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Employment and Wage Consequences of Flexible Wage Components

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ABSTRACT

I document new facts about the relationship between flexible wage components and firm performance using a unique matched employer-employee database from Hungary. Firms providing flexible wage components adjust total wage compensation more to revenue shocks than firms without flexible wages. Nevertheless, employment responses to revenue shocks are the same at firms with and without flexible wage components. These findings also hold in the case of aggregate shocks and during the Great Recession. The results suggest that flexible wage components in their current magnitude do not attenuate employment responses to a negative revenue shock. Finally, I discuss the possible explanations for the empirical findings.

1. Introduction

The share of workers with flexible wages has increased substantially in the last decades (Lawler and Mohrman, 2003; Lazear and Shaw, 2008). In fact, by 2010, half of the workers in the United States received compensation which included some kind of output-dependent wage component (for example, overtime payments, regular and irregular bonuses, allowances) (Bloom and Van Reenen, 2011).

A central question of economic research and policy making is whether flexible wages have beneficial employment effects. The seminal models of Tobin (1972) and Weitzman (1983, 1985) argue that there is a trade-off between cutting wages and laying off workers. If firms can cut the flexible wage components when facing adverse shocks, they can decrease the total wage bill without laying off workers. This argument implies that an economy with a more flexible wage structure could sustain higher employment during recessions.

The main challenge in the empirical investigation of this question is the scarcity of databases with direct information on individual-level wage flexibility. That is why existing empirical research usually uses proxies for wage flexibility such us the prevalence of wage freezes (Adamopoulou et al., 2016; Altonji and Devereux, 2000; Card and Hyslop, 1997; Elsby, 2009; Fehr and Goette, 2005; Kurman and McEntarfer, 2019). Other studies use small-scale surveys on managerial practices to measure wage flexibility (Cahuc and Dormont, 1997; Gielen et al., 2010; Kruse, 1993). These papers present mixed results on the employment effects of flexible wages. A recent strand of literature uses individual- or household-level income surveys. These data sources include individual-level information on flexible wages, but lack data on the revenue of employers. The papers using these surveys argue that flexible wage components can protect jobs in the face of negative shocks because workers with flexible wage components are less likely to become unemployed during recessions (Lemieux et al., 2012; Pischke, 2018; Stokes et al., 2017).

This paper combines detailed worker-level information on flexible wage components[1] with firm-level income statements to estimate the employment effects of flexible wages. Using a unique Hungarian linked employer-employee database between 2002 and 2013, I have two main contributions to the literature. First, I estimate whether the employment and wage responses to idiosyncratic revenue changes are different for firms with and without a flexible wage structure. I confirm the intuition that flexible wage firms adjust wages more not only in case of aggregate shocks but even in the case of idiosyncratic revenue changes. Second, I show that, this higher wage flexibility does not result in more stable employment. Flexible-wage and rigid-wage firms adjust their employment similarly in response to an idiosyncratic revenue change. These relationships persist under year-to-year and long run revenue changes, in case of aggregate shocks and even applied to the Great Recession. Based on the results I conclude that flexible wage components in their current magnitude are unlikely to have a positive employment effect. In the final part of the paper I discuss two potential mechanisms which

[1] In the main specification I consider both bonuses and overtime payments as part of flexible wage components. I discuss the reasons in the data section in more detail. The results are qualitatively the same if I consider only bonuses and premia as flexible wage components.

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may simultaneously contribute to the results. First, the share of flexible wage components are too low compared with the total costs of firms, and that is why they cannot counterbalance negative revenue shocks. Second, there is a trade-off between lay-offs and voluntary quits, and firms avoid large wage cuts to prevent workers from voluntarily quitting.

As firms can freely decide about their wage structure, I start the analysis by exploring what firm-level factors are associated with a flexible wage structure. I show that the share of workers receiving flexible wage components is uncorrelated with worker characteristics, industry and the growth rate of the revenue, while it is closely correlated with and strictly decreasing in the volatility of sales. As a consequence, firms with the highest revenue volatility are the least likely to pay flexible wage components. This is exactly the opposite of what one would expect if it is assumed that flexible wages protect jobs. Firms with high revenue volatility suffer large negative shocks more often and thus they are more likely in need of flexible wages to protect jobs. Lastly, larger and more productive firms are more likely to pay flexible wages.

Next, I estimate the wage and employment reactions of firms to revenue changes using a difference-in-differences strategy. I estimate whether a firm having a flexible wage structure adjusts wages and employment more in the case of a one percent revenue change than firms having a rigid wage structure. I also control for firm-specific trends in revenue to account for unobserved differences among firms which are correlated with the wage structure and the sales and employment growth of firms.

The results show that firms paying flexible wage components adjust average wages more if their revenue changes than rigid-wage firms. The elasticity of wages with respect to revenue changes is higher by approximately 0.06 in the case of firms that pay flexible wages. The difference is driven solely by flexible wage components as flexible- and rigid-wage firms adjust the base wage by the same magnitude if their revenue changes. I also demonstrate that flexible-wage firms adjust the wages of incumbents to a higher degree than rigid-wage firms. I also investigate the different types of flexible wage components separately and show that both bonuses and overtime payments react more to revenue changes.

In contrast to the difference in the elasticity of wages, there is no difference in the employment adjustment of firms with and without flexible wages following a revenue shock. This pattern is similar for small and large revenue declines alike. Similarly, flexible- and rigid-wage firms increase their separation rates by the same magnitude if their revenue drops. The only notable difference between these two types of firms is that a firm with a fully flexible wage structure has a lower churn rate. This means on average a 5 percentage points lower separation rate and hiring rate than in the case of firms with a fully rigid wage structure. This difference in separation rates is apparent not only in the case of negative shocks but in the case of large revenue increases as well. Finally, the results are not driven by temporary revenue changes as the results are qualitatively the same if I consider long-term (3-year) changes in revenue. As flexible wage firms do not decrease employment and increase separation rates less than rigid-wage firms, I conclude that flexible wage components in their current state do not attenuate employment responses to a negative revenue shock.

The main threats to identification are that flexible- and rigid-wage firms are different in their unobservable characteristics, or they are hit by different types of shocks. To circumvent the first problem, I use propensity score matching to compare firms with similar observable characteristics. To cirumvent the second problem, I control for firm-specific time trends in revenue and employment to take into account unobserved differences in the growth potential of firms. I also instrument the revenue of the firms with leave-out-mean industry growth. In line with previous results, flexible-wage firms decrease wages more but do not decrease employment significantly less than rigid-wage firms if unemployment increases.

