	7.83	180.2	1,059,329	8295
1995	0.47	0.30	1441	620	7.87	179.1	1,063,816	8372
1996	0.47	0.30	1492	646	7.94	172.9	1,069,946	8495
1997	0.46	0.30	1550	670	7.96	163.1	1,058,116	8423
1998	0.46	0.29	1580	697	7.97	156.2	1,082,872	8630
1999	0.45	0.28	1595	711	7.86	138.3	1,136,162	8930
2000	0.44	0.27	1637	766	7.97	139.1	1,181,332	9415
2001	0.44	0.27	1675	821	7.98	140.1	1,222,383	9755
2002	0.44	0.26	1693	788	7.73	133.2	1,293,290	9997
2003	0.44	0.25	1728	819	7.70	130.0	1,325,115	10203
2004	0.43	0.24	1765	837	7.59	127.9	1,369,569	10395
2005	0.42	0.24	1816	892	7.56	128.7	1,380,837	10439
2006	0.42	0.23	1872	938	7.55	132.0	1,403,806	10599
2007	0.42	0.22	1898	994	7.53	133.5	1,474,110	11100
2008	0.41	0.22	1973	1030	7.57	129.0	1,496,808	11331
2009	0.40	0.22	1975	1006	7.48	146.9	1,478,586	11060
2010	0.39	0.21	2031	1055	7.43	169.6	1,471,068	10930
2011	0.38	0.21	2068	1070	7.46	165.1	1,467,732	10949
2012	0.37	0.21	2073	1086	7.35	167.6	1,468,611	10794
2013	0.36	0.21	2100	1139	7.44	169.1	1,414,664	10525

Source: own calculations on INPS data for the universe of firms. Statistics of wages are weighted by the number of employees in the firm.

Table 2: Descriptive statistics on workers (at the contract level)

Year	Daily wage		Age		% Females	% Full time workers	% Blue collar s	% White collar s	% Middle managers ²⁶	% Industry	N Employees	N Firms ²⁷
	mean	sd	mean	sd								
1990	47.98	41.56	36.32	11.00	0.30	0.96	0.64	0.32	0.64	674,323	275,097	
1991	52.72	46.07	36.38	10.97	0.30	0.95	0.64	0.33	0.63	683,562	279,240	
1992	57.04	101.73	36.52	10.92	0.30	0.95	0.63	0.33	0.63	683,054	281,303	
1993	58.82	82.45	36.70	10.79	0.31	0.94	0.63	0.34	0.61	656,780	273,051	
1994	62.52	155.91	36.74	10.69	0.31	0.93	0.62	0.34	0.60	648,790	269,532	
1995	62.32	501.87	36.60	10.57	0.32	0.92	0.63	0.34	0.60	654,213	271,591	
1996	63.44	50.98	36.62	10.52	0.32	0.91	0.63	0.32	0.02	665,874	277,402	
1997	65.83	57.88	36.64	10.42	0.32	0.91	0.63	0.32	0.02	665,189	275,443	
1998	68.43	267.70	36.78	10.41	0.33	0.90	0.62	0.32	0.02	677,313	278,839	
1999	69.44	209.62	36.75	10.37	0.33	0.89	0.62	0.31	0.02	702,667	289,796	
2000	69.93	127.29	36.87	10.34	0.33	0.89	0.61	0.31	0.02	747,452	305,346	
2001	71.46	114.35	37.04	10.32	0.34	0.88	0.61	0.31	0.03	774,441	317,081	
2002	72.92	84.91	37.04	10.28	0.33	0.87	0.62	0.30	0.03	810,656	338,477	
2003	74.20	76.96	37.30	10.26	0.34	0.86	0.62	0.30	0.03	818,386	343,671	
2004	77.19	145.20	37.56	10.22	0.34	0.85	0.61	0.30	0.03	826,728	349,247	
2005	78.72	110.82	37.93	10.24	0.34	0.84	0.60	0.31	0.03	822,301	349,395	
2006	81.03	88.65	38.24	10.27	0.35	0.83	0.60	0.31	0.03	836,545	354,814	
2007	82.50	75.67	38.34	10.35	0.35	0.82	0.60	0.30	0.03	880,269	376,583	
2008	86.52	92.70	38.56	10.39	0.35	0.81	0.60	0.30	0.03	897,100	383,582	
2009	88.04	105.54	39.11	10.43	0.36	0.80	0.59	0.31	0.03	884,268	379,699	
2010	90.12	223.53	39.40	10.47	0.36	0.79	0.59	0.31	0.03	879,297	377,338	
2011	91.55	93.72	39.69	10.52	0.36	0.79	0.60	0.31	0.03	882,700	377,665	
2012	92.99	91.31	40.04	10.57	0.37	0.77	0.60	0.31	0.03	873,231	375,006	
2013	95.12	101.79	40.48	10.58	0.37	0.75	0.59	0.32	0.03	845,808	358,291	
2014	95.36	92.66	40.86	10.67	0.37	0.74	0.59	0.32	0.03	840,787	351,484	

Source: own calculations on INPS data, data are summarized at the contract level and refer to all employees born on the 1st and 9th day of each month

²⁶ Data on middle managers and white collars are reported together before 1997.

²⁷ Number of firms where at least one worker in the sample transited in the considered year.

Table 3: Determinants of firm level wage rigidity

Dep. Var:	Skewness 2003-2008						
size cat=2	-0.019**					-0.016*	-0.016*
	(0.08)					(0.009)	(0.009)
size cat=3	-0.021*					-0.023*	-0.026*
	(0.012)					(0.013)	(0.013)
% blue coll=2	-0.026***					-0.018**	-0.016
	(0.007)					(0.009)	(0.010)
% blue coll=3	-0.046***					-0.045***	-0.042***
	(0.007)					(0.010)	(0.010)
overtime pw=2		0.002				0.000	0.001
		(0.007)				(0.009)	(0.009)
overtime pw=3		-0.006				-0.016*	-0.018*
		(0.007)				(0.009)	(0.009)
va pw==2			0.015**			0.018**	0.022**
			(0.007)			(0.009)	(0.010)
va pw==3			0.017**			0.022**	0.029***
			(0.007)			(0.010)	(0.010)
% temporary=2				0.001		0.003	0.002
				(0.007)		(0.009)	(0.009)
% temporary=3				0.016**		0.024***	0.019**
				(0.007)		(0.009)	(0.009)
Observations	2170	3650	3650	3519	3650	2103	2101
Sector FE	No	No	No	No	No	No	Yes

Note: all controls are the average of the considered characteristic between 2003-2008. Categories refer to tertiles of the distribution (3=highest tertile). Robust standard errors in parenthesis.

Table 4: Descriptive statistics of INVIND firms: mean and standard deviation

Characteristics	Mean	s.d.
Skewness ₂₀₀₃₋₂₀₀₈	0.138	0.161
Turnover ₂₀₀₉	0.194	0.258
% Accessions ₂₀₀₉	0.087	0.142
% Separations ₂₀₀₉	0.107	0.132
Turnover ₂₀₁₁	0.579	0.751
% Accessions ₂₀₁₁	0.276	0.391
% Separations ₂₀₁₁	0.300	0.365
Turnover ₂₀₁₃	0.905	1.198
% Accessions ₂₀₁₃	0.439	0.629
% Separations ₂₀₁₃	0.466	0.585
% Δ (firm's average wage) ₂₀₀₉	-0.010	0.080
% Δ (firm's average wage) ₂₀₁₁	0.061	0.089
% Δ (firm's average wage) ₂₀₁₃	0.092	0.119
% Temporary employees ₂₀₀₈	0.068	0.115
Firm size ₂₀₀₈	468	2152
% Industry	0.760	-
Firm age ₂₀₀₈	25.89	13.15
Value added per worker ₂₀₀₈	71.09	74.28
Overtime hours per worker ₂₀₀₈	5336	3062
% Δ (sales) ₂₀₀₉	0.068	0.115

Note: Source: The skewness is taken from INPS data on the population of workers belonging to firms in the INVIND sample. Turnover, accessions, separations, share of temporary workers, overtime hours per worker, and sales from the INVIND survey. Average wage, firm size, age, and sector from INPS data on the population of firms. Value added per worker from CERVED. Turnover₂₀₁₁, accessions₂₀₁₁ and separations₂₀₁₁ are cumulative for the years 2009-2011, turnover₂₀₁₃, accessions₂₀₁₃ and separations₂₀₁₃ are cumulative for the years 2009-2013. All variables in % Δ are defined with 2008 as base year.

