Firms' margins of adjustment.
The role of wage rigidities and industrial relations.

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Abstract

We investigate the margins of adjustments of firms to demand shocks following the economic crisis. We use firm-level panel dataset for the Italian metal engineering industry over 2009-2015 to estimate the elasticity of the wage bill to demand shocks and decompose the overall effects by the different wage margins (base wage, wage cushion and performance-related-pay) and labour inputs margins (permanent vs. temporary employment and working hours). Our estimates show that Italian firms mainly adjusted to the negative demand shocks reducing labour inputs, especially temporary employment and relying on short-time working schemes. Wages in general exhibit a lower resilience to demand shocks, with only the wage cushion adjusting slowly and with some lags. Larger firms and firms characterised by a two-tier bargaining structure are more likely to adjust wages rather than simply reducing labour inputs.

Key words: Wage bill, demand shock, employment, wage, hours, temporary lay-offs
JEL codes: J30, J58, C81

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1. Introduction

The 2008-2009 economic crisis exposed most firms to unprecedented large and persistent demand shocks. In some EU countries (such as Greece, Ireland, Italy, Portugal and Spain) more than others, the effects of the recession were more severe and fell disproportionally on employment causing mass lay-offs and a substantial increase in unemployment. In order to explain the heterogeneous resilience of firms to the shocks across different countries, the economic literature has renewed attention on the role of labour market institutions in firm's decisions about margins of adjustments.

Typically, firms adjust to a change in demand by either increasing output price or reducing production costs. Where the former is mainly used when demand is high and product competition is weak, while the latter strategy is more likely when facing negative demand shock and intense competition (Druant et al., 2012). Focusing on labour cost margins, firms can adjust the wage bill either cutting wages or reducing employment. However, if nominal base wages are rigid due to institutional constraints, such as the presence of collective wage agreements at the national or industry level, firms react to a demand shock by reducing employment, especially temporary employment if permanent employees are protected by strict employment protection legislation (Bertola et al., 2012). When firms are not free to cut the base wage, the negative employment effects of a demand shock may actually be less relevant if firms can use other margins of adjustment involving labour inputs (Backeby et al. 2012; Dias et al. 2013). For example, firms may react by reducing or eliminating flexible pay components, decreasing working hours or acting on workforce turnover (by freezing new hires and promotions or encouraging early retirement).

Hence, a better understanding of the actual margins of adjustment of the wage bill is crucial to assess the potential negative employment effects of a fall in output.

In this paper we contribute to the literature on firm's margins of adjustment providing quantitative evidence on the elasticity of the wage bill to demand shocks and on the sensitivity of specific employment and wage margins.

Most of the recent research on the margins of adjustment to demand shocks at the firm level is based on qualitative firm-level survey data collected by the Wage Dynamics Network (WDN).

Evidence based on this data confirms that downward nominal wage rigidity is a relevant phenomenon even in periods of slow economic growth and low wage inflation (Branten et al 2018).

Given the persistency of wage rigidity, Marotzke et al. (2017) explore whether firms with more constraints in cutting wages are also those declaring larger employment losses and show that, compared to firms with unchanged base wage, the probability that employment falls is significantly lower in firms cutting wages. Fabiani et al. (2015) confirm that labour cost reduction through the adjustment of quantities (i.e., employment) rather than price (i.e., wage) was the prevailing strategy that firms adopted to cope with demand shocks during the crisis.

Backeby et al. (2012) argue that, although workers' nominal base wages are seldom cut, firms can more easily adjust other wage components, such as bonuses and non-pay benefits. Their analysis confirms that European firms make extensive use of other components of compensation to adjust the cost of labour, especially in the case of firms facing base wage rigidity. Similar results are found by Dias et al (2013) using the WDN data matched with firm-level administrative data for Portugal. Estimates show that employment reduction is by far the main strategy used by firms to reduce labour costs, followed by the reduction of flexible monetary bonuses or non-monetary benefits.

In light of this evidence, Backeby et al. (2012) conclude that the impact of downward wage rigidity on labour costs might be lower than previous research has suggested. However, the qualitative nature of the questions does not enable to assess the quantitative dimension of the process of substitution between base wage flexibility and flexibility of other wage components, and ultimately the extent to which the wage bill is actually affected by downward wage rigidities.

This paper contributes to the literature on firm's margins of adjustments to demand shocks thanks to the availability of a unique firm-level panel dataset containing detailed quantitative information on wage and employment levels and changes, also for narrowly defined employment and wage components. The final sample consists of almost 2,400 metal engineering firms in Italy over the 2009-2015 period. This dataset contains information on employment level and composition by gender, skill, education and type of contract. Furthermore, it provides detailed information on wage levels and composition by skill and job title (as they are defined in the industry collective agreement). More specifically, the available data allow to compute, other than total annual wages, the base wage and other wage components, including seniority bonuses, other individual (both fixed and variable) bonuses and collective performance related pay. The latter is bargained at the firm level and is the main source of wage flexibility, allowing some cyclical variability into pay levels. Even if variable pay components only add up to the industry wage levels bargained at the national level (or they may be zero when the performance targets are not met), they may partly mitigate the impact on employment of negative demand shocks. Furthermore, in the medium run, they can also absorb part of the wage increases bargained at the firm level (Lucifora and Origo, 2015).

Thanks to the richness of this information, we investigate the elasticity of the wage bill and its main components (i.e., per-capita wage and total employment) to firm-level demand shocks proxied by changes in sales. Furthermore, we further split the wage bill and consider the sensitivity to demand shocks of different wage components (base wage, wage cushion and, within the latter, collective performance related pay) and employment components (permanent full-time employment, part-time employment, temporary employment and workers on short time working schemes). A valuable feature of this data-set is that it provides information also on firm-level industrial relations (such as the number of local union representatives) and local wage bargaining (such as the adoption of a firm-level agreement and bargaining of collective performance related pay). Since these micro-level institutional features are likely to influence the degree of wage rigidity, we shall discuss the role of firm-level industrial relations in influencing wage and employment adjustments to demand shocks.

The remainder of the paper is organized as follows. In Section 2 we sketch the institutional context. In Section 3 we present the dataset, the main variables of interests and some basic descriptive statistics. In Section 4 we discuss the main results of the multivariate analysis regarding the margins of adjustments to demand shocks, while in Section 5 we provide some robustness checks and discuss the role of industrial relations. The last Section concludes.

2. Institutional context

Collective wage bargaining in Italy consists of a two-stage system: collective agreements define base wages, usually by job title, at the industry or occupation level, but additional wage components can be bargained at the firm or local level. The first level of bargaining occurs every three years, has a national coverage and is targeted to adjust for changes in inflation. The second level of bargaining concerns employers and local unions and is meant to favor rent sharing by easing the introduction of collective performance related schemes, with wage increases linked to specific indicators of productivity, profitability or other measures of firm performance.

Interestingly, the second tier of collective bargaining has always been subordinated to the national level. Furthermore, the second-level bargaining is not compulsory and it is subject to the *in melius* or favorability principle: that is, wages and working conditions cannot be worse than those agreed at the industry level.

In order to allow firms to use more margins of adjustments to cope with negative demand shocks during the crisis, in 2009 it was institutionalized for the first time the possibility for firms' collective agreements to deviate and derogate from the national ones, but wages were not among the issues that could be derogated, thus preventing companies in financial difficulty to use downward wage flexibility.