Finally, I discuss the possible reasons why the downward wage flexibility provided by flexible wage components does not cushion the employment effects of revenue drops. First of all, the cutting of flexible wage components may not decrease the total wage bill enough to protect jobs. The share of flexible wages is approximately 10 percent of the total wage bill in European countries (Druant et al., 2012) and 9.1 percent in the Hungarian context. As the ratio of the wage bill to total revenue is 0.205, the 0.06 elasticity of wages to revenue implies that flexible wages can decrease total cost by 0.06*.0205=0.013 percent more if the revenue drops by one percent. Second, firms may not want to cut flexible wage components significantly to prevent voluntary quits.[2] On a market with search frictions (Coles and Mortensen, 2016; Mortensen and Pissarides, 1994; Moscarini and Postel-Vinay, 2013), workers may quit voluntarily after a wage cut and search another firm. I derive in a wage posting framework formally that if the flexible wage structure increases voluntary quit rates and incentivizes workers' effort at the same time then large firms with low revenue volatility choose flexible wage structure. The model also predicts that small firms with high revenue volatility – which may need downward wage flexibility the most to protect jobs – opt for fixed-wage contracts to decrease voluntary quits.

The paper contributes to the literature on the incentive effects of flexible wages. Contract theory interprets wage flexibility as incentives for higher effort levels (Grossman and Hart, 1981; Holmström, 1979; 1982; Levin, 2003), called 'performance payments' or 'incentive payments' (e.g. Lazear, 2000; Lemieux et al., 2009). In these models, firms with low volatility in revenue can easily infer workers' effort and incentivize them with revenue sharing to exert higher effort. However, the more volatile the revenue shocks are, the harder it is to draw such an inference, and when the revenue is too noisy firms simply opt for a fixed-wage contract. Previous empirical tests of these models used field experiments to show that piece-rate payments – a specific form of flexible wages – increase the productivity of workers (Bandiera et al., 2005; Lazear, 2000; Shearer, 2004). I add to the literature by showing that larger firms with higher productivity and lower revenue volatility are more likely to implement a flexible wage structure.

The paper also contributes to the literature on revenue sharing. Manning (2003) and Card et al. (2018) suggest that firms face upward sloping labor supply and increase (decrease) wages if they want to move up (down) on the labor supply curve. Other papers (Cardoso and Portela, 2009; Guiso et al., 2005; Juhn et al., 2018; Kátay, 2016) argue that firms only partially insure risk-averse workers against revenue shocks which leads to the co-movement of wages and revenue. My results indicate that flexible wage components are the main source of revenue sharing, while the base wage does not respond to changes in revenue.

The paper is also related to the literature on downward wage rigidity. Previous research (Altonji and Devereux, 2000; Card and Hyslop, 1997; Daly et al., 2012; Dickens et al., 2006; Kátay, 2011) provides ample evidence of downward wage rigidity in many countries and industries. In contrast, recent studies using administrative payroll data suggest smaller downward wage rigidity (Elsby and Solon, 2019; Jardim et al., 2019). Previous studies showed that wage parts which are not regulated play a crucial role in mitigating adverse shocks (Card and Cardoso, 2021; Cardoso and Portugal, 2005). In line with this, flexible wage components are usually shown to be an important mitigator of wage rigidity as they are adjusted more in the event of aggregate shocks, such as local unemployment changes (Anger, 2011; Makridis and Gittleman, 2019; Messina et al., 2010; Oyer, 2005). These results are in sharp contrast with the recent findings of Grigsby et al. (2021). They show using US payroll data that only 2 percent of the workers suffer a cut in their sample, and wage freezes are also prevalent just like in most countries examined in previous studies. In contrast, the share of flexible wage components are

[2] There are other reasons which may also constrain firms in offering more flexible wages. For example, Bewley (1999) and Howitt (2002) argue that significant wage cuts decrease the morale and productivity of workers.

smaller than in most of the European countries, and the base wage is adjusted much more than flexible wage components if local unemployment changes. My results also suggest that the base wage is rigid downward, while flexible wage components are cut more than the base wage when the unemployment rate increases. I also extend the previous literature by showing that flexible components are adjusted more in the event of firm-level revenue shocks.

The results of Ehrlich and Montes (2018) and Kurman and McEntarfer (2019) are the closest to my findings. Ehrlich and Montes (2018) found that firms with a more rigid wage structure have lower separation rates and entry rates in Germany. They argue that wage rigidity has allocative consequences as the cost of a nominal wage cut is 30 percent of the average workers' annual compensation. In contrast, Kurman and McEntarfer (2019) argue that wage rigidity decreases employment because firms which used more wage freezes before the Great Recession decreased employment more during the recession in the US. The most likely explanation for the discrepancy between the results of the latter study and my own findings is that firms with more wage freezes may be hit by a different type of shocks than other firms. In line with these, I found that rigid-wage firms have larger volatility in revenue, and as a consequence, they are more likely to be hit by large negative revenue shocks as well. Thus, it is possible that rigid-wage firms suffer more severe shocks and decrease employment more during crises even though the elasticity of employment to revenue is the same for flexible and rigid firms. In line with this, I also show that the partial effect of revenue changes on employment change is the same at firms with more and with less prevalent wage freezes.

The paper is organized as follows: Section 2 describes the Hungarian institutional context. The next section introduces the database and the descriptive statistics. Section 4 estimates the wage reactions of firms while Section 5 presents employment reactions. Section 6 discusses the potential explanations for the results. Finally, Section 7 concludes.

2. Institutional background

Employment contracts in Hungary must specify whether the worker is paid on an hourly basis or is salaried and paid once a month. In both cases, the nominal hourly wage, or in the case of salaried workers, the monthly nominal base wage must be determined in the contract. Nominal wage rates can only be decreased with the consent of workers. Even though firms are not restricted in the use of hourly wage contracts, Hungarian workers are usually salaried and work full-time. Part-time work contracts add up to only 5 percent of the workforce. The contracts of salaried workers usually specify 40 working hours weekly. Even if the workers are salaried, firms can request and register overtime hours. In this case, they have to pay overtime payments on an hourly basis. Just as in the US (Grigsby et al., 2021), firms do not always report these overtime hours even if their employees work more than 40 h a week.[3] Bonus payments, premia and other benefits are not regulated and firms can modify these elements in the compensation package without any constraint. Even if a worker' s compensation is based on a piece rate or is paid on an hourly basis, her monthly payment has to exceed the base wage specified in the employment contract.

According to the Wage Dynamics Network Survey, conducted in 24 countries of the European Union between 2006 and 2009, the flexible elements over the base wage account for approximately 10 percent of total worker compensation in Hungary. This share is close to the Western European average (Kézdi and Kónya, 2011) but significantly larger than in the United States (Grigsby et al., 2021). The Survey also shows that Hungarian firms adjust the base wage every 13.8 months, while 80 percent of firms adjust wages once a year. The frequency of wage changes in Hungary is slightly higher than in other European countries. For example, firms in the Eurozone change wages every 15 months on average (Druant et al., 2012).

Hungarian employment protection institutions are closer to Anglo-Saxon institutions than to those found in continental countries. It is relatively easy to dismiss workers (Riboud et al., 2002; Tonin, 2009) and wage bargaining takes place mostly at the individual level. Collective wage bargaining is based on firm-level agreements with the unions (Rigó, 2012). Union membership is less than 20 percent, which is lower than in other OECD countries (OECD, 2004). Apart from firm-level bargaining, industry-level agreements are rare and set weak requirements only (Neumann, 2006). Unions participate in the country-level bargaining forum called the National Interest Reconciliation Council. The Council is a tripartite forum consisting of union federations, employer associations and the government. It makes non-binding recommendations for wage increases and sets an obligatory minimum wage for the following year.[4] Finally, the share of firms using automatic wage indexation policies is also low (Druant et al., 2012).