Table 5: Relationship between turnover and wage rigidity controlling for demand shocks

	Turnover ₂₀₀₉		Turnover ₂₀₁₁		Turnover ₂₀₁₃	
	(1)	(2)	(3)	(4)	(5)	(6)
Skewness ₂₀₀₃₋₂₀₀₈	0.116*	0.107	0.444**	0.425**	0.711*	0.649*
	(0.0651)	(0.0651)	(0.201)	(0.201)	(0.364)	(0.365)
Overtime hours per wrk ₂₀₀₈	0.0196	0.0202	0.121*	0.119*	0.283***	0.290***
	(0.0215)	(0.0214)	(0.0719)	(0.0707)	(0.0860)	(0.0830)
Value added per wrk ₂₀₀₈	0.000313	0.000316	0.000112	4.59e-05	-0.00211*	-0.00241**
	(0.000412)	(0.000412)	(0.00121)	(0.00122)	(0.00119)	(0.00117)
Share temporary wrk ₂₀₀₈	1.003***	0.994***	3.057***	3.016***	4.176***	4.098***
	(0.286)	(0.287)	(0.883)	(0.888)	(0.929)	(0.916)
% Δ(sales) ₂₀₀₉		0.0923***		0.356***		0.723***
		(0.0348)		(0.115)		(0.209)
Firms' size, sector and province dummies, age	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R ²	0.373	0.376	0.425	0.431	0.492	0.503
N	1,792	1,792	1,321	1,321	1,019	1,019

Source: turnover, overtime hours, share of temporary workers and sales are taken from the INVIND survey. Skewness from INPS data on the population of workers belonging to firms in the INVIND sample. Firm's size, age, sector and province from INPS data on the population of firms. Value added per worker from CERVED. Turnover₂₀₁₁ and Turnover₂₀₁₃ are cumulative for the years 2009-2011 and 2009-2013. Robust standard errors in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Relationship between accessions and wage rigidities-heterogeneity by the share of temporary workers in the firm in 2008

	Accessions ₂₀₀₉		Accessions ₂₀₁₁		Accessions ₂₀₁₃	
	(1)	(2)	(3)	(4)	(5)	(6)
	Low % temp wrks	High % temp wrks	Low % temp wrks	High % temp wrks	Low % temp wrks	High % temp wrks
Skewness ₂₀₀₃₋₂₀₀₈	0.00584	0.129*	0.240**	0.467**	0.532**	0.907**
	(0.0321)	(0.0694)	(0.116)	(0.223)	(0.255)	(0.431)
Overtime hour per wrk ₂₀₀₈	-7.75e-05	0.0344**	0.0303	0.170***	0.0540	0.175**
	(0.00564)	(0.0174)	(0.0237)	(0.0548)	(0.0435)	(0.0691)
Value added per wrk ₂₀₀₈	-4.25e-05	0.000320	-0.000529	0.000807	-0.00107	-0.000220
	(0.000107)	(0.000381)	(0.000452)	(0.000854)	(0.000946)	(0.00126)
Firms' size, sector and province dummies, age	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R ²	0.229	0.338	0.341	0.438	0.272	0.459
N	897	896	662	659	513	506

Source: turnover, overtime hours and share of temporary workers are taken from the INVIND survey. Skewness from INPS data on the population of workers belonging to firms in the INVIND sample. Firm's size, age, sector and province from INPS data on the population of firms. Value added per worker from CERVED. Turnover₂₀₁₁ and Turnover₂₀₁₃ are cumulative for the years 2009-2011 and 2009-2013. Low share of temporary means that the share of temporary workers in 2008 was below the median. Robust standard in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Relationship between separations and wage rigidities-heterogeneity by the share of temporary workers in the firm in 2008

	Separations ₂₀₀₉		Separations ₂₀₁₁		Separations ₂₀₁₃	
	(1) Low % temp wrks	(2) High % temp wrks	(3) Low % temp wrks	(4) High % temp wrks	(5) Low % temp wrks	(6) High % temp wrks
Skewness ₂₀₀₃₋₂₀₀₈	-0.0110 (0.0344)	0.0722 (0.0556)	0.0843 (0.100)	0.375** (0.190)	0.238 (0.222)	0.596* (0.370)
Overtime hour per wrk ₂₀₀₈	-0.00130 (0.00528)	0.0227* (0.0138)	0.0234 (0.0212)	0.124** (0.0481)	0.0480 (0.0430)	0.0990 (0.0625)
Value added per wrk ₂₀₀₈	-6.73e-06 (0.000100)	0.000126 (0.000333)	-0.000570 (0.000393)	-8.00e-05 (0.000846)	-0.00110 (0.000917)	-0.00158 (0.00113)
Firms' size, sector and province dummies, age	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.198	0.344	0.254	0.405	0.175	0.426
N	898	894	663	658	513	506

Source: turnover, overtime hours and share of temporary workers are taken from the INVIND survey. Skewness from INPS data on the population of workers belonging to firms in the INVIND sample. Firm's size, age, sector and province from INPS data on the population of firms. Value added per worker from CERVED. Turnover₂₀₁₁ and Turnover₂₀₁₃ are cumulative for the years 2009-2011 and 2009-2013. Low share of temporary means that the share of temporary workers in 2008 was below the median. Robust standard errors in parenthesis. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

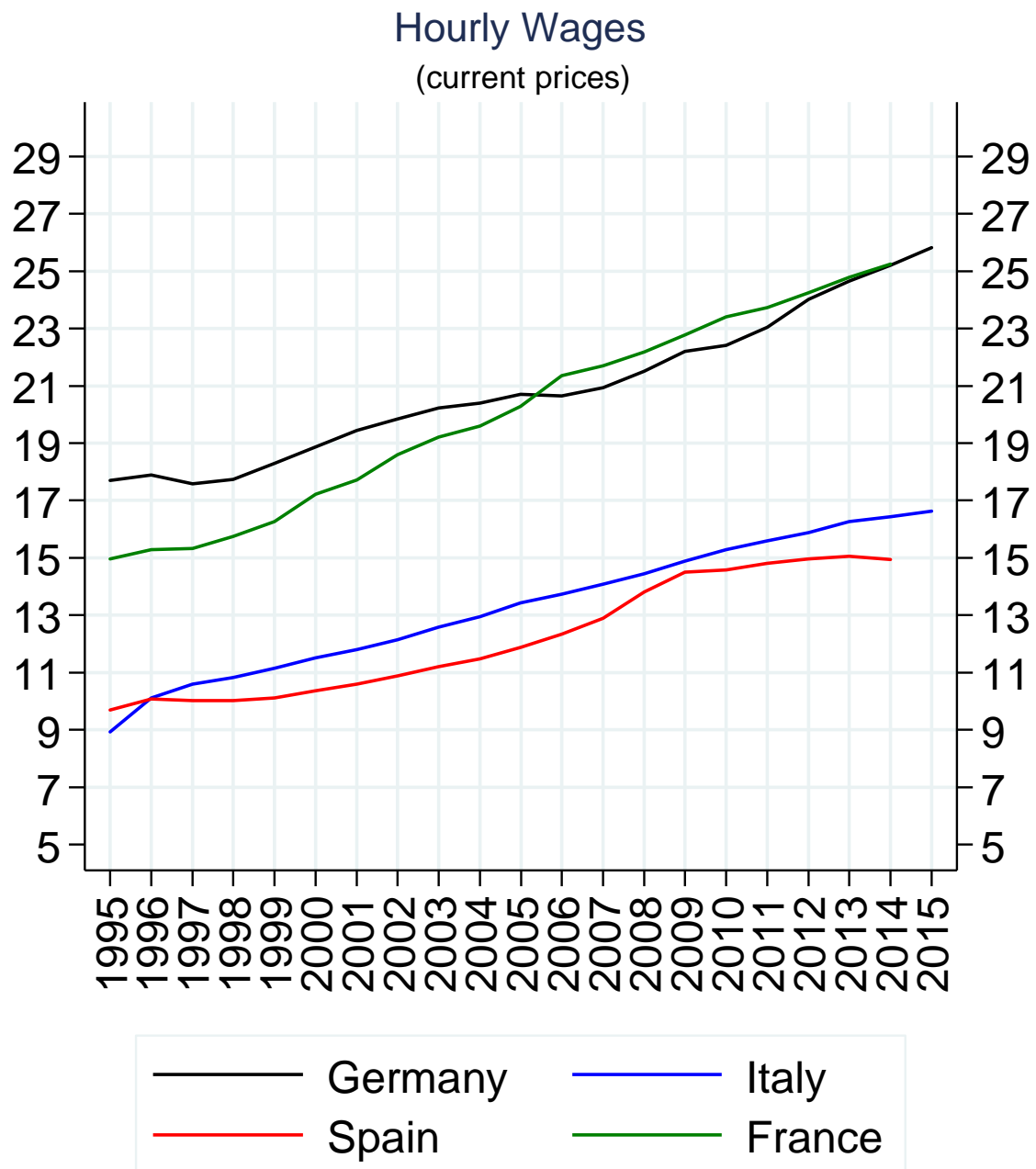
Table 8: Average wage adjustment of the firm, skewness, and share of temporary workers in 2008