Even if base wage cuts are formally forbidden, the responsiveness of flexible wage components to local productivity or other indicators of firm performance can partly mitigate the impact of negative demand shocks on employment. Despite the progressive diffusion of collective performance related pay schemes and their workforce coverage within the adopting firms (the amount of the premium is usually the same for all the workers employed in a certain firm, and when it differs it is proportional to the average wage for each job title, or to an indicator of individual absenteeism), their actual incidence in total wage is rather small (close to 5-6 per cent of the total gross wage; Casadio, 2003; Brandolini et al., 2007). Furthermore, firm-level bargaining is still fairly limited to the largest firms and the North regions. Available data from the Survey of Industrial and Service Firms (INVIND) by the Bank of Italy suggest that in 2010 only 21 percent of firms had some form of second-level agreement (D'Amuri and Giorgiantonio, 2014).

During the financial crisis, the current structure of collective bargaining favored an increase in the dynamics of negotiated wages regardless of the evolution of productivity. Even between 2008 and 2014, when GDP in Italy decreased by around 9% and productivity growth was flat, the dynamic of contractual wages remained positive. Nonetheless, in 2015 during an official speech, on the basis of the results of an ECB research (Di Mauro and Ronchi, 2016), the ECB Governor Mario Draghi argued that "[…] firms with flexibility at the plant-level have reduced employment less during the crisis than those bound by centralised wage bargaining agreements, partly because they have been able to adjust wages to economic conditions".

3. Data and descriptive statistics

Data and sample selection

The empirical analysis is based on a unique firm-level panel dataset combining detailed survey information with accounting data for a sample of metal engineering firms in Italy. This industry accounts for almost 40% of the firms and employment in manufacturing in Italy and is a leading industry for issues related to industrial relations and decentralized bargaining. Moreover, while we acknowledge that the external validity of our results may be limited and that it would also be interesting to gain insights into other industries, focusing on a single industry also has positive features, since the lower (within) industry heterogeneity reduces the confounding factors that may affect econometric estimates.

The survey is carried out by the main national employers' association of this industry with the aim to collect information on issues related to the labour market, firm-level bargaining and industrial relations. It is run every year since 2009; for our analysis, we could access data referred to the 2009-2015 period.[2] On average, approximately 1,500 firms employing around 225,000 workers are surveyed each year, corresponding to almost one fifth of the employees in this industry. Overall

[2] We thank Federmeccanica for having provided the data used for the empirical analysis.

almost 5,000 different firms took part to the survey in at least one of the years considered. Three quarters of the firms participated to the survey more than once, thus allowing to create an unbalanced panel over the period considered. The survey provides information on the following main aspects (corresponding to different Sections of the questionnaire): employment levels, composition and changes (with some information by skill, gender, education and type of contract); working hours and absenteeism; wage levels and composition by skill and job title; firm-level bargaining and industrial relations.[3]

The survey does not collect information on firm's economic or financial performance. However, using the unique firm identifier (VAT number), we could merge survey data with accounting data from AIDA dataset (*Analisi Informatizzata delle Aziende Italiane* - Computerized Analysis of Italian Firms) for the 2006-2015 period. This database is updated and distributed by Bureau van Dijk and it contains the financial statements of all the active and bankrupt Italian companies (excluding banks, insurance companies and public bodies).[4]

This procedure allowed us to successfully merge information for 3,392 different firms, corresponding to around 68% of the firms in the initial sample.

To select the final sample for the empirical analysis, we dropped observations with missing or negative values for the main variables of interest (sales, wage components and employment). Furthermore, for each wage component we excluded outliers of the corresponding distribution (dropping observations below and above the 1st and 99th percentile respectively). The final sample consists of 2,366 firms, corresponding to almost 70% of the merged sample.

Main variables of interest: definitions and evidence

The empirical analysis investigates firms' margins of adjustments to demand shocks, focusing on detailed wage, employment and working hours components.

Demand shocks are defined as changes in firm-level sales as reported in accounting data.

Figure 1 plots the common trend in sales (corresponding to the estimated time fixed effects in a simple model with firm fixed effects and firm-level sales as dependent variable) over the period considered. Trends in sales nicely resemble the Italian business cycle, characterized by a short recovery in 2010-2011, followed by a decline in sales in 2012-2013 (corresponding to the second recession caused by the sovereign debt crisis) and the subsequent recovery since 2014.

(FIGURE 1 AROUND HERE)

[3] In specific waves, there are also additional questions on specific policies related to human resources management or labour market reforms implemented over the period covered by the survey.

[4] For Italy AIDA is the main source feeding Amadeus, the international Bureau van Dijk's dataset containing similar comparable information on public and private companies across Europe.

Regarding wages, for the universe of full-time permanent employees the survey provides information on total gross monthly wages, annual collective performance related pay and other annual bonuses. Firms are required to provide data also on three main components of the monthly wage: base wage (set by industry collective agreements by job title), seniority premia and other individual monthly premia (that may be either fixed or variable).[5]

This information is available for different job titles within each skill. [6] This leads to information on wage levels and composition for sixteen different types of jobs within each firm. Hence, the dataset is close to a matched employer-employees dataset, with data on employees available as cell means (with on average eight full-time permanent employees per cell).

This is a great advantage compared to existing household and administrative datasets, which usually do not contain information on different wage components. As pointed out by Grigsby et al (2019), this is a crucial issue, especially when firms and workers are interested in long-term employment relationships. In this case, it is not the spot wage of new hires that should matter for employment fluctuations, but rather the user cost of labor, which is defined as the expected present value of costs to the firm associated with adding an additional worker in period t rather than waiting and adding the worker in period t+1 (Kudlyak, 2014). Grigsby et al (2019) show that base wages are a better proxy of the user cost of labor than measures of compensation inclusive of bonuses behaving like sales.

Using the available information, for each skill and job title we compute the annual gross wages (total monthly wage*13+collective PRP + other annual bonuses) and split it into two main components: base wage and wage cushion, the latter given by the difference between total wage and the base wage. Given the role of collective performance related pay in the metal engineering collective agreement as a local rents sharing device, we also focus on the use of this specific wage component to adjust to demand shocks.

Finally, the corresponding firm-level wage measures are computed as weighted averages, using as weights the distribution of full-time permanent employees by skill and job title.

Figure 2 reports the common trends of total wage and its main components over the period considered. Changes in total annual wages seem unrelated to changes in sales: total nominal wages have been increasing constantly over time, mainly driven by similar changes in the base wage. On the contrary the wage cushion, especially its performance related pay component, displays more sensitivity to the

[5] The latter is a wage component that adds up to the base wage, agreed directly between the employer and the employee at the time of employment, or as a supplement to the employment contract.

[6] Metal-engineering workers are classified into two skill categories (blue and white collars) and eight job titles broadly defined in the national agreement for the metal-engineering industry. The basic pay is parameterized on these levels. The same kind of normalization is sometimes used to determine the actual amount of performance related pay at the firm level.

business cycle. Hence, changes in both total and base wage provide clear evidence of wage rigidity, but this does not hold for all the wage components, especially for those more related to firm performance. The greater volatility of collective performance related pay does not show up when considering total annual wages because the former represents a very small share of the latter (less than 2% on average; around 4% in firms paying it, corresponding to almost one fifth of the wage cushion).

(FIGURE 2 AROUND HERE)

This is even clearer in Figure 3, where we plot annual changes in total wage and its main components by firm and year. In each panel, we also report the standard skewness statistics and the Kelley's skewness indicator, which is computed on the basis of specific quantiles of the distribution and hence it is robust to very extreme values.[7] Furthermore, a solid red line indicates the zero threshold for nominal wage rigidity, while the dashed green line indicates the target inflation rate defined in the industry collective agreement, which may be considered the threshold for real wage rigidity.