As a consequence of the weak labor protection regulation, Hungarian wages are not rigid downward in an international comparison. Using the approach developed for the International Wage Flexibility Project, Kátay (2011) showed that Hungarian nominal wage rigidity is close to the average of the 18 participating EU countries and is somewhat lower than the downward nominal wage rigidity of the US. Kátay (2011) also argues that the most important barrier to cutting nominal wages is the minimum wage. In line with this, only 44 percent of firms replied in the WDN survey that they cannot cut wages because of legal constraints. This ratio is very close to the average of other Central European countries (45 percent) but half of the average of Western European countries (85 percent) (Du Caju et al., 2015).

I focus on the 2002–2013 period that can be divided into two different sub-periods based on the macroeconomic environment. As Appendix Figure demonstrates, the economy grew by around 4 percent until 2006 when growth started to slow down. The crisis was severe in Hungary, GDP fell by 6 percent in 2009 and the growth rate remained low until 2013. In line with this, the unemployment rate was around 7 percent in the pre-crisis period and increased to 11 percent during the crisis. Inflation was moderate at around 4 percent during the observed years.

3. Data and descriptive statistics

3.1. Data

I use two main data sets for empirical investigation. To measure revenue and employment changes, I use administrative firm-level revenue data from the corporate income tax returns collected by the National Tax and Customs Administration. In Hungary, every firm has to use double book-keeping and file their corporate income tax. The database contains the universe of tax files including the balance sheets, income statements and the employment of firms. I use this database to compute the employment and revenue change of firms between years.

I merge wage information in the Hungarian Structure of Earnings Survey (HSES) with balance sheets, since balance sheet data do not contain information on flexible wage elements. The Structure of Earnings Surveys are available in other countries of the European Union as well. In most of the countries, the SES is conducted only every fourth year and the data cannot be linked to the balance sheets of firms. Contrary to this, the Hungarian version is repeated every year, and the balance

[3] For example, the Hungarian Structure of Earnings Survey shows that firms report and pay overtime for 5 percent of college graduates only. As opposed to this, self-reported working hours data in the Hungarian Labor Force Survey shows that 7.4 percent of college graduates worked more than 40 during the crisis in 2009, and 10.3 percent in 2013. These results suggest that salaried workers do unpaid overtime work and such unpaid overtime is procyclical.

[4] Although the government can set the minimum wage unilaterally, the Council members managed to reach an agreement on the minimum wage every year, except for 2001 Rigó (2012).

sheet data and the HSES share the same anonymized firm identifiers. Therefore, I can match balance sheet data to every firm in the HSES. This feature of the data also allows me to compute revenue and employment changes between year $t-1$ and t even if the firm participates in the HSES only in year $t-1$.

The HSES has a stratified sampling design and has wage information on approximately 10 thousand firms and 170 thousand workers annually. Every firm with more than 20 employees and a further random sample of firms between 5 and 20 employees must participate in the HSES. As a consequence, small firms are underrepresented in the HSES. Participating firms with less than 20 employees must report wages for every worker. Above 20 employees, the sampling of workers within firms is based on date of birth. The wages of blue-collar workers are reported if they were born on the 15th or 25th day of the month, and the wages of white-collar workers are reported if they were born on the 5th, 15th or 25th day of the month. The HSES contains individual weights which ensures worker representativity within firms. Furthermore, the quasi-random sampling of workers ensures that the wage of the same worker is reported across years, so I can construct a worker-level panel database. I can track around 70 percent of workers between years if they do not leave the firm. Appendix B discusses the construction of the worker-level panel.

A unique feature of the Survey is that it contains the different wage components in addition to total compensation. It records extra payments for overtime hours, night and weekend shifts, allowances for special working conditions, extra payments for foreign language knowledge, premia as well as regular and irregular bonuses paid in May. The wage information in the HSES contains the payroll data reported by the firms, so measurement error in wages is not an issue. Lastly, the database also contains a wide range of personal information (age, gender, education, occupation) and tenure in the job.

I use the municipality of the firms' headquarters to merge the data with local unemployment rates. The unemployment information comes from the T-STAR database provided by the Hungarian Central Statistical Office. This database collects information on every Hungarian municipality on a yearly basis. I measure the local unemployment rate with the ratio of the registered unemployed and the size of the working age population (between 18 and 65 years).

Due to data availability, I use the survey waves between 2002 and 2013 for the present analysis. I restrict my sample to private sector firms since the wage and employment decisions of public sector firms are affected by politics in Hungary Telegdy (2016, 2018). I do not weight firms in the regressions. Using employment or revenue for weighting the firms would be problematic in my sample. Using the same database, Harasztosi and Lindner (2019) showed that firms have a highly skewed distribution (Pareto coefficient $\alpha = 1.5$), so the mean and variance of size and revenue is infinite. That is why the central limit theorem in my case would not hold with weighted regressions and the standard errors would be biased.

3.2. Variable definitions

I define workers as receiving flexible wages if they received at least one type of flexible component in any year during the observed years. This means that I include not only bonuses but also overtime-related payments in flexible payments. The most important reason is that bonuses, piece rate contracts and overtime payments can all be analyzed within the framework of incentive contracting.[5] Among low-skilled people, work hours and actual pieces done are useful measures of effort and that is why firms may want to contract on these outcomes. Contrary to this, salespeople usually get commissions, while highly skilled white-collar workers get (occasional) bonuses if certain requirements are met. The most probable explanation for these facts is that work hours are a poor measure of effort in these occupations. In line with these arguments, several previous papers documented that highly skilled workers do more unpaid overtime hours in general (Bauer and Zimmermann, 1999; Bell and Hart, 1999; Pannenberg and Wagner, 2001), they are willing to work more unpaid overtime if they expect bonus payments (Engellandt and Riphahn, 2011) and manipulate the reported overtime more for tax optimization purposes (Cahuc and Carcillo, 2014).

Second, if firms cut overtime payments or bonuses, the total wage cost also decreases without decreasing the number of workers.[6] That is why both overtime payments and bonuses may have favorable employment effects on the extensive margin. In Appendix D4, I re-estimate the main specifications considering only bonuses and premia as flexible wage components. Reassuringly, the results are qualitatively very similar to the findings in the main text.

The definition of flexible wages used in the main text also ensures that workers who received flexible wages in almost every year and only a fixed wage in a year because of temporary weak performance are not misclassified as having a fixed-wage contract (Lemieux et al., 2009). A drawback of the definition is that I classify workers as having fixed-wage contracts if they were offered a flexible-wage contract *ex ante* but leave the firm before receiving the first flexible wage component. Still, this measurement error in individual wage schemes does not threaten the identification of the employment effects of flexible wage components. The reason is that firms can cut flexible wage components between year $t-1$ and t only if they actually paid flexible wages in year $t-1$. I show in Appendix D6 that the results are robust to alternative definitions of wage flexibility.