	Δ avg. w ₂₀₀₉		Δ avg. w ₂₀₁₁		Δ avg. w ₂₀₁₃	
	(1) Low % temp wrks	(2) High % temp wrks	(3) Low % temp wrks	(4) High % temp wrks	(5) Low % temp wrks	(6) High % temp wrks
Skewness ₂₀₀₃₋₂₀₀₈	0.112** (0.0434)	0.0380 (0.0255)	0.107** (0.0515)	0.0706 (0.0464)	0.0267 (0.0597)	0.160** (0.0682)
Overtime hour per wrk ₂₀₀₈	-0.00910 (0.00906)	-0.00602 (0.00647)	0.00681 (0.0156)	-0.0120 (0.00783)	0.0397** (0.0175)	-0.00297 (0.00903)
Value added per wrk ₂₀₀₈	0.000575*** (0.000167)	3.20e-05 (0.000188)	0.000600** (0.000239)	4.38e-05 (0.000253)	0.000789*** (0.000262)	-9.76e-05 (0.000317)
Firms' size, sector and province dummies, age	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.413	0.514	0.267	0.281	0.309	0.309
N	885	888	707	721	620	634

Source: turnover, overtime hours and share of temporary workers are taken from the INVIND survey. Skewness from INPS data on the population of workers belonging to firms in the INVIND sample. Firm's average wage, size, age, sector and province from INPS data on the population of firms. Value added per worker from CERVED. Turnover₂₀₁₁ and Turnover₂₀₁₃ are cumulative for the years 2009-2011 and 2009-2013. Low share of temporary means that the share of temporary workers in 2008 was below the median. Robust standard errors in parenthesis. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

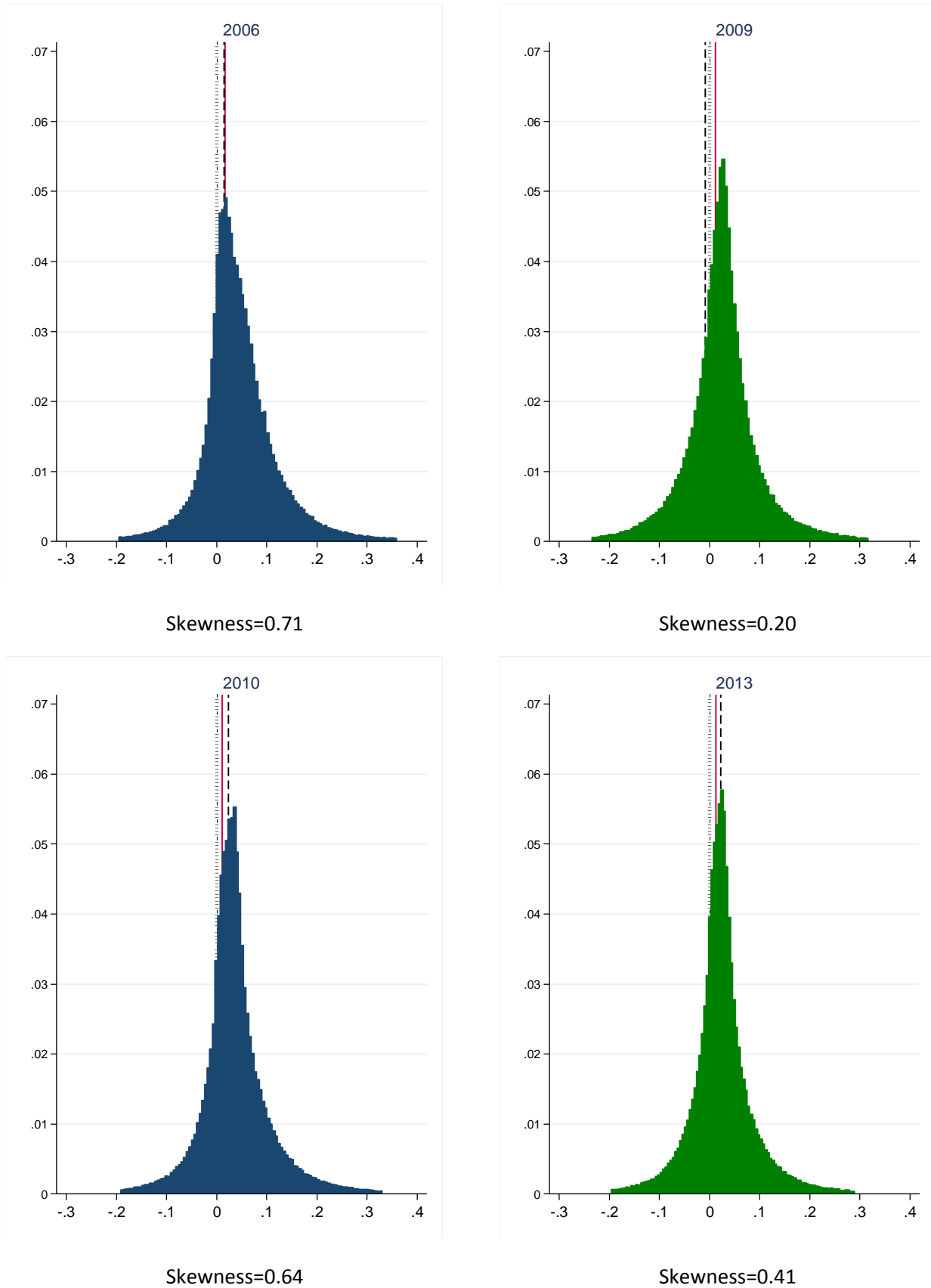
Figures

Figure 1: Evolution of hourly wages over time



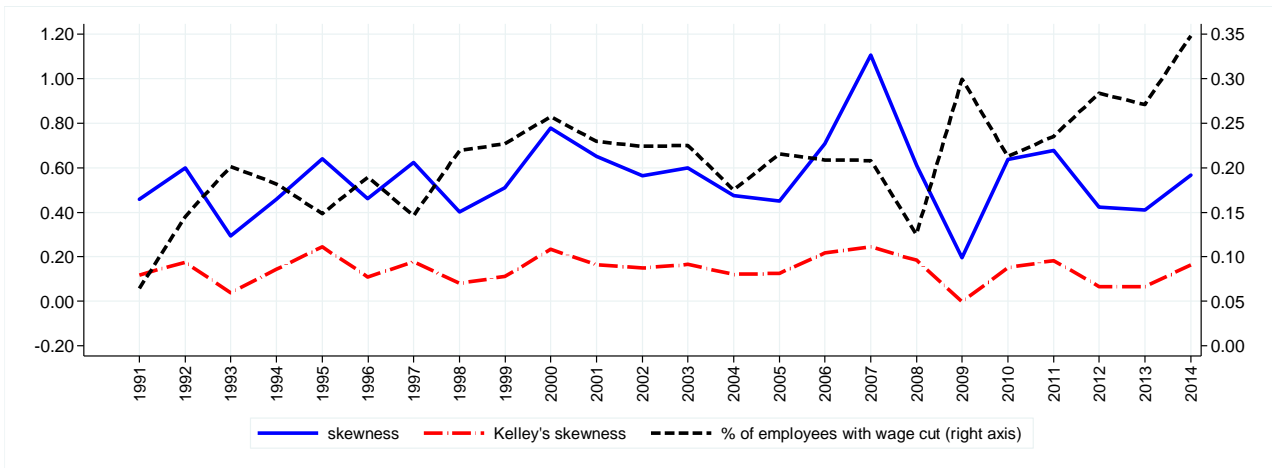
Source: Own calculations based on Eurostat data, National Accounts.