However, since the years on the analysis are characterised by very low inflation, it is difficult to statistically distinguish between nominal and real wage rigidities (Adamopoulou et al. 2016). Hence, we shall interpret any spike between 0 and the inflation rate as a signal of wage rigidity, without distinguishing between nominal and real one.

The first two panels of the figure confirm that wage rigidity is relevant mainly when we consider total annual wages and the base wage, given the mass of the distribution between zero and the inflation rate. Such mass is less evident when we consider the wage cushion and especially the performance related pay component. The latter is characterized by a longer left tail compared to the other wage components.

(FIGURE 3 AROUND HERE)

On the whole, descriptive evidence shows that total annual wage does not adjust to demand shocks, as proxied by changes in sales, mainly because of the substantial incidence of the base wage set by industry collective agreements. On average, the base wage accounts for almost 80% of total wage, but with great variability across firms (ranging from 60% at the 1st percentile to 100% at the 99th one). Furthermore, since variable pay usually increases with skills, figure 4 reports that its incidence varies notably by job title and skill, ranging from more than 97% for the lowest job titles to around 70% for the highest ones for both blue and white collars. Since white collar workers are more concentrated in higher job titles than blue collar ones, the incidence of the average base wage on the median total

[7] More specifically, the Kelley's index is computed as the relative difference between the upper and the lower tail densities: ((p90-p50)-(p50-p10))/(p90-p10). A positive index indicates that the upper tail is larger than the lower tail, a negative index indicates the opposite.

wage decreases substantially with skills, going from above 85% for blue collars, to around 75% for white collars and below 60% for managers.

(FIGURE 4 AROUND HERE)

We carried out a similar analysis for employment, also distinguishing between permanent and temporary employment. The distributions of annual changes by firm and year reported in Figure 5 show a mass at zero, implying some rigidity also in terms of employment adjustment, especially in the case of permanent one.[8] Furthermore, regardless of the measure of employment considered, the right tail is longer than the left one. Nonetheless, the overall distributions look less skewed than those reported for wages.

(FIGURE 5 AROUND HERE)

Finally, another great advantage of the available dataset is that it provides detailed information on contractual weekly hours, annual temporary lay-offs and absenteeism. Exploiting this information, we could compute an accurate measure of annual working hours, distinguishing between contractual and actual working hours, where the difference between the two is given by the number of hours of temporary lay-offs.[9]

Figure 6 display annual changes in these two measures of annual working hours over the period considered. As expected, the distribution of annual changes in contractual hours is much more concentrated than that in actual ones. Furthermore, the latter is skewed to the right, due to the declining use of temporary lay-offs both in the 2010 short recovery and since 2014.[10]

(FIGURE 6 AROUND HERE)

4. Main results

The aim of the empirical analysis is to test the sensitivity of the wage bill to demand shocks, paying attention to firms' adjustment along specific wage and employment components.

To this end, we estimate the following baseline model:

$$\log(Y)_{it} = \alpha + \beta_1 \log(sales)_{it} + \beta_2 \log(sales)_{it-1} + \tau_t + \mu_i + \varepsilon_{it} \qquad [1]$$

[8] The other masses in the case of temporary employment are the effect of changes in small integer numbers.
[9] See Appendix 1 for the procedure we used to estimate working hours.
[10] The number of annual temporary lay-offs hours per workers has been declining from 162 in 2009 to 63 in 2011; then it raised to 80 in 2012-2013 and progressively declined in the following years, reaching 47 hours in 2015.

where y represents one of the wage or employment indicators discussed in the previous Section, τ_t are time fixed effects, $\mu_i$are firm fixed effects and ε the error term.

In order to capture potential lags in the adjustment process, we proxy demand shocks with both current and lagged sales. Given the use of a log-linear specification, β estimates can be interpreted as elasticities.

As a preliminary step, in order to highlight the relative importance of wages and employment as margins of adjustment, we analyse the sensitivity of the annual wage bill and of its two main components (i.e., per-capita annual wage and employment) to demand shocks. The main estimates are reported in Table 1, with standard errors clustered at the firm level. Columns differ for the dependent variable used: total wage bill in the first column, per-capita annual wage in column 2 and total employment in column 3.

Estimates in the table show that the total wage bill is significantly influenced by changes in total sales, but the size of the estimated elasticity is rather small: a 10% increase in sales causes an increase in the wage bill of approximately 1.5%. If we take into account also some lags in the adjustment, the overall change is around 2%. Quite interestingly, when we look at the sensitivity of the two main components of the wage bill, we see that the overall change of the wage bill is fully driven by changes in employment, given that wages are largely unaffected by changes in sales, except for a very small elasticity to lagged sales.

(TABLE 1 AROUND HERE)

In order to test whether the overall wage insensitivity is common to the main wage components, in table 2 we estimate equation [1] separately for the base wage, the wage cushion and, within the latter, collective performance-related pay (PRP). Our estimates confirm that wage rigidity to demand shocks is fully caused by the rigidity of the base wage set by collective agreements at the industry level. The wage cushion adjusts slowly and with some lags, while performance related pay turns to be the most responsive component of wages to demand shocks: a 10% increase in sales translates into a 3% increase in the annual performance related pay. However, given the relatively low share of this component in total wage, the effect in terms of changes in total annual wage is rather negligible.

(TABLE 2 AROUND HERE)

We then perform a similar analysis for the employment components, distinguishing between permanent and temporary workers and splitting further the first group into full-time and part-time employees. The main results reported in Table 3 show, as expected, a relatively high elasticity of temporary employment to sales: the estimated elasticity implies that 10% increase in sales increases temporary employees by almost 3%. However, also permanent full-time employment proves to be somehow sensitive to demand shocks, while the least flexible component is represented by part-time (permanent) employment. It should be noticed that both types of atypical employment represents on average a small share of total employment in the metal engineering sector (around 5% of total workforce is on a temporary contract, a similar share on a part-time one). Hence, changes in total employment due to changes in sales are mainly driven by changes in full-time permanent employment.

(TABLE 3 AROUND HERE)

The lack of a massive use of part-time contracts is a structural feature of the Italian metal engineering industry, which has traditionally reached flexibility in working hours through the use of overtime during recoveries and temporary lay-offs during downturns. Short-time working schemes were actually one of the first (and sometimes main) tool used by large manufacturing firms to cope with the 2008 crisis. In the period covered by our analysis, Italy was the EU country with the most generous short-time working scheme (corresponding to 80% of the previous gross earnings and lasting up to three years); furthermore, this benefit was significantly higher than ordinary unemployment benefit and hence it was very attractive for both employers and workers. Finally, in 2009 its coverage was temporarily extended to employees in small companies (with less than 15 employees) previously excluded (Arpaia et al, 2010).

In light of these features, it is crucial to consider also changes in working hours in order to get a full picture on the margins of adjustments that firms can use to respond to demand shocks.

Table 4 reports or main estimates of the sensitivity of annual working hours to sales. As dependent variable, we used both contractual and actual hours, where the difference between the two is mainly due to the use of short time working schemes. To provide more direct evidence on the role plaid by the latter as a margin of adjustment to demand shocks, we used also the total hours of temporary lay-offs as dependent variable (column 3 of the Table).

Results in the table clearly show that, while contractual hours are roughly insensitive to demand shocks, the estimated elasticity for actual hours is very similar to that of employment. The last column in the Table clearly highlights that such sensitivity is driven by the use of short-time work, which turns out to be the margin of adjustment with the largest elasticity to demand shocks: a one percent increase in current sales causes almost a 3 percent decline in total hours of temporary lay-offs.