At firm level, I define flexible wage structure in year $t-1$ as the share of flexible wage workers in year $t-1$.[7] This measure has two important advantages. First, it takes into account within-firm heterogeneity in wage flexibility as some firms do not want to incentivize every worker or reward those workers who deliver temporary weak performance. Second, it captures the heterogeneity in wage flexibility across firms as firm-level wages are more flexible when a larger share of workers receive flexible wages. As a result, firms may even preserve some of the fixed-wage jobs if they can decrease the flexible wage components of other workers. To sum up, this measure can change within firms between years if the firm separates (hires) a flexible wage worker and hires (separates) instead a worker without a flexible wage, while it does not change if the nominal amount of bonus or overtime payments received by worker i changes between years.

As discussed in the beginning of this section, firms do not always report overtime payments if the workers are salaried. That is why I use the total monthly wage paid in May as the baseline measure of worker income, and its firm-level average to compute the wage level of the firm. The results are virtually the same if I measure the wage level of firms with the ratio of the total wage bill paid in May and the ratio of total reported working hours.[8]

[5] Note: The effort of workers cannot be perfectly observed even in the case of piece rate or hourly wage contracts. For example, workers paid on a piece rate basis may try to hide their effort to bargain for a higher piece rate (Atkin et al., 2017), while workers on hourly wages are more likely to loaf than salaried workers (Burda et al., 2016)

[6] In line with (Engellandt and Riphahn, 2011), cutting bonus payments may decrease unpaid overtime and thus the labor input of firms even if reported overtime does not change. This conclusion is also supported by self-reported working hours (Footnote 3), since college graduates do more (unpaid) overtime in boom periods than during crises.

[7] I use the individual sampling weights to ensure worker representativity within firms. The results are virtually the same if I do not weight workers. The results are available upon request.

[8] Furthermore I controll in the regression analysis for the change of reported working hours per workers between years to filter out the firm adjustment on the intensive margin as much as possible.

Table 1
The share of different wage components in total worker compensation.

	Prob. of receiving the wage element	Share of wage elements conditional on receiving			
		mean	sd	p25	p75
Overtime payments	0.134	0.098	0.071	0.047	0.134
Monthly bonuses and premia	0.202	0.338	0.306	0.099	0.488
Occasional bonuses	0.329	0.094	0.094	0.035	0.122
Allowances for special working conditions	0.285	0.118	0.089	0.052	0.165
Reimbursements	0.357	0.072	0.109	0.026	0.076
Any type	0.692	0.281	0.263	0.087	0.375

Note: Table 1 shows the probability of receiving flexible wage elements over the base wage and the share of these in total worker compensation.

3.3. Descriptive statistics

Table 1 summarizes the descriptive statistics of the different wage elements.[9] The first column shows that approximately 69 percent of workers receive at least one type of additional wage component and workers usually earn more than one types of flexible components. The most widespread type of additional wage elements are occasional bonuses, while monthly bonuses have the largest share in the compensation package of workers, conditional on receiving such a wage element. The share of flexible wage elements is higher in the sample than the national average recorded in the Wage Dynamics Network Survey. The most likely explanation is that large firms are over-represented by survey design and they are more likely to pay flexible wages. Table A-1 and Table A-2 in Appendix D1 show that flexible wages are prevalent at every educational level and in every occupational category to the same extent. The only notable difference is that workers of a lower educational level and an occupation with a lower skill requirement are more likely to receive overtime payments and are less likely to receive bonuses. These differences can be explained by incentive contracting, as highly educated workers tend to do tasks which are hard to monitor and therefore working hours can only be a weak measure of their individual effort.

Using the individual-level panel, I construct the distribution of nominal wage changes for workers with and without flexible wage components. These distributions are able to reflect the downward nominal rigidity of the different wage elements. When wages are downward rigid, firms can only decrease average labor compensation by laying off their workers and hiring new ones for a lower wage. If replacing workers is costly and wage rigidity prevents wage cuts, we expect a spike at 0 in the distribution of wage changes and positive excess mass or 'bunching' at small increases. By contrast, when wages are flexible, it is expected that the distribution of wage changes is continuous around 0. This means that the probability of an infinitesimally small wage decrease should be roughly the same as the probability of an infinitesimally small wage increase.

Fig. 1 presents the log-changes of monthly and hourly wages. The distributions are winsorized at a 50 percent change. The filled bars show the changes of wages for employees who receive only a base wage while the empty bars indicate the distribution of workers receiving flexible components as well. Panels (a) and (c) show that the nominal monthly wage of workers without flexible components is rigid downwards, while the wages of workers receiving flexible components is flexible.[10] Furthermore, wage freezes are also prevalent: between years, the wages of workers without flexible components do not change with a 30 percent probability. Wages were frozen with more than a 40 percent probability in the crisis years, which means that downward wage rigidity was more limiting during that time. Panels (b) and (d) show that the monthly base wage is downward rigid for workers with and without flexible components alike. Panels (e) and (f) confirm that not only the monthly wage but also the ratio of monthly wage and reported hours are more flexible downward than the base wage. Consequently, flexible wage components are the reason for downward wage flexibility.

Table A-4 computes wage growth conditional on the wage structure of the current and the previous year. It highlights that the wage structure is persistent even at the individual level. For instance, if a worker received only a bonus besides the base wage last year then the probability of receiving only the base wage and bonuses this year is 80 percent. Similarly, if a worker received the base wage and overtime payments the previous year, she will most likely receive overtime payments next year as well. Table A-4 also shows that average real wage growth between years is around 2 percent if the wage structure does not change between years. In line with Fig. 1, total wages are cut if the worker loses her overtime payments or bonuses and wages rise more than the average if the worker receives flexible wage components for the first time.

Turning to the characteristics of firms with flexible payments, Fig. 2 shows the distribution of firms by the share of workers with flexible wage components. Panel (a) shows that 25 percent of firms in the sample opt for paying only a base wage and do not pay flexible wage components to any worker, while around 40 percent of the firms employ every worker under flexible wage schemes. The remaining firms pay flexible wages only to part of their workers. These firms probably do not want to incentivize every worker, or part of their workers did not perform satisfactorily. Panel (b) of Fig. 2 shows that the share of flexible wage components is less than 30 percent at most of the firms.

Appendix Figure A-3 shows the persistence of flexible wage structures within the firms. Panel (a) highlights that the share of workers with flexible wages within any firm does not change on the average between years, while there is a large heterogeneity across firms. The ratio of flexible wage components to total wages show similar patterns as well (Panel (b)).

Lastly, Table 2 shows the characteristics of firms in more detail. Here, I group firms into two categories. The first column shows firms where no worker received flexible wage components. The second column presents firms where at least one worker received a flexible wage. The third column shows the difference between the two groups, while Column (4) shows the normalized difference suggested by Imbens and Rubin (2015). Table 2 also shows that the characteristics of workers are uncorrelated with the wage structure: the share of women, the average age and years of education are very similar in the two groups. The left panel shows that firms paying flexible wage components are significantly larger: firms where every worker receives flexible wages have 131 workers on average, while firms without flexible wage components have only 21 workers on average. Comparing the firms' performance, firms with flexible wage components are shown to perform much better than firms with fixed wages; they pay more to their workers, have significantly less volatile revenue, but attain larger revenue per worker and are better equipped with capital. Finally, firms with flexible wage components have lower worker turnover since the share of new entrants is lower among these firms.