Figure 2: Distribution of percentage annual change of daily wages, private non-agricultural sector



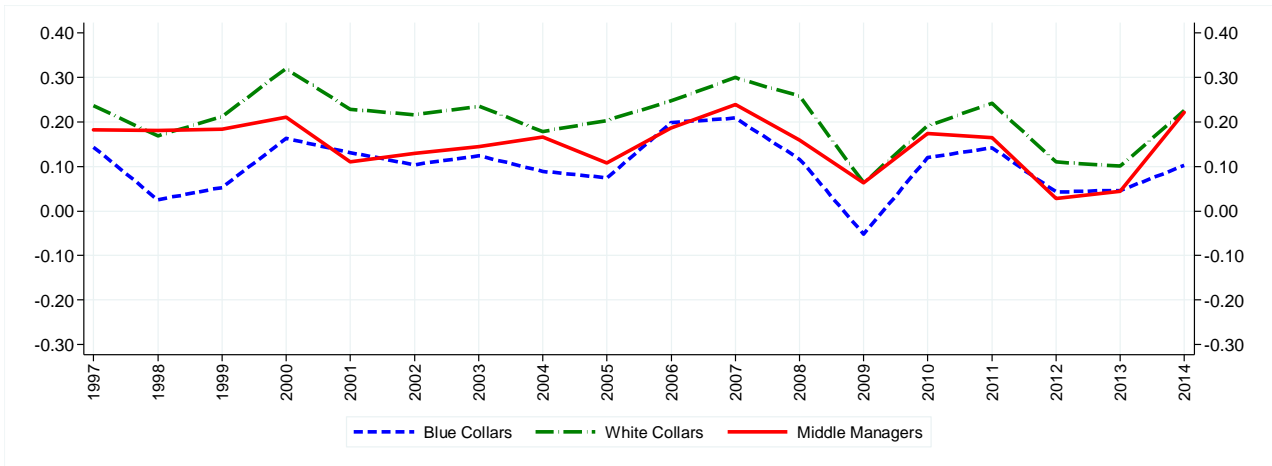
Source: own calculations on INPS data (on the sample of job stayers).

Figure 3: Evolution of wage rigidities over time



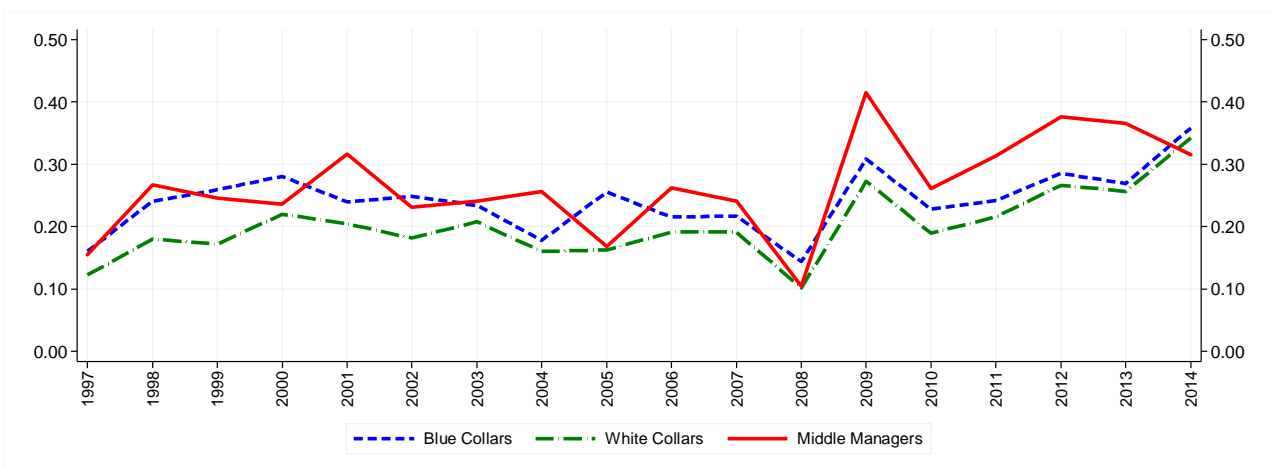
Source: own calculations on INPS data (on the sample of job stayers). Non-agricultural business sector.

Figure 4: Wage rigidity by position, Kelley's skewness



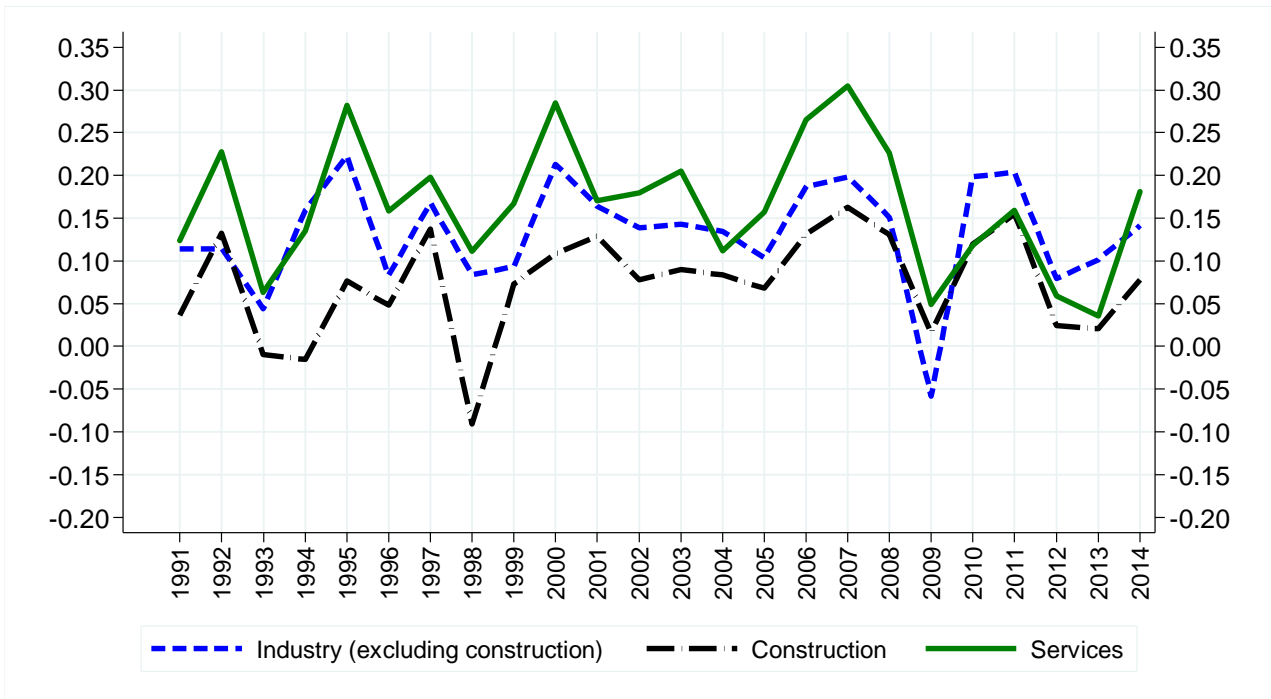
Source: own calculations on INPS data (on the sample of job stayers).