(TABLE 4 AROUND HERE)

5. Further estimates and robustness checks

Our empirical analysis point out that temporary employment and working hours, through the use of short-time working schemes, are by far the margins of adjustment that are more sensitive to demand shocks. In light of these results, it may be interesting to understand how firms use these two margins of adjustment given a certain level of permanent employment. In order to understand the relationship between the use of temporary employment, temporary lay-offs and permanent employment, we estimate a SUR model using these three factors as dependent variables. Notice that this approach should provide estimates that are similar to those from a random effects model, but it allows also to estimate the correlation in the unobservables of the three equations. The main results reported in Table 5 qualitatively confirm the sensitivity to demand shocks discussed in the previous Section, albeit with a larger sensitivity to demand shock for permanent employment compared to temporary one. The estimated correlations in the unobservables show that temporary employment and short time working schemes are negatively correlated, both are positively related with permanent employment, but the size of the correlation is larger for the latter. These results seem to imply that temporary employment and short time working schemes are somehow alternative margins of adjustment given a certain level of permanent employment, but the relationship with the latter is stronger in the case of short time working schemes.

(TABLE 5 AROUND HERE)

As a further step of the analysis, we test the existence of asymmetries in the adjustment to, respectively, positive and negative shocks. In presence of downward nominal wage rigidity, it may be the case that firms cannot reduce wages as they would like when they face a negative demand shock, but in principle they can fully adjust in case of a positive demand shock. Hence, sensitivity to sales should be larger in case of positive shocks compared to negative ones.

To test the presence of asymmetries in the elasticity of wages to demand shocks, we create a set of four dummies capturing the sign (i.e., positive or negative) of both current and lagged shocks and interact them with the corresponding measures of sales. Estimates of the interaction effects are reported in Table A1 in Appendix for total annual wage (column 1) and its main components (columns 2-4).

Overall our estimates show no significant asymmetries in the adjustment of total wage and its components to different types of shocks, with the only exception of wage cushion (column 3). For the latter, the estimated elasticity to negative shocks is slightly larger than the one estimated for positive shocks. Hence, for wage components that are potentially less constrained by downward nominal wage rigidity, firms seem to adjust slightly more when facing a decline in sales compared to when they face an increase in sales.

Furthermore, we also test whether our main results on the sensitivity of employment to demand shocks holds also in a labour demand framework. More specifically, assuming a Cobb-Douglas production function, it can be shown that changes in labour demand depend negatively on changes in wages and positively on changes in sales. Hence, if wages are completely rigid, a fall in demand completely translates into a fall in employment. In the other extreme case, if wages completely adjust to changes in product demand, employment should be largely unaffected. In this perspective, wage flexibility could reduce the impact of a negative demand shock on employment.

Hence, estimates of the employment sensitivity to demand shocks in the previous Sections may overestimate the true effect, since they do not take into account for potential adjustments in total wages.

To test the robustness of the sensitivity of employment to demand shocks once controlling for wages, we estimate the following conditional labor demand equation:

$$\log(E)_{it} = \alpha + \theta\log(W)_{it} + \beta_1\log(sales)_{it} + \beta_2\log(sales)_{it-1} + \tau_t + \mu_i + \varepsilon_{it} \qquad [2]$$

where E is total employment, W is per-capita annual wage and all the other variables have the same meaning as before.

In order to take into account of potential endogeneity of wages in the labor demand equation, we use an Instrumental Variables (IV) approach. More specifically, we estimate a 2SLS fixed effect model using the base wage as an instrument for total wage. Given the institutional context discussed in Section 2 and the descriptive evidence provided in Section 3, we assume that the base wage is exogenously determined and affects the employment level only through its effect on total wage level. Table A2 in Appendix reports the results of the second stage. All standard tests allow to reject the hypothesis of a weak instrument.

Regardless of model specification, once conditioning on total wage we still find a statistically significant effect of demand shocks on employment. Furthermore, the size of the estimated elasticities are similar to those discussed in the previous Section, confirming that wage adjustments do not help to mitigate the employment effect of demand shocks.

6. Heterogeneous effects: the role of firm size and firm-level bargaining

Our main results provide an interesting insight on how firms on average react to demand shocks, but they may actually hide significant heterogeneity across groups. More specifically, the wage margin may be more relevant in firms paying higher wages than the base ones set at the national (industry) level. This implies that wage adjustments to demand shocks may be influenced by the presence of firm-level bargaining. Furthermore, until 2015 firms with less than 15 employees were characterized by much lower firing costs of permanent workers than larger firms, mainly because they wer not forced to reinstate workers in case of unfair dismissals. This makes changes in permanent employment less costly in small firms compared to large ones. Small firms are also less likely to bargain on wages at the local level and have less access to generous short time working schemes than larger firms. This implies that, in absence of relevant wage or hours margins of adjustment, changes in permanent employment may be the main tool that small firms can use to react to demand shocks. Hence, in this Section we test the existence of heterogeneous results by firm size and by presence of a firm-level agreement.

In order to capture the effect of firm size on the sensitivity of different margins of adjustment, we re-estimated our main models interacting the demand shocks (both the current and the lagged one) with a set of dummies capturing firm size. More specifically, we distinguish firms with less than 15 employees and large firms (with more than 300 employees)[11]. In order to take into account of potential endogeneity, we measure firm size using the time-invariant average number of employees over the entire period considered.

The main results are reported in Table 6. Our estimates actually point out that employment in small firms is more sensitive to (lagged) demand shocks; such sensitivity is driven by changes in permanent employment. On the contrary, very large firms are those registering the largest sensitivity of collective PRP to demand shocks

(TABLE 6 AROUND HERE)

Finally we perform a similar exercise interacting the demand shocks with a dummy for the presence of firm-level bargaining. Estimates in Table 7 show that the wage bill in firms with a firm-level contract is less sensitive to demand shock than in other firms. This is due to the lower elasticity of employment to demand shocks, especially the permanent component. As expected, these firms can leverage more on wage flexibility through a larger sensitivity of collective PRP to demand shocks, but estimates are not precise enough to conclude that the estimated difference between the two groups is statistically significant. Furthermore, bargaining firms seem to react more also in terms of temporary lay-offs, probably because the actual implementation of short-time working schemes is bargained at the firm level.

(TABLE 7 AROUND HERE)

[11] We used this threshold for large firms because it is the one used to define the number of local union representatives, which is a factor closely related to the importance of firm-level bargaining. However, our results are unchanged even if we use the standard threshold of 250 employees to identify large firms.

7. Conclusions

In this paper we have investigated the firms' margins of adjustments to demand shocks following the economic crisis using a rich firm-level panel dataset for the Italian metal engineering industry over 2009-2015.

Our estimates highlight that the total wage bill is significantly influenced by demand shocks, but such sensitivity is mainly driven by changes in employment, as total wages are largely unaffected by changes in sales. Wage rigidity to demand shocks is driven by rigidity of the base wage set by collective agreements at the industry level. The wage cushion adjusts slowly and with some lags, while performance related pay turns to be the most responsive component of wages to demand shocks. When we turn to employment components, we find a high elasticity of both temporary employment and workers on short-time working schemes to sales, but also permanent full-time employment proves to be somehow sensitive to demand shocks.

Our results confirm that firms have a number of margins of adjustments to cope with negative demand shocks, also in terms of wage adjustments: even in contexts where nominal wage rigidity prevents from cutting wages, firms can adjust other flexible wage components, usually bargained at the firm level. However, if these components represent a negligible share of total wage, as it is the case in the Italia metalworking industry, their buffering effect on employment reduction is rather limited.