[9] See Appendix Table A-3 for the descriptive statistics of workers with and without flexible wages.

[10] Fig. A-2 also highlights that flexible wage components have a symmetric distribution around zero.

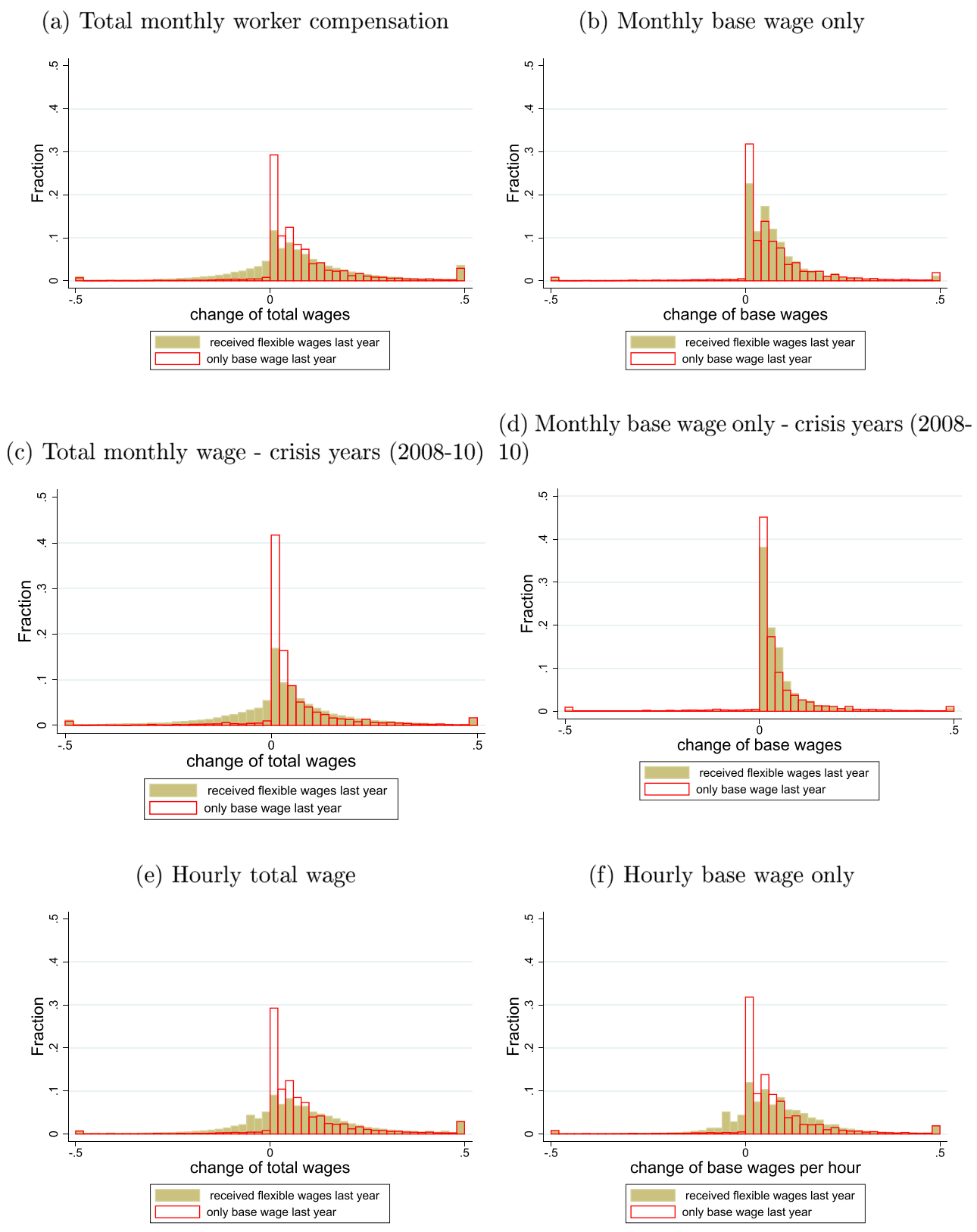

Fig. 1. The distribution of changes in worker compensation. *Note:* Panels (a), (c) and (e) show the distribution of wage changes for workers who do or do not receive flexible wages. Panels (b), (d) and (f) show the distribution of changes in the base wage for both types of workers. Panels (a)–(d) show monthly wages while Panels (e) and (f) show monthly wages divided by the reported hours. Figure 1 indicates that workers with a fixed wage (filled bars) only occasionally experience a nominal wage decline. Furthermore, the large spike at zero suggests that many firms prefer to keep wages intact rather than decreasing them. In contrast to this, workers with flexible wages (empty bars) often experience a decline in their wages.

Table 2
Descriptive statistics: comparing the main characteristics of firms with and without flexible wages.

	Whole sample				Matched sample			
	Fixed wages	Flex. wages	Diff.	Normalized diff.	Fixed wages	Flex. wages	Diff.	Normalized diff.
Share of women	0.323	0.379	0.056	0.13	0.32	0.394	0.074	0.17
	(0.301)	(0.297)			(0.3)	(0.311)		
Years of education	11.64	11.6	−0.0	0.00	11.65	11.5	−0.1	−0.05
	(1.46)	(1.48)			(1.45)	(1.29)		
Average age	39.3	41.2	1.86	0.21	39.3	40.3	1.07	0.12
	(6.18)	(6.34)			(6.13)	(6.64)		
Average wage (log)	11.37	11.84	0.476	0.62	11.37	11.47	0.099	0.15
	(0.48)	(0.59)			(0.47)	(0.45)		
Number of employees	21.2	131.4	110.1	0.48	21.1	22.1	1.0	0.03
	(28.32)	(227.2)			(27.47)	(24.72)		
Sales per capita (log)	5.79	7.40	1.61	0.75	5.82	5.93	0.11	0.06
	(1.434)	(1.59)			(1.408)	(1.355)		
Capital per worker (log)	3.81	5.71	1.89	0.66	3.80	3.91	0.11	0.04
	(1.956)	(2.092)			(1.945)	(2.016)		
Exports	0.25	0.48	0.22	0.35	0.26	0.27	0.00	0.01
	(0.438)	(0.5)			(0.44)	(0.445)		
Share of new entrants	0.19	0.15	−0.04	−0.14	0.18	0.18	0.00	−0.01
	(0.211)	(0.184)			(0.206)	(0.202)		
Volatility of revenue	0.07	0.05	−0.02	−0.19	0.07	0.06	−0.01	−0.09
	(0.09)	(0.077)			(0.089)	(0.084)		
Observations	17690	74531			14713	12221		

Note: Table 2 compares firms with and without flexible wage components for the whole sample and for the matched sample. Fixed wages: no worker receives flexible wages. Flexible wages: at least one worker receives flexible wages. The last column shows the normalized difference suggested by Imbens and Rubin (2015).