Figure 5: Negative wage changes by position, % of employees



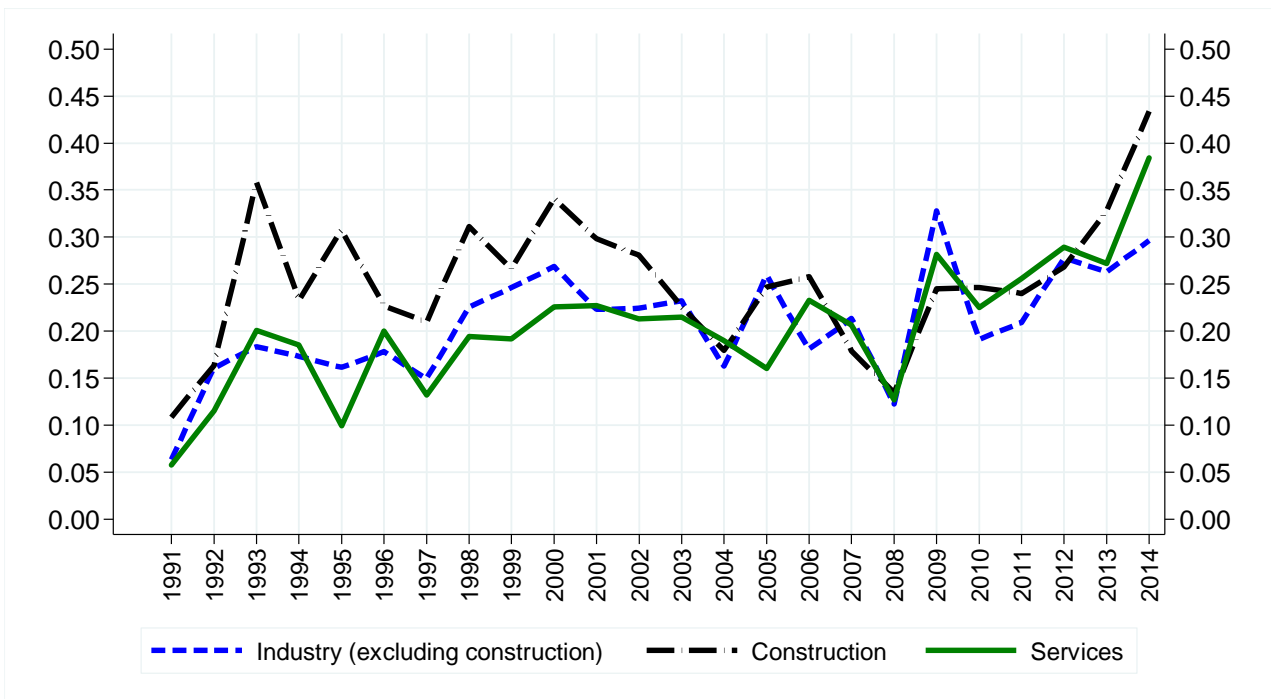
Source: own calculations on INPS data (on the sample of job stayers).

Figure 6: Wage rigidity by sector, Kelley's skewness



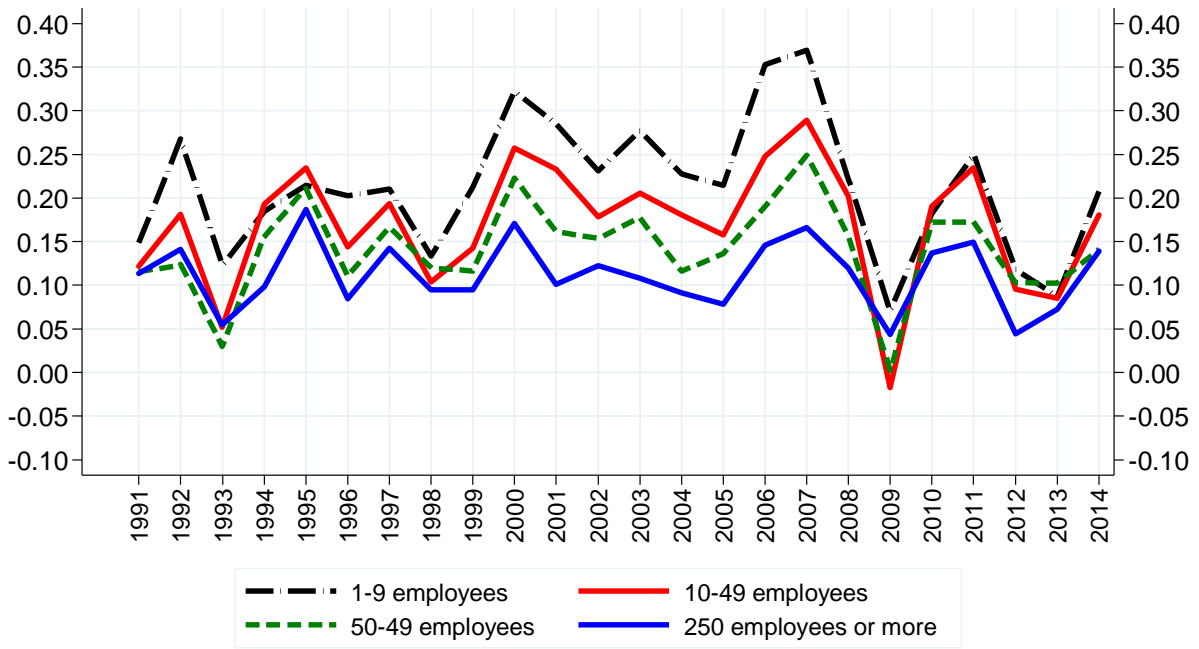
Source: own calculations on INPS data (on the sample of job stayers).

Figure 7: Negative wage changes by sector, % of employees



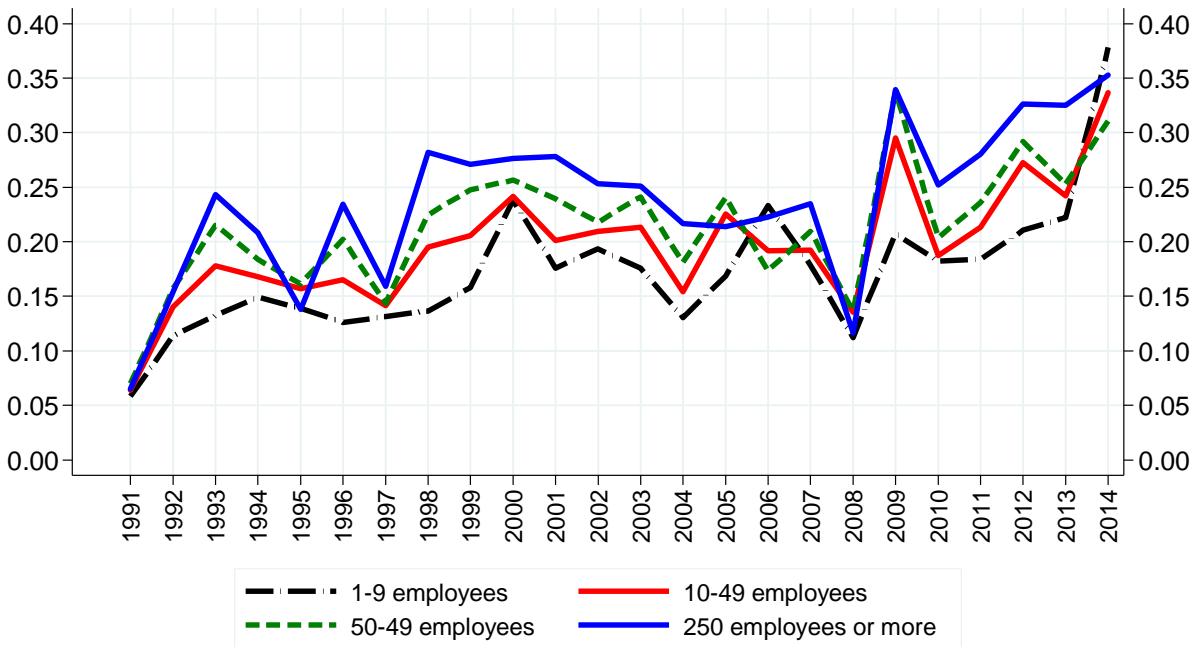
Source: own calculations on INPS data (on the sample of job stayers).