References

Adamopoulou, E., E. Bobbio, M. De Philippis, and F. Giorgi (2016). Wage rigidities and business cycle fluctuations: a linked employer-employee analysis. IZA Journal of Labor Policy 5 (1), 22.

Agell, J. and P. Lundborg (2003). Survey evidence on wage rigidity and unemployment: Sweden in the 1990s. Scandinavian Journal of Economics 105 (1), 15-30.

Altonji, J. G. and P. J. Devereux (2000). The extent and consequences of downward nominal wage rigidity. In Research in labor economics, pp. 383-431. Emerald Group Publishing Limited.

Anderton, R., B. Bonthuis, et al. (2015). Downward wage rigidities in the euro area. University of Nottingham Centre for Globalisation and Economic Policy Research Paper Series 9.

Anger, S. (2011). The cyclicality of effective wages within employer-employee matches in a rigid labor market. Labour Economics 18 (6), 786-797.

Arpaia, A. N. Curci, E. Meyermans, J. Peschner and F.. Pierini (2010). Short time working arrangements as response to cyclical fluctuations, European Commission Occasional Papers, 64.

Babecky, J., P. Du Caju, T. Kosma, M. Lawless, J. Messina, and T. Room (2012). How do European firms adjust their labour costs when nominal wages are rigid? Labour Economics, 19 (5),

Barwell, R. D. and M. E. Schweitzer (2007). The incidence of nominal and real wage rigidities in great britain: 1978-98. The Economic Journal 117 (524), F553-F569.

Bauer, T., H. Bonin, L. Goette, and U. Sunde (2007). Real and nominal wage rigidities and the rate of ination: Evidence from west german micro data. The Economic Journal 117 (524), F508-F529.

Beraja, M., E. Hurst, and J. Ospina (2014). The regional evolution of prices and wages during the great recession. unpublished paper.

Bertola, G., A. Dabusinskas, M. Hoeberichts, M. Izquierdo, C. Kwapil, J. Montornes, and D. Radowski (2012). Price, wage and employment response to shocks: evidence from the WDN survey. Labour Economics 19 (5), 783-791.

Branten, E., A. Lamo, T. Room (2018). Nominal wage rigidity in the EU countries before and after the great recession: evidence from the wdn surveys. Technical report.

Card, D., F. Kramarz, T. Lemieux, et al. (1999). Changes in the relative structure of wages and employment: A comparison of the United States, Canada, and France. Canadian Journal of Economics 32 (4), 843-877.

Cardoso, A. R. and M. Portela (2009). Micro foundations for wage flexibility: wage insurance at the firm level. Scandinavian Journal of Economics 111 (1), 29-50.

Cardoso, A. R. and P. Portugal (2005). Contractual wages and the wage cushion under different bargaining settings. Journal of Labor economics 23 (4), 875-902.

Daly, M. C., B. Hobijn, and T. S. Wiles (2012). Dissecting aggregate real wage fluctuations: Individual wage growth and the composition e_ect. Federal Reserve Bank of San Francisco.

D'Amuri, F., and Giorgiantonio, C. (2014). Diffusion and outlook of firm-level bargaining in Italy, Questioni di Economia e Finanza (Occasional papers 221).

Devereux, P. J. and R. A. Hart (2006). Real wage cyclicality of job stayers, within-company job movers, and between-company job movers. ILR Review 60 (1), 105-119.

Devicienti, F., B. Fanfani, and A. Maida (2016). Collective bargaining and the evolution of wage inequality in italy, IZA WP.

Devicienti, F., A. Maida, and P. Sestito (2007). Downward wage rigidity in Italy: microbased measures and implications. The Economic Journal 117 (524), F530-F552.

Dias, D. A., C. R. Marques, and F. Martins (2013). Wage rigidity and employment adjustment at the firm level: Evidence from survey data. Labour Economics 23, 40-49.

Dickens, W. T., L. Goette, E. L. Groshen, S. Holden, J. Messina, M. E. Schweitzer, J. Turunen, and M. E.Ward (2007). How wages change: micro evidence from the international wage flexibility project. Journal of Economic Perspectives 21 (2), 195-214.

Di Mauro, F. and Ronchi, M. (2016). Centralisation of wage bargaining and firms' adjustment to the great recession - A micro-based analysis, European Central Bank, CompNet Policy Brief 8.

Doris, A., D. ONeill, and O. Sweetman (2015). Wage flexibility and the great recession: the response of the irish labour market. IZA Journal of European Labor Studies 4 (1), 18.

Druant, M., S. Fabiani, G. Kezdi, A. Lamo, F. Martins, and R. Sabbatini (2012). Firms' price and wage adjustment in europe: Survey evidence on nominal stickiness. Labour Economics 19 (5), 772-782.

Du Caju, P., T. Kosma, M. Lawless, T. Room et al. (2015). Why firms avoid cutting wages. ILR Review 68 (4), 862-888.

Ehrlich, G. and J. Montes (2014). Wage rigidity and employment outcomes: evidence from German administrative data. Technical report, Working paper.

Elsby, M. W., D. Shin, and G. Solon (2016). Wage adjustment in the great recession and other downturns: Evidence from the United States and Great Britain. Journal of Labor Economics 34 (S1), S249-S291.

Fabiani, S., A. Lamo, J. Messina, and T. Room (2015). European firm adjustment during times of economic crisis. IZA Journal of Labor Policy 4 (1), 24.

Fehr, E. and L. Goette (2005). Robustness and real consequences of nominal wage rigidity. Journal of Monetary Economics 52 (4), 779-804.

Galuscak, K., M. Keeney, D. Nicolitsas, F. Smets, P. Strzelecki, and M. Vodopivec (2012). The determination of wages of newly hired employees: Survey evidence on internal versus external factors. Labour Economics 19 (5), 802-812.

Goette, L., U. Sunde, and T. Bauer (2007). Wage rigidity: measurement, causes and consequences. The Economic Journal 117 (524), F499-F507.

Grigsby, J., E. Hurst and A. Yildirmaz (2019). Aggregate Nominal Wage Adjustments: New Evidence from Administrative Payroll Data. NBER Working Paper No. 25628.

Guriev, S. M., B. Speciale, and M. Tuccio (2016). How do regulated and unregulated labor markets respond to shocks? evidence from immigrants during the great recession.

Holden, S. (1998). Wage drift and the relevance of centralised wage setting. Scandinavian Journal of Economics 100 (4), 711-731.

Holden, S. and F. Wulfsberg (2008). Downward nominal wage rigidity in the OECD. The BE Journal of Macroeconomics 8 (1).

Kahn, S. (1997). Evidence of nominal wage stickiness from microdata. The American Economic Review 87 (5), 993-1008.

Knoppik, C. and T. Beissinger (2009). Downward nominal wage rigidity in Europe: an analysis of european micro data from the ECHP 1994-2001. Empirical Economics 36 (2), 321-338.

Lemieux, T. (2006). Increasing residual wage inequality: Composition effects, noisy data, or rising demand for skill? American Economic Review 96 (3), 461-498.

Lemieux, T., W. B. MacLeod, and D. Parent (2012). Contract form, wage flexibility, and employment. American Economic Review 102 (3), 526-31.

Lucifora, C. and Origo, F. (2015). Performance Related Pay and Firm Productivity. Evidence from a Reform in the Structure of Collective Bargaining. Industrial and Labor Relations Review, 68(3): 603-632.

Marotzke, P., R. Anderton, A. Bairrao, C. Berson, and P. Toth (2017). Asymmetric wage adjustment and employment in European firms, ECB Working Papers Series, 2103.

Messina, J., C. F. Duarte, M. Izquierdo, P. Du Caju, and N. L. Hansen (2010). The incidence of nominal and real wage rigidity: An individual-based sectoral approach. Journal of the European Economic Association 8 (2-3), 487-496.