As flexible wage firms are larger and more productive than rigid-wage firms I also use nearest neighbor matching to ensure common support. First, I predict the propensity score of paying flexible wages conditional on number of employees, sales and capital per worker, average wage, share of new entrants and export dummy using a probit model. Next, I keep only flexible-wage firms at a sufficiently low distance in propensity score from the nearest fixed-wage firm. The right panel of Table 2 shows that on the matched sample the normalized difference is always smaller than one quarter. This threshold value is suggested by Imbens and Rubin (2015). They argue that linear regression results are well-balanced and not sensitive to specification if the normalized difference is less than one quarter.[11]

3.4. What factors explain a flexible wage structure?

As the introduction of flexible wage structures is not random, I estimate how a flexible wage structure is related to the characteristics of firms. Furthermore, I show that revenue volatility is negatively correlated with the prevalence of flexible wages. For this purpose, I run the following regression:

$$flex_{jt} = \lambda_0 + \lambda X_{jt} + \nu_{jt} \quad (1)$$

where $flex_{jt}$ measures the share of workers with flexible wages at firm j at year t. X_{jt} are proxies of firm characteristics that may be correlated with the prevalence of flexible payments, such as variance of growth rate, firm size, value added per worker and capital per worker. Most importantly, I use the growth of firms between year t and $t+1$ as an additional control variable. If the coefficient of this variable is positive then firms with flexible wages would have a larger expected growth rate than firms without flexible wages. This result would indicate that revenue changes are not random and flexible wage firms are less likely to be hit by negative revenue shocks. As a consequence, the estimated effect of revenue change on employment change would be biased.

As I do not observe the volatility of the growth rate directly, I estimate it based on White (1980)'s method. First, I calculate the expected growth rate of firms as follows:

$$\Delta \log(sales_{jt}) = \mu_j + \mu_t + \epsilon_{jt} \quad (2)$$

The dependent variable is the growth rate of firm j between years $t-1$ and t. The explanatory variables are firm fixed effects (μ_j) and year fixed effects (μ_t). Second, I predict the error term and use $\hat{\epsilon}^2_{it}$ as a proxy of the conditional volatility of the growth rate in Eq. (1). Note that $\hat{\epsilon}^2_{jt}$ is the square of the deviation from the expected growth rate of firm j, which is basically the conditional variance of the growth rate.[12]

Since this is a two-step estimation procedure, I bootstrap standard errors with 1000 replications and the sampling is clustered at firm level. I use every observed year for this exercise. The estimates are the same when I use the crisis years only (the results are available upon request).

Table 3 shows the relationship between flexible wage structures and the characteristics of firms. The first column shows that firms which have a 1 percentage point more volatile growth rate are paying flexible wage components to a −0.41 percentage point smaller fraction of their workers, while firms which have 1 percent more workers pay flexible wages to a 0.12 larger fraction of their workers. A main message of the table is that the growth rate of firms between year t and $t+1$ is uncorrelated with the prevalence of flexible wages at year t. The point estimates are very small, a 1 percent larger growth rate corresponds to a 0.01 percentage point smaller incidence of flexible wages and this difference is not even statistically significant. The value added or capital per worker is only weakly related to the incidence of flexible wages. Firms with 1 percent larger value added per worker pay flexible wages only to a 0.03 percentage point larger share of their workers, while this difference is only 0.01 in the case of capital per worker. Column (2) shows that the point estimates remain very similar even if I control for other firm characteristics, such as industry and average worker composition.

[11] Individual-level descriptive statistics show patterns similar to firm-level data (Table A-3).

[12] The results are the same if I add additional control variables to Eq. (2) to measure firm quality (firm size, value added per worker, capital per worker, 2-digit industry dummies), a wide set of worker characteristics (share of women, average age, years of education, average working hours per worker, share of blue-collar workers and workers with tertiary education) or industry X year fixed effects to filter out aggregate shocks. The corresponding results are available upon request.

(a) by the share of workers receiving flexible wages

(b) by the share of flexible components in total compensation

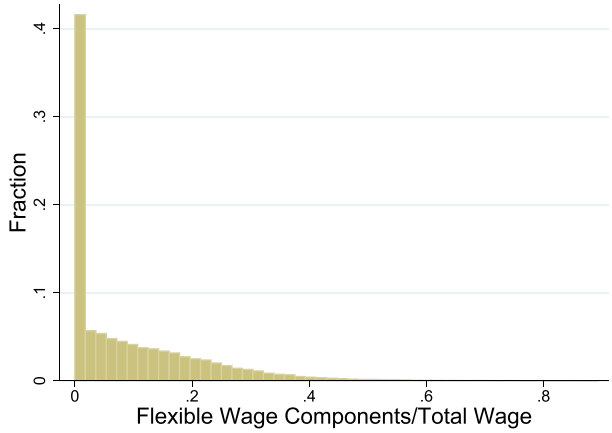

Fig. 2. The distribution of firms by wage structure. *Note:* Panel (a) presents the distribution of firms by the share of workers receiving flexible wages. Panel (b) displays the distribution of firms by the ratio of flexible wage components to total compensation.

Furthermore, I add firm fixed effects to the regression in Column (3). If flexible wages does not change on the average over time within firm, we expect that conditional on firm fixed effects, the observable characteristics of the firm have only very limited effect on the share of workers with flexible wages.[13] In line with this assumption, the volatility of growth and the value added per worker is not correlated with the share of workers with flexible wages conditional on firm fixed effects. Similarly, the effect of firm size also halves after controlling for firm fixed effects.

Finally, Table A-5 in Appendix D2 shows that the results are qualitatively similar if I use the ratio of flexible wage components to total wage bill in year t or an indicator variable which is one if any worker received a flexible wage. Table A-6 also confirms that the results are not driven by a specific type of flexible wage. Firms with low volatility of revenue are more likely to pay both regular and irregular bonuses and overtime payments as well, but this difference disappears if I control for firm fixed effects.

[13] Note: The actual amount of bonuses and overtime payments can change between years even if the share of workers with flexible-wage contracts remains the same.

Table 3
Factors explaining flexible wage structure.

	(1)	(2)	(3)
	Share of workers with flex. wages		
Volatility of growth	−0.406***	−0.281***	−0.003
	(0.034)	(0.033)	(0.021)
Change in revenue	−0.011	−0.011	−0.006
	(0.008)	(0.008)	(0.005)
Value added per worker (log)	0.028***	0.042***	0.01***
	(0.002)	(0.002)	(0.004)
Capital per worker (log)	0.011***	−0.002	−0.006***
	(0.002)	(0.002)	(0.003)
Employment (log)	0.119***	0.106***	0.06***
	(0.002)	(0.003)	(0.006)
Additional controls	No	Yes	Yes
Firm fixed effects	No	No	Yes
Observations	49,139	49,139	49,139
R-squared	0.297	0.306	

Note: Table 3 estimates the relationship between the incidence of flexible wage structure and other firm characteristics. The dependent variable is the share of workers with flexible wages. The additional control variables are the age of the firm, 2-digit industry categories, the share of women, blue-collar workers and college graduates, and the average years of education and experience of workers. Bootstrapped standard errors are in parentheses. See Section 3.4 for the estimation procedure.