Figure 8: Wage rigidity by firm size, Kelley's skewness



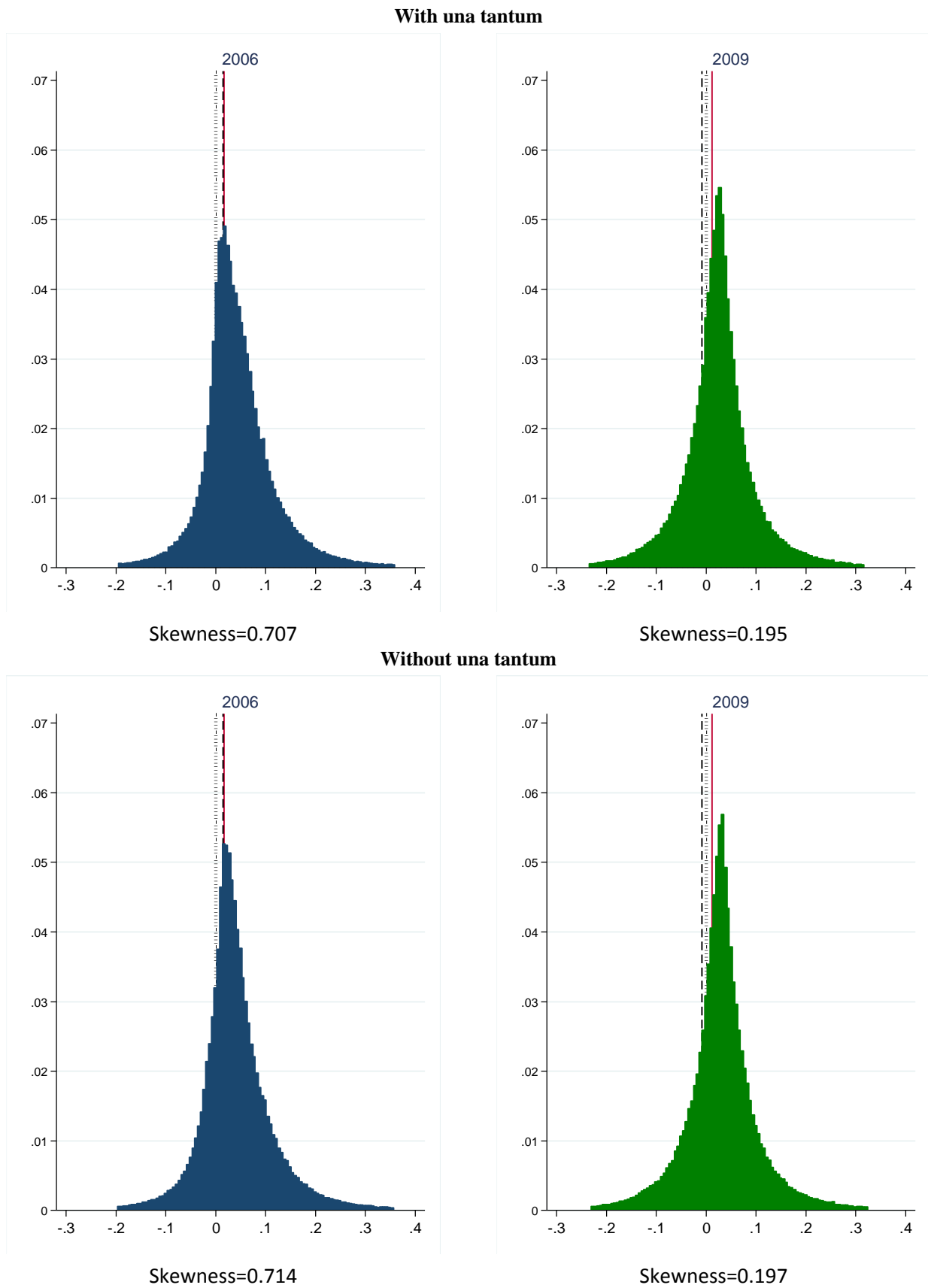
Source: own calculations on INPS data (on the sample of job stayers).

Figure 9: Negative wage changes by firm size, % employees



Source: own calculations on INPS data (on the sample of job stayers).

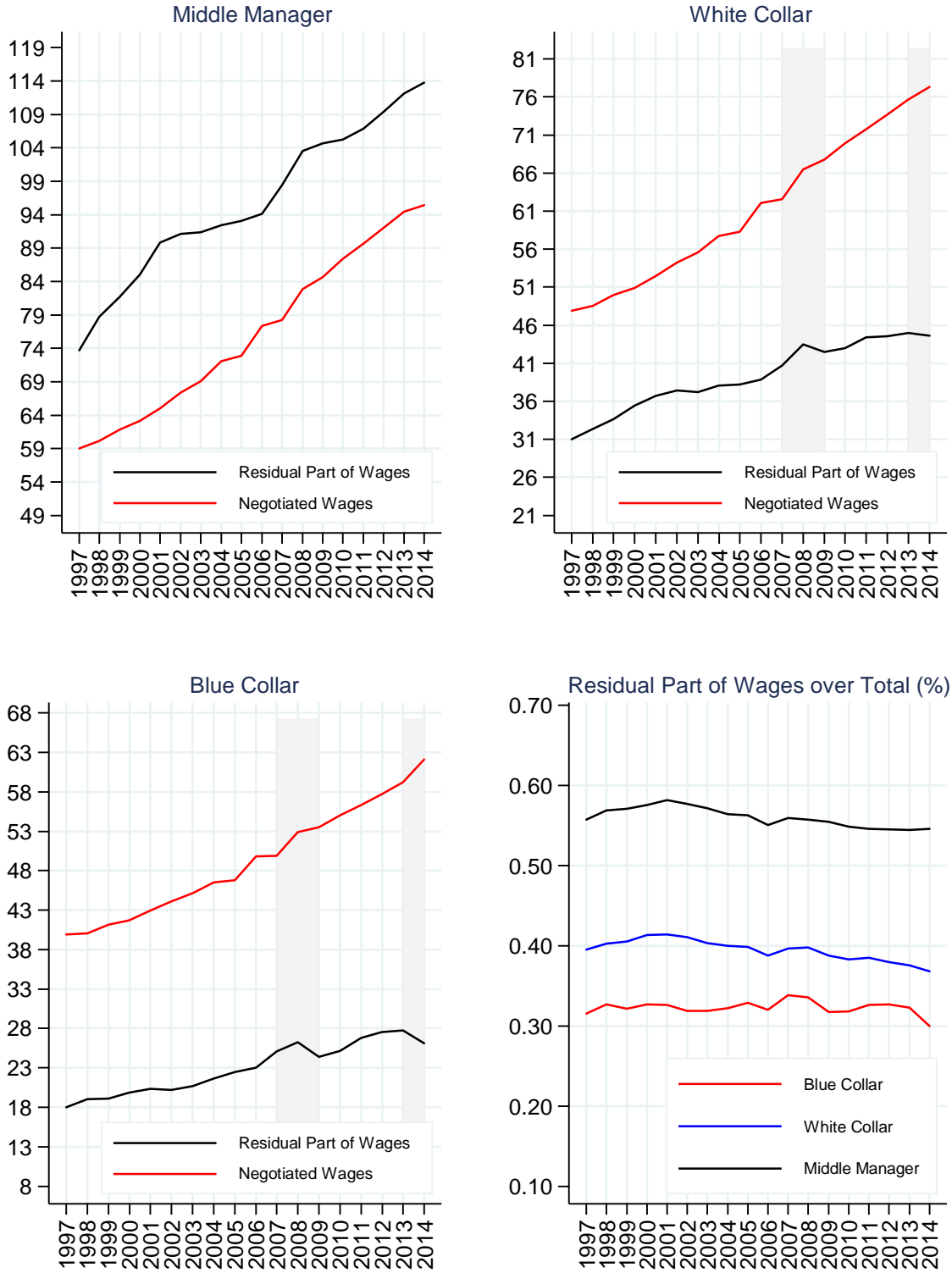
Figure 10: Distribution of percentage annual change of daily wages ,private non-agricultural sector, with and without una tantum



Source: own calculations on INPS data (on the sample of job stayers).

Figure 11: Changes in the nationally negotiated and residual part of wages over time, by workers' position. Metalworkers.