Peng, F. and W. S. Siebert (2008). Real wage cyclicality in Italy. Labour 22 (4), 569-591.

Pischke, J.-S. (2018). Wage flexibility and employment fluctuations: evidence from the housing sector. Economica 85 (339), 407-427.

Pissarides, C. A. (2009). The unemployment volatility puzzle: Is wage stickiness the answer? Econometrica 77 (5), 1339-1369.

Snell, A., H. Stuber, and J. Thomas (2018). Downward real wage rigidity and equal treatment wage contracts: Theory and evidence. Review of Economic Dynamics, 30, 265-284.

Solon, G., R. Barsky, and J. A. Parker (1994). Measuring the cyclicality of real wages: how important is composition bias? The quarterly journal of economics 109 (1), 1-25.

Verdugo, G. (2016). Real wage cyclicality in the eurozone before and during the great recession: Evidence from micro data. European Economic Review 82, 46-69.

Figure 1 – Trends in sales, 2009-2015.

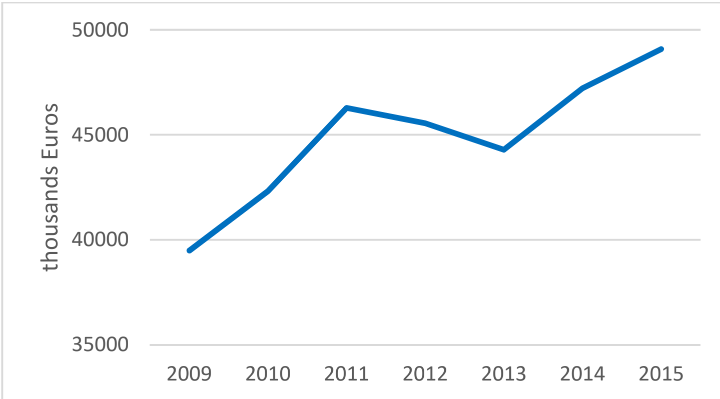


Figure 2 – Trends in total wage and its main components (2009=100)

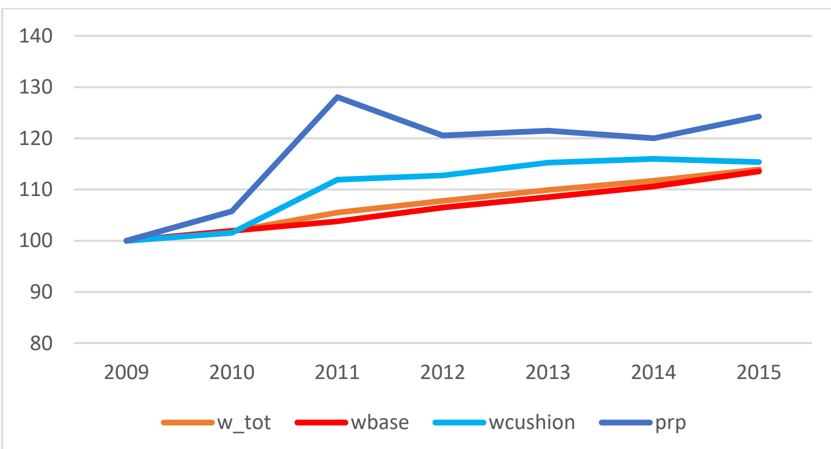
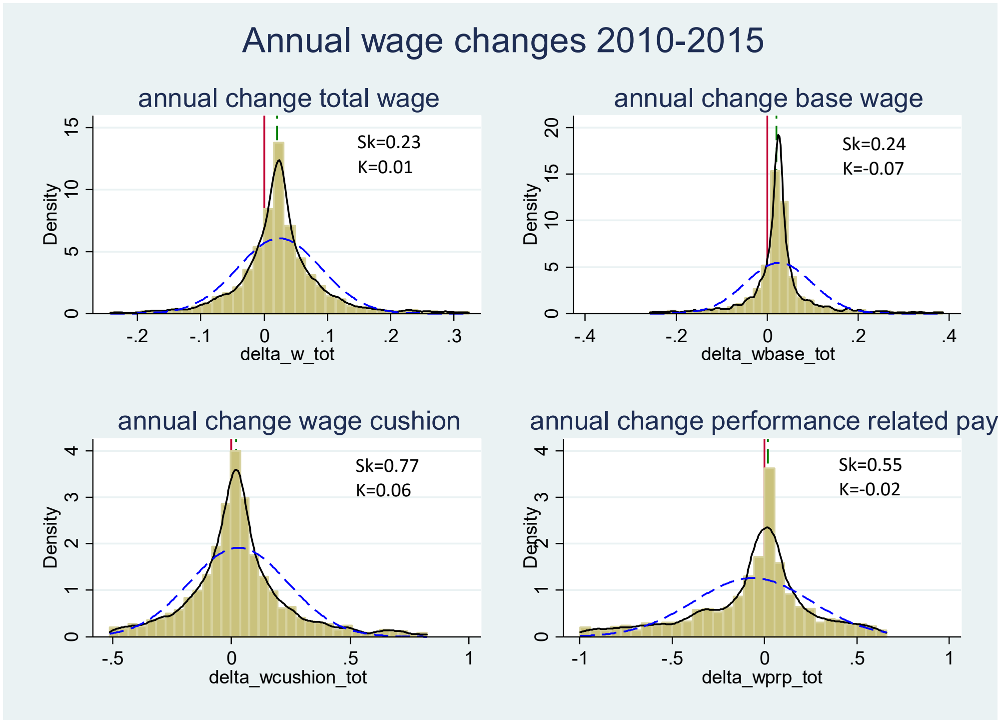


Figure 3 – Annual changes in total wage and main wage components.



Note: the red line indicates 0, the dashed green line indicates the target inflation rate set in the industry collective agreement (0.02). The black line is the kernel density, while the dashed blue line is the normal distribution

Figure 4 – Incidence of base wage on total annual wage by job title and skill.

Keitz index (average base wage/median annual wage)