Fig. 3 (a) shows a non-parametric estimate for the share of firms paying flexible components as a function of the unconditional volatility of growth rates. I grouped firm-year observations into twenty equally sized bins based on the unconditional variance in growth rates, and plotted the share of firms with flexible wage components for every bin. Fig. 3(a) shows a strong negative relationship between the prevalence of flexible components and the volatility of growth rates. The share of firms paying flexible wage components is 70 percent for firms with a very small variance in growth rate. In contrast, the share of firms with flexible wage components is around 55 percent if the volatility of the growth rate is more than 20 percent. Fig. 3(b) shows that the relationship is visually the same even if I control for productivity, firm size and other observable characteristics of the firm. This strict negative relationship provides suggestive evidence on the incentive effects of flexible wages. The smaller the volatility of growth, the better a firm can infer the effort of workers by observing the output and the more it wants to incentivize workers with output-dependent flexible components.

4. The wage reaction of firms

4.1. Estimation strategy

Due to data limitations previous studies on the downward flexibility of various wage components (Anger, 2011; Lemieux et al., 2012) focused only on the effect of aggregate shocks. In contrast, the Hungarian data enable us to estimate wage adjustments in the case of firm-level revenue changes :

$$\Delta \log(wage_{jt}) = \alpha_1 \Delta \log(sales_{jt}) + \alpha_2 flex_{jt} + \alpha_3 flex_{jt-1} \cdot \Delta \log(sales_{jt}) + \alpha X_{j,t-1} + \mu_j + \mu_t + \varepsilon_{it} \quad (3)$$

where the dependent variable is the change in the average wage at firm j between year $t-1$ and t. $\Delta \log(sales_{jt})$ stands for the change in the revenue of firm j between year $t-1$ and t. $flex_{jt-1}$ indicates the share of workers who received flexible wage elements in addition to the base wage at firm j in year $t-1$. The main variable of interest is the interaction between $flex_{jt-1}$ and changes in revenue. α_3 means how much more a firm can adjust wages if it pays flexible wage components to every worker compared with a firm which does not pay flexible wage components to anybody. X_{jt-1} denotes the control variables, while μ_t stands for year dummies controlling for inflation and aggregate revenue shocks.

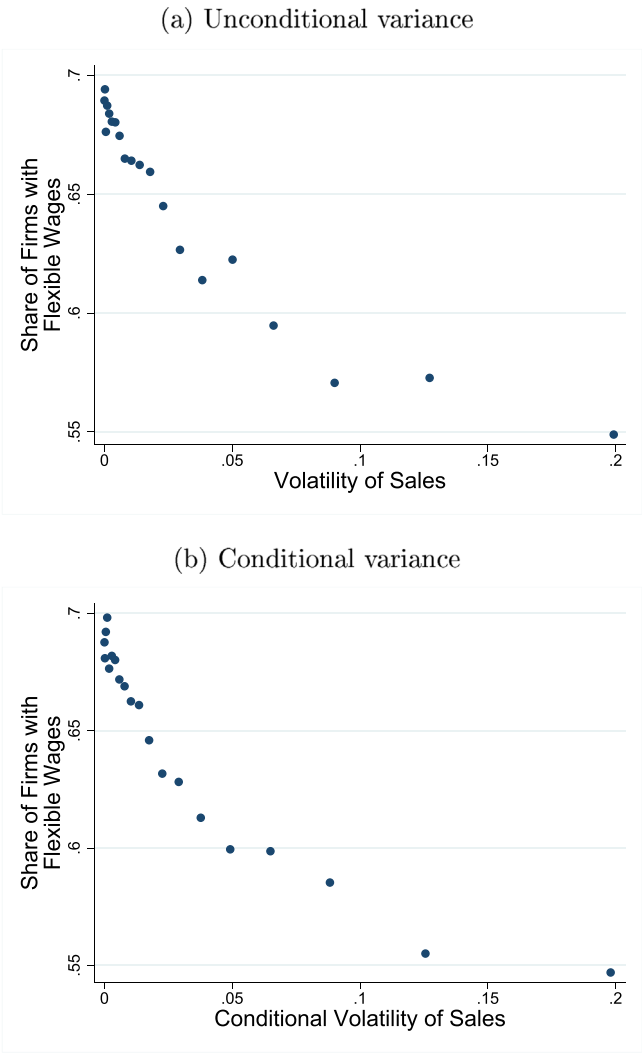

Fig. 3. The relationship between flexible components and the volatility of the growth rate. *Note:* Firms are grouped into equally sized bins based on the volatility of their growth rate. The vertical axis shows the share of firms with flexible components. Panel (a) has no controls, while Panel (b) controls for the share of women, average age and years of education, capital and sales per worker in the base year, 2-digit industry codes (NACE) and year dummies. The figures show that firms are less likely to pay flexible components if the growth rate of the firm is more volatile. See Section 3.4 for the estimation procedure.

Since this is a first-differenced equation, it sweeps out time-invariant firm fixed effects which may be correlated with the wage structure of the firm.

The main threat to the identification is that firms with and without flexible wages have different expected growth rates. To solve this issue, I use two additional robustness checks. First, in my most preferred specification, I add firm fixed effects to Eq. (3). As the equation contains the growth rates in wages and the revenue (the first difference of revenue and wages), adding additional fixed effects means that I control for firm-specific time trends in wages and revenue. Second, I instrument the revenue change of firm i between year $t-1$ and t with the leave-out-mean growth rate of the (2-digit NACE) industry (Card et al., 2014; Townsend, 1994).

As a final robustness check, I match flexible and rigid-wage firms based on observable characteristics (as shown in Section 3.2). The reason for that is that flexible-wage firms tend to be larger and more productive than rigid-wage firms.

Even if the wage structure is determined at firm level, individual-level regressions provide two important insights. First, we can estimate the effects of flexible wage components within firms. In other words, we can test whether the wages of workers with flexible wage components are adjusted more than the wages of other workers of the same firm in the same year but without any flexible wage components. Second, individual-level regressions allow me to restrict the sample on incumbents, thus I can rule out the hypothesis that firms paying flexible components adjust average wages by changing only entry wages. At individual level I estimate:

$$\Delta \log(wage_{ijt}) = \alpha_1 \Delta \log(sales_{jt}) + \alpha_2 flex_{ij} + \alpha_3 flex_{ij} \cdot \Delta \log(sales_{jt}) + \alpha X_{j,t-1} + \mu_t + \varepsilon_{it} \quad (4)$$

where the dependent variable shows the wage change of worker i at firm j between year $t-1$ and t. The main explanatory variables are the change in sales at firm j between year $t-1$ and t, a dummy variable denoting the wage flexibility of worker i at firm j ($flex_{ij}$) and their interaction. I use different measures of wage flexibility, and $flex_{ij}$ takes the value of 1 if the worker received only overtime payments, only regular bonuses, only irregular bonuses or more than one type of flexible wage components at the same time. The main variable of interest is α_3 which is positive when the wages of workers receiving flexible components are more reactive to revenue changes.