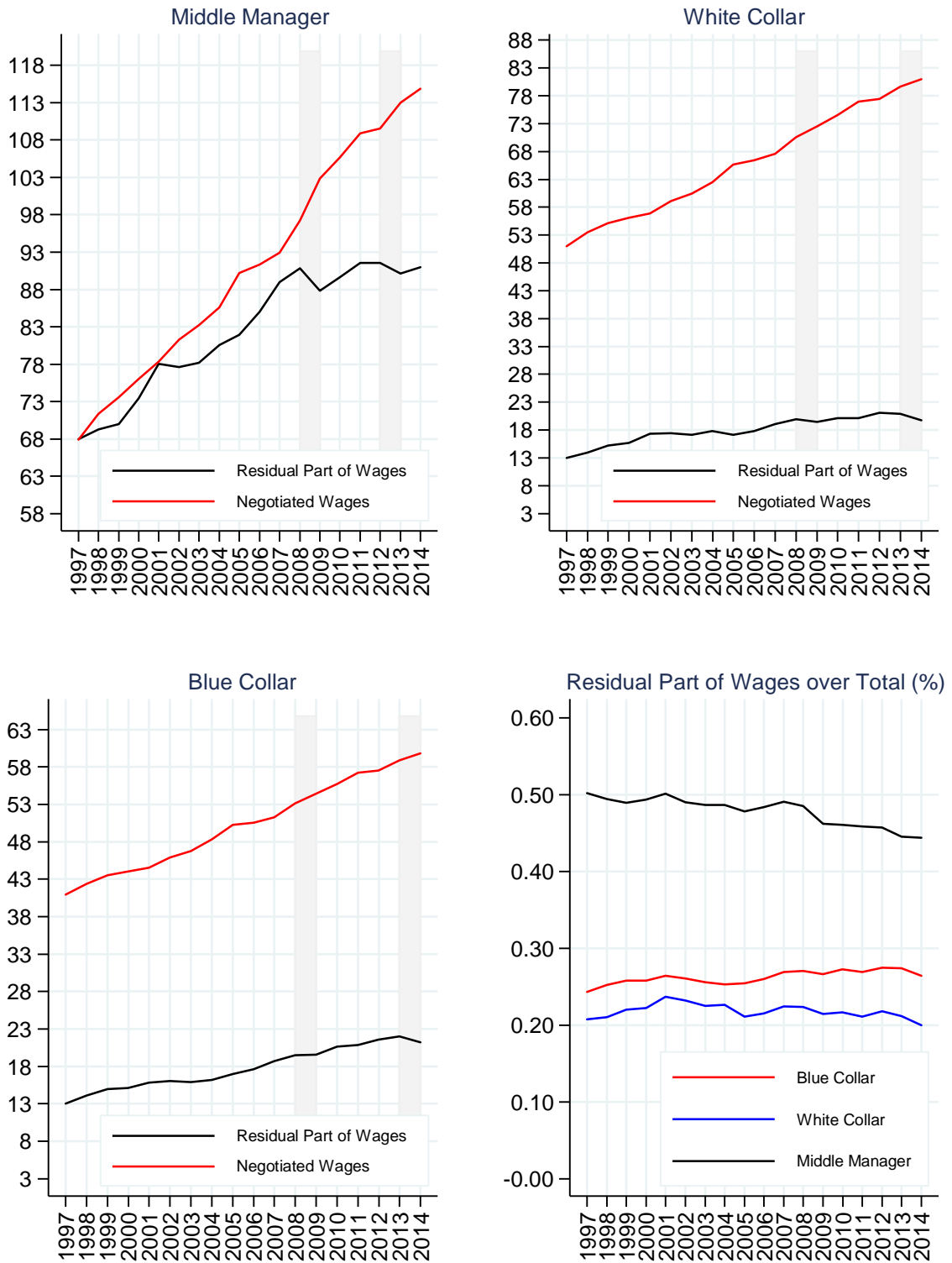
Daily wages: Metal Workers



Source: own calculations on INPS data (on the sample of job stayers).

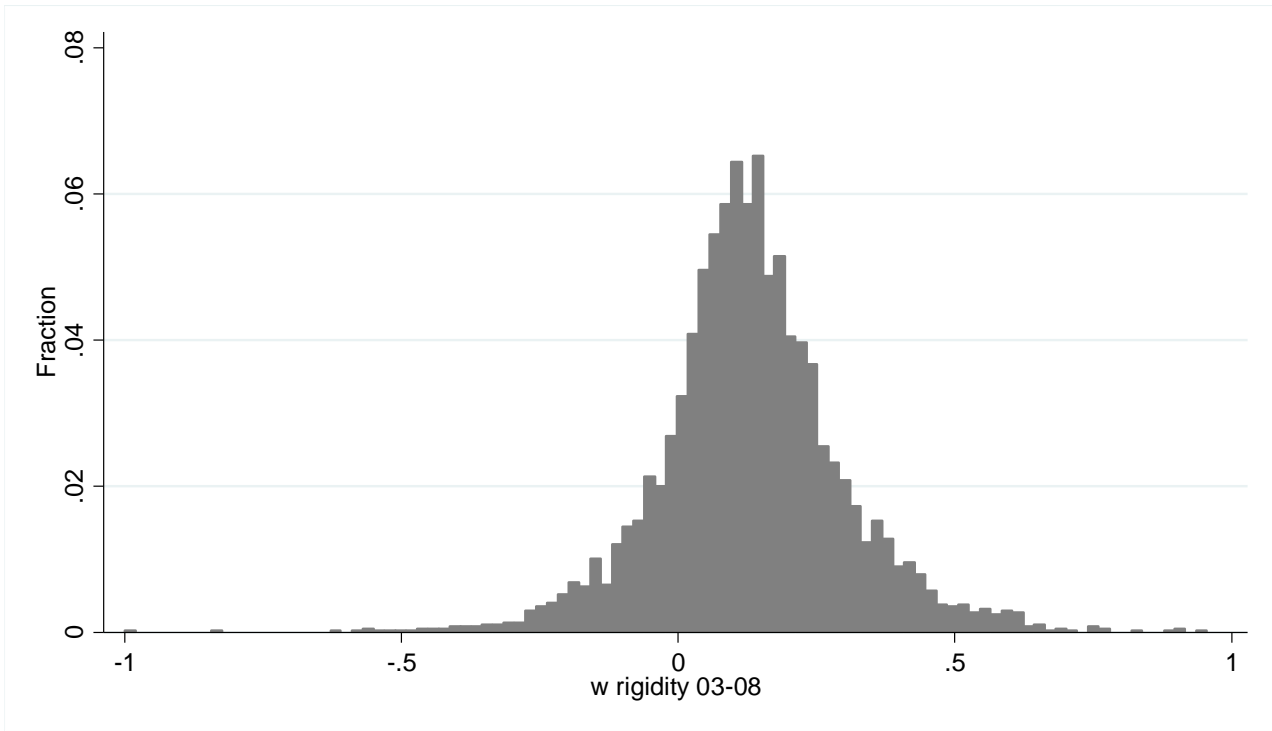
Figure 12: Changes in the nationally negotiated and residual part of wages over time, by workers' position. Workers in the wholesale and trade sector