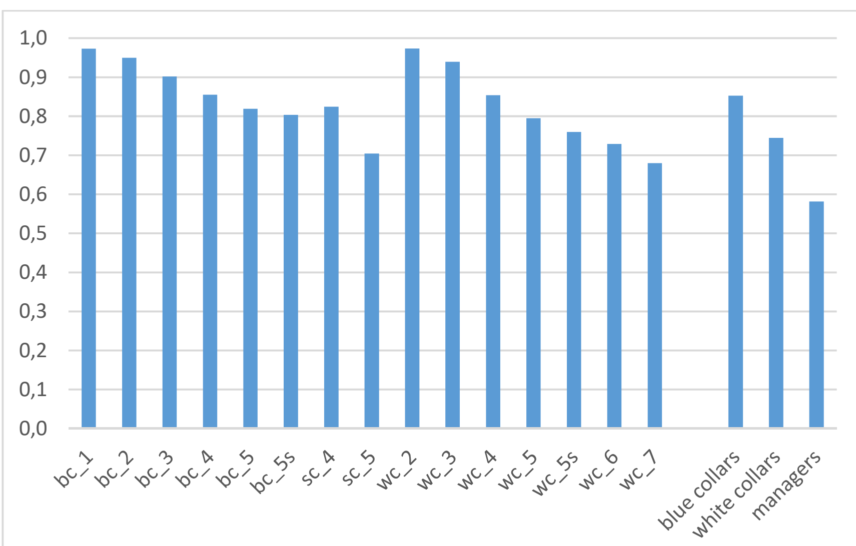
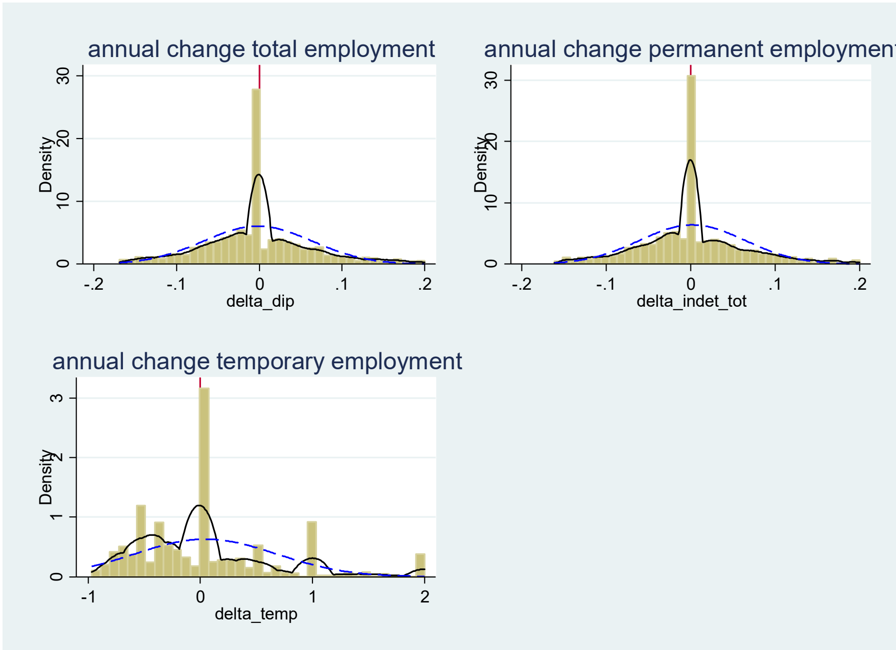
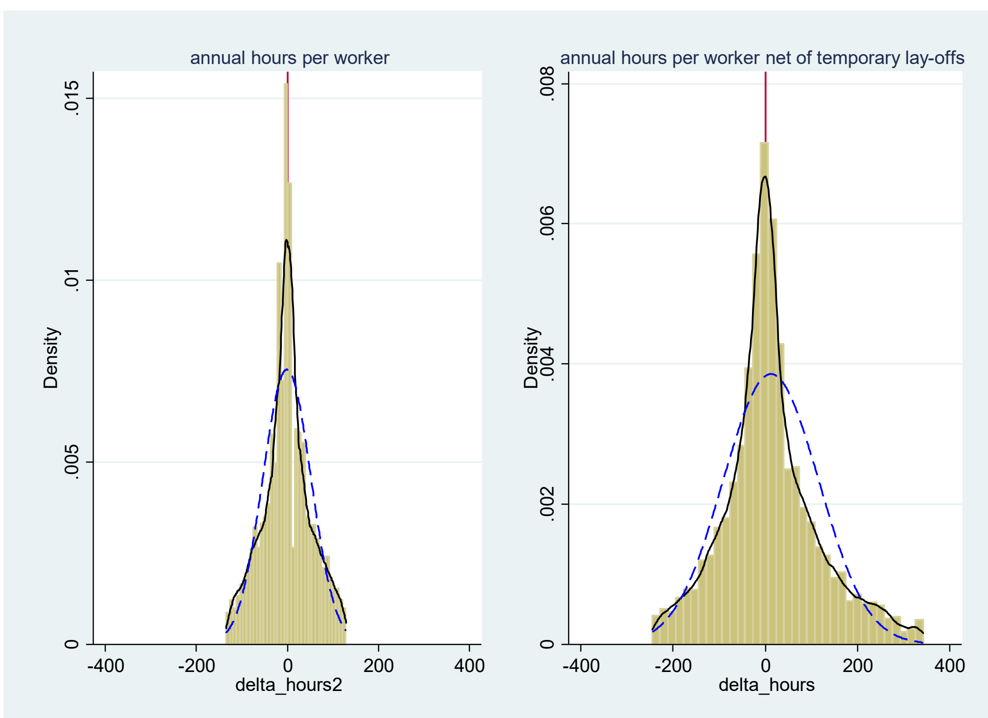


Figure 5 – Annual changes in total, permanent and temporary employment, 2010-2015.



Note: the red line indicates 0. The black line is the kernel density, while the dashed blue line is the normal distribution

Figure 6 – Annual changes in total working hours, 2010-2015.



Note: the red line indicates 0. The black line is the kernel density, while the dashed blue line is the normal distribution

Table 1 – Elasticity of the wage bill to sales.

Firm fixed effects estimates

VARIABLES	(1) wage bill	(2) wage	(3) employment
logsales	0.142***	0.006	0.149***
	[0.028]	[0.004]	[0.028]
logsales_lag	0.059***	0.009***	0.056***
	[0.017]	[0.003]	[0.016]
Observations	5,737	5,737	5,737
R-squared	0.064	0.350	0.107
Number of firms	2,364	2,364	2,364

NOTE: all dependent variables are logs; models include also time fixed effects. Robust standard errors clustered at the firm level in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table 2 – Elasticity of wage components to sales.

Firm fixed effects estimates

VARIABLES	(1) Base wage	(2) Wage cushion	(3) PRP
logsales	0.000	0.017	0.311**
	[0.005]	[0.086]	[0.144]
logsales_lag	0.002	0.125*	0.131
	[0.004]	[0.070]	[0.110]
Observations	5,737	5,737	5,737
R-squared	0.275	0.016	0.008
Number of firms	2,364	2,364	2,364

NOTE: all dependent variables are logs; models include also time fixed effects. Robust standard errors clustered at the firm level in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table 3 – Elasticity of employment to sales

Firm fixed effects estimates

	(1)	(2)	(3)	(4)
VARIABLES	Permanent	Permanent full time	Permanent part-time	Temporary
logsales	0.141***	0.139***	0.045	0.282***
	[0.029]	[0.027]	[0.045]	[0.050]
logsales_lag	0.060***	0.059***	0.040*	0.051
	[0.016]	[0.016]	[0.022]	[0.031]
Observations	5,736	5,737	5,737	5,737
R-squared	0.096	0.097	0.015	0.032
Number of firms	2,364	2,364	2,364	2,364

NOTE: all dependent variables are logs; models include also time fixed effects. Robust standard errors clustered at the firm level in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table 4 – Elasticity of annual working hours to sales

Firm fixed effects estimates

	(1)	(2)	(3)
		Annual hours	
VARIABLES	Total	net of temporary lay-offs	Temporary lay-offs
logsales	0.007**	0.161***	-2.897***
	[0.003]	[0.047]	[0.344]
logsales_lag	-0.002	-0.030**	0.558***
	[0.002]	[0.015]	[0.192]
Observations	5,665	5,643	5,716
R-squared	0.025	0.093	0.122
Number of firms	2,351	2,349	2,364

NOTE: all dependent variables are logs; models include also time fixed effects. Robust standard errors clustered at the firm level in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table 5 – The relationship between permanent employment, temporary employment and temporary lay-offs (short-time work)

Seemingly Unrelated Regression

VARIABLES	(1) Permanent employees	(2) Temporary employees	(3) Hours of temporary lay-offs
logsales	0.505***	0.372***	-1.380***
	[0.018]	[0.030]	[0.146]
logsales_lag	0.232***	-0.036	1.808***
	[0.018]	[0.030]	[0.145]
Constant	-2.839***	-2.151***	0.850**
	[0.046]	[0.076]	[0.368]
Correlation matrix of residuals:			
perm-temp	0.125		
perm-hours	0.300		
temp-hours	-0.138		
Breusch-Pagan test of independence chi2(p-value)	705.763 (0.000)		
Observations	5,716	5,716	5,716
R-squared	0.818	0.263	0.082

NOTE: all dependent variables are logs.

*** p<0.01, ** p<0.05, * p<0.1

Table 6 – Heterogeneous effects by firm size

Firm fixed effects estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Wage components			Employment		Hours	
VARIABLES	wage bill	wage	employment	base wage	wage cushion	PRP	Permanent	Temporary	Annual hours	Temporarry lay-offs
logsales	0.133***	0.006	0.140***	0.001	-0.005	0.419***	0.128***	0.248***	0.006**	-2.864***
	[0.031]	[0.004]	[0.031]	[0.005]	[0.090]	[0.159]	[0.031]	[0.052]	[0.003]	[0.389]
logsales*small	0.067	-0.003	0.073	-0.023	0.643	-0.324	0.135	-0.062	0.012	-0.249
	[0.071]	[0.019]	[0.050]	[0.018]	[0.416]	[0.517]	[0.096]	[0.117]	[0.009]	[0.781]
logsales*large	0.045	-0.005	0.029	0.015	-0.395*	-0.902	0.018	0.463**	-0.005	-0.116
	[0.056]	[0.021]	[0.063]	[0.019]	[0.235]	[0.550]	[0.062]	[0.231]	[0.013]	[1.025]
logsales_lag	0.054***	0.007**	0.045***	-0.002	0.156*	0.047	0.048***	0.039	-0.004	0.485**
	[0.018]	[0.003]	[0.016]	[0.004]	[0.084]	[0.110]	[0.016]	[0.036]	[0.002]	[0.223]
logsaleslag*small	0.058	0.025	0.085**	0.023*	-0.036	-0.321	0.111**	-0.008	0.002	0.257
	[0.050]	[0.016]	[0.037]	[0.014]	[0.320]	[0.297]	[0.052]	[0.070]	[0.008]	[0.593]
logsaleslag*large	0.006	0.004	0.030	0.011	-0.102	0.650***	0.027	0.026	0.008	0.309
	[0.049]	[0.009]	[0.049]	[0.009]	[0.126]	[0.220]	[0.049]	[0.100]	[0.005]	[0.476]
Observations	5,737	5,737	5,737	5,737	5,737	5,737	5,736	5,737	5,665	5,716
R-squared	0.065	0.352	0.112	0.277	0.019	0.010	0.106	0.036	0.026	0.122
Number of firms	2,364	2,364	2,364	2,364	2,364	2,364	2,364	2,364	2,351	2,364

NOTE: all dependent variables are logs; models include also time fixed effects. Small firms have less than 15 employees; large firms have more than 300 employees. Robust standard errors clustered at the firm level in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table 7 – Heterogeneous effects by firm-level bargaining

Firm fixed effects estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Wage components			Employment		Hours	
VARIABLES	wage bill	wage	employment	base wage	wage cushion	PRP	Permanent	Temporary	Annual hours	Temporarry lay-offs
logsales	0.170***	0.001	0.187***	-0.004	0.045	0.262	0.183***	0.281***	0.005	-2.700***
	[0.033]	[0.005]	[0.030]	[0.006]	[0.118]	[0.197]	[0.032]	[0.059]	[0.004]	[0.391]
logsales*bargaining	-0.083*	0.013	-0.115***	0.012	-0.050	0.126	-0.122***	-0.012	0.007	-0.687
	[0.047]	[0.009]	[0.043]	[0.010]	[0.141]	[0.273]	[0.044]	[0.113]	[0.007]	[0.695]
logsales_lag	0.055***	0.010***	0.057***	-0.001	0.190*	0.088	0.062***	0.022	-0.002	0.370*
	[0.018]	[0.004]	[0.018]	[0.005]	[0.097]	[0.115]	[0.019]	[0.032]	[0.002]	[0.210]
logsaleslag*bargaining	0.019	-0.005	0.005	0.007	-0.224**	0.143	0.000	0.103		0.707*
	[0.037]	[0.007]	[0.033]	[0.007]	[0.104]	[0.244]	[0.034]	[0.079]		[0.391]
Observations	5,737	5,737	5,737	5,737	5,737	5,737	5,736	5,737	5,665	5,716
R-squared	0.066	0.351	0.116	0.276	0.017	0.008	0.106	0.033	0.025	0.124
Number of firms	2,364	2,364	2,364	2,364	2,364	2,364	2,364	2,364	2,351	2,364

NOTE: all dependent variables are logs; models include also time fixed effects. Robust standard errors clustered at the firm level in brackets

*** p<0.01, ** p<0.05, * p<0.1

APPENDIX

Table A1 – Asymmetric adjustments to positive and negative demand shocks

Firm fixed effects estimates

VARIABLES	(1) annual wage	(2) base wage	(3) wage cushion	(4) PRP
logsales_pos (γ1)	0.0084*	-0.0017	0.1580	0.3547**
	[0.005]	[0.006]	[0.102]	[0.158]
logsales_neg (γ2)	0.0089*	-0.0021	0.1789*	0.3616**
	[0.005]	[0.006]	[0.105]	[0.161]
logsaleslag_pos (γ3)	0.0072**	0.0031	0.0504	0.1018
	[0.003]	[0.004]	[0.074]	[0.115]
logsaleslag_neg (γ4)	0.0072**	0.0032	0.0561	0.1014
	[0.003]	[0.004]	[0.075]	[0.117]
Constant	10.0413***	7.3837***	5.9326***	-1.1706
	[0.057]	[0.060]	[0.811]	[1.730]
F test (p value)				
γ1=γ2	3.24(0.07)	0.94(0.33)	12.99(0.00)	0.54(0.46)
γ3=γ4	0.00(0.95)	0.03(0.86)	1.28(0.26)	0.00(0.97)
Observations	5,737	5,737	5,737	5,737
R-squared	0.351	0.275	0.020	0.008
Number of piva	2,364	2,364	2,364	2,364

NOTE: all model includes also time fixed effects. Robust standard errors clustered at the firm level in brackets

*** p<0.01, ** p<0.05, * p<0.1

TABLE A2 – Conditional labour demand estimates

IV fixed effects estimates

VARIABLES	(1) logdip	(2) log_hours2	(3) log_hours
logw	-0.243*	0.027	0.027
	[0.136]	[0.025]	[0.073]
logsales	0.150***	0.011**	0.166***
	[0.028]	[0.005]	[0.048]
logsales_lag	0.058***	-0.003	-0.031**
	[0.016]	[0.003]	[0.016]
y2010	-0.006	0.012***	0.039***
	[0.010]	[0.002]	[0.008]
y2011	-0.023	-0.003	0.040***
	[0.014]	[0.002]	[0.011]
y2012	-0.030*	-0.003	0.039***
	[0.015]	[0.003]	[0.010]
y2013	-0.017	-0.004	0.030**
	[0.018]	[0.003]	[0.012]
y2014	-0.031*	-0.004	0.014
	[0.017]	[0.004]	[0.018]
y2015	-0.008	-0.004	0.043***
	[0.019]	[0.003]	[0.014]
Constant	4.609***	7.325***	6.053***
	[1.389]	[0.102]	[0.501]
Observations	5,737	5,643	5,643
Number of piva	2,364	2,349	2,349

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

NOTE: all model includes also time fixed effects. Robust standard errors clustered at the firm level in brackets

*** p<0.01, ** p<0.05, * p<0.1