Daily wages: Wholesale and Trade



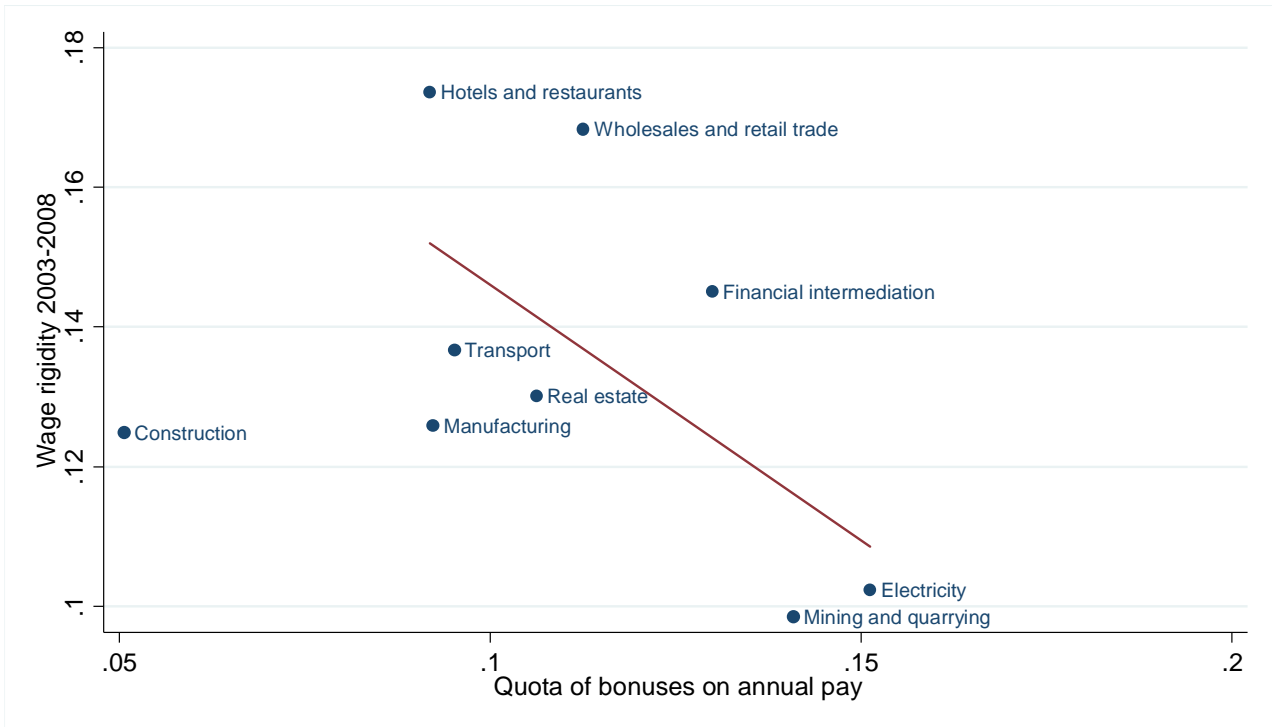
Source: own calculations on INPS data (on the sample of job stayers).

Figure 13: Distribution of firm level wage rigidity (Kelley's skewness, 2003-2008)



Note: own calculations from INPS data, INVIND sample. Mean=0.13, standard deviation=0.17.

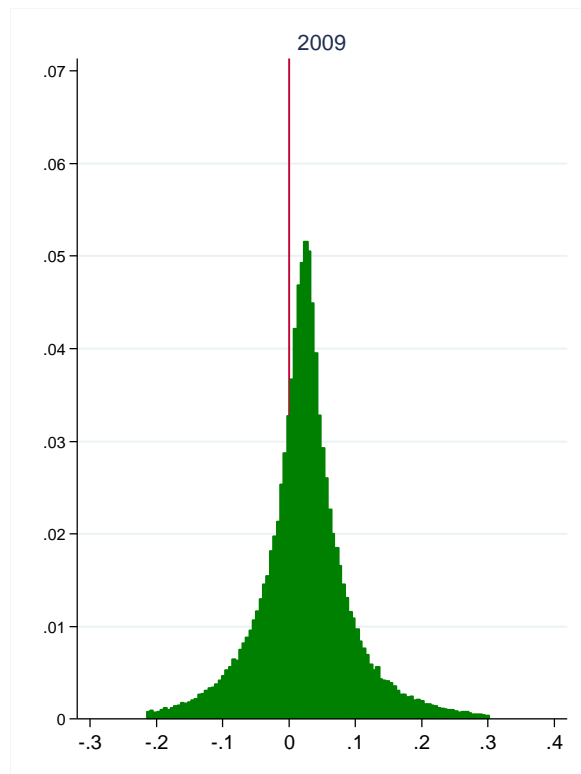
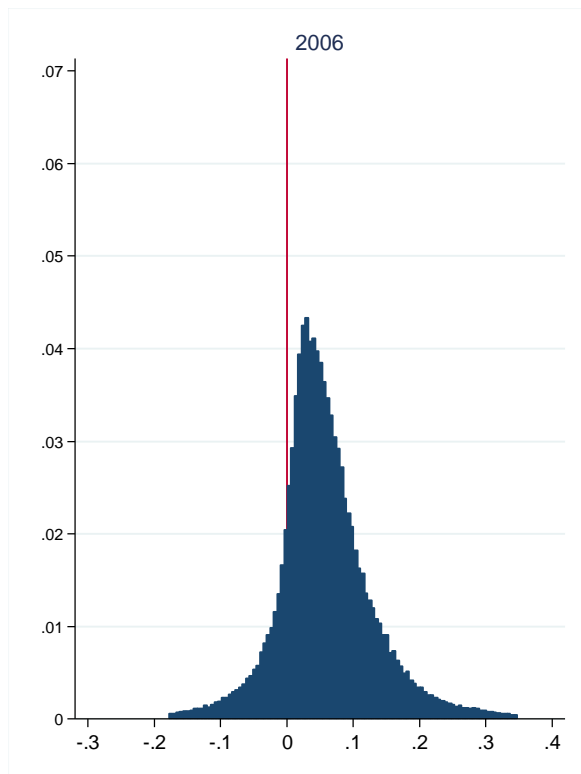
Figure 14: Wage rigidity and share of bonuses at the sector level



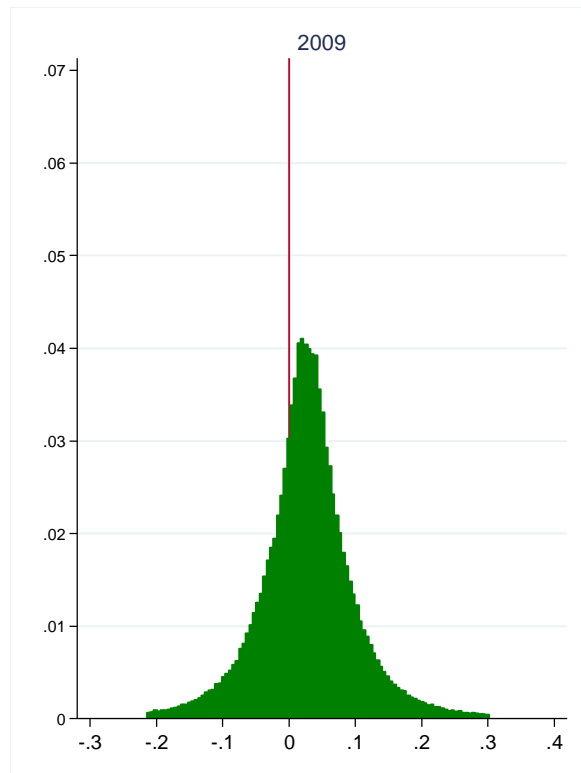
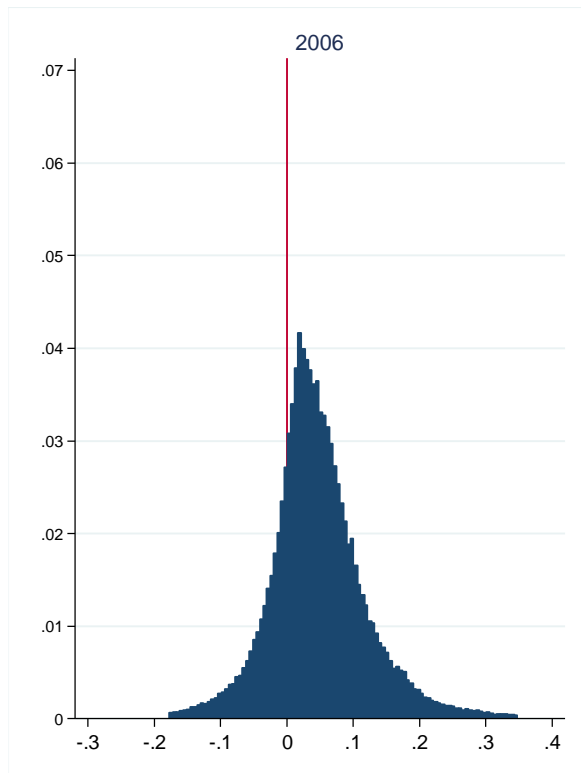
Note: quota of annual bonuses on annual earnings obtained from the Structure of Earning survey, 2006. The fitting line is computed excluding the construction sector.

Figure 15: Distribution of percentage annual change of daily wages, by firms' level of overtime hours per capita in 2008

Firms with low level of overtime hours per capita in 2008



Firms with high level of overtime hours per capita in 2008



Source: own calculations on INVIND data (on the sample of job stayers).