4.2. Results

The point estimates are shown in Table 4. Column (1) shows that firms without flexible wage components do not adjust wages significantly when their revenue changes. The point estimate (0.007 s.e. 0.005) is small in economic terms and is statistically not different from zero. As opposed to this, firms paying flexible wage components to every worker adjust average wages 0.036 percent (s.e. 0.007) more compared with firms without flexible wages when their revenue changes by one percent. These point estimates suggest that firms with flexible wage components adjust wages significantly more than those paying only a base wage. The estimates are also robust to the inclusion of different control variables. The interaction term further increases (0.038 s.e. 0.007) when I control for firm characteristics and worker characteristics. The most preferred specification in Column (3) shows that firms paying flexibe wages to every worker adjust wages 0.061 percent (s.e. 0.013) more when their revenue changes once I control for unobserved firm-level differences with firm-specific fixed trends in growth. The point estimate is sightly larger (0.106 s.e. 0.023) if I instrument the revenue change with the leave-out-mean growth of the industry in Column (4), but lower if I use the matched sample (0.03 s.e. 0.011) in Column (5).

In Columns (6)–(8), the adjustment of the base wage is estimated to show that the adjustment of flexible wage components drive my results, and firms with flexible wage structures do not have a more flexible base wage either. In line with this claim, firms with flexible wage structures do not adjust the base wage significantly more if their revenue changes.[14]

An alternative way to show that flexible wage components are the main driver of the wage adjustment is to analyze the ratio of flexible wage components to total wages. In line with the previous results, Appendix D3 shows that the ratio of flexible wage components goes up (down) if the revenue of the firm increases (decreases).

Finally, Appendix D4 shows that the effect of revenue changes on wage adjustment is linear. The results are the same if I consider only bonuses as flexible payments (Appendix D5). The results are also robust to the use of other proxies of wage flexibility and are similar in manufacturing and services, irrespective of firm size, local unemployment or the labor share of the firm (Appendix D6).

[14] The sum of α_1 and α_3 in Eq. (3) is not significantly different from zero.

Table 4
Wage adjustment at firm level as the function of revenue change.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Change of monthly total wage					Change of monthly base wage		
Share of workers	−0.019***	−0.016***	−0.038***	−0.031***	0.005**	0.003	0.010	0.014***
with flex. wages	(0.001)	(0.002)	(0.007)	(0.005)	(0.003)	(0.002)	(0,006)	(0.003)
Change in sales	0.007	0.008	−0.012	0.079*	0.005	0.013**	0.072	0.006
	(0.005)	(0.005)	(0.010)	(0.046)	(0.006)	(0.006)	(.047)	(0.007)
Interaction	0.036***	0.039***	0.061***	0.106***	0.030***	−0.018**	0.012	0.003
	(0.007)	(0.007)	(0.013)	(0.023)	(0.011)	(0.008)	(0.023)	(0.012)
Controls	No	Yes	Yes	Yes	0.135***	Yes	Yes	Yes
Firm fixed trends	No	No	Yes	Yes	(0.017)	Yes	Yes	No
Estimation method	OLS	OLS	OLS	IV	Matched sample	OLS	IV	Matched Sample
F-statistics				277			277	
Observations	55,694	54,233	54,001	54,001	28,138	53,941	53,941	13,117
R-squared	0.036	0.069	0.298		0.078	0.083		0.113

Note: Table 4 shows the effect of flexible wage components and sales changes on the average wages of workers. I measure the flexible wage structure with the share of workers receiving flexible wages over the years. Columns (1)–(3) differ in the control variables. Every column includes year dummies to eliminate the effect of inflation. Column (2) controls for log-capital per worker and log-sales per worker, the age of the firm and 2-digit industry categories, the share of women, average years of education, experience, square of experience, a dummy indicator for being a new entrant and 2-digit occupation categories. Column (3) controls for firm-specific trends in revenue and wages. Column (4) uses industry-level leave-out-mean growth rate as the IV of revenue change and Column (5) uses the matchedsample. Columns (6)–(8) estimate the adjustment of the base wage. Standard errors are clustered at firm level. Table 4 highlights that firms with flexible wage components adjust wages significantly more than firms paying only a base wage.

Table 5
Wage adjustment at individual level as the function of revenue change.

	(1)	(2)	(3)	(4)	(5)	(6)
			Worker fixed trend	Only above MW	Females	Males
Flexible wage components	−0.009***	−0.007***		−0.000	−0.006***	−0.008***
	(0.001)	(0.002)		(0.002)	(0.002)	(0.002)
Change in sales	0.027***	0.025***	0.035***	0.034***	0.029***	0.023***
	(0.006)	(0.006)	(0.012)	(0.007)	(0.009)	(0.006)
Interaction	0.053***	0.052***	0.045***	0.050***	0.044***	0.055***
	(0.007)	(0.007)	(0.014)	(0.008)	(0.011)	(0.008)
Controls	No	Yes	Yes	Yes	Yes	Yes
Observations	370,905	360,174	230,185	322,459	137,908	222,266
R-squared	0.029	0.034	0.263	0.034	0.036	0.036

Note: Table 5 shows the effect of flexible wage components and sales changes on the monthly wages of workers. I define a worker as receiving flexible wage components if she earned flexible wage components at least once during the observed period. Column (1) controls for the year of observation while the other columns also control for capital and sales per worker, number of workers (all in logs), 2-digit industry and occupation categories, gender, tenure at the firm, average years of education and potential experience. Column (3) controls for worker-level fixed trends. Column (4) considers only workers whose wage was above 110 percent of the minimum wage in year $t-1$. Columns (5) and (6) estimate the effects of flexible wages by gender. Standard errors are clustered at firm level. Table 5 highlights that the wages of workers with flexible wage components are adjusted three times as much as that of workers receiving only a base wage.

How does the wage of incumbents react to revenue changes? Columns (1) and (2) of Table 5 show the point estimates for Eq. (4): the wages of workers without flexible components are adjusted by 0.027 (s.e. 0.005) percent if the revenue of the firm changes by one percent. As in the case of firm-level estimates, the wages of workers with flexible wage components are shown to be more flexible than the wages of workers receiving only a base wage. The wages of workers with flexible wage components are adjusted 0.053 percent more than the wages of workers receiving only a base wage. This means that the wages of workers with flexible wage components are adjusted more than the wages of workers without flexible wages even if they worked at the same firm in the same year. The results remain the same if I add worker fixed trends to the regression (Column (3)) or drop workers who earned less than 110 percent of the minimum wage. Finally, Columns (5) and (6) highlight that the results do not differ by gender either. Based on these results we can conclude that flexible wage components increase wage responsiveness not only between firms but also within firms.

Relation to the literature on flexible revenue sharing. Recent literature on revenue sharing estimates the elasticity of average wages with respect to various profitability measures, such as sales per worker (Barth et al., 2016; Carlsson et al., 2015; Juhn et al., 2018), labor productivity per worker (Card et al., 2014; Chan et al., 2020; Guiso et al., 2005; Kátay, 2016) or profit per worker (Arai and Heyman, 2009; Hildreth and Oswald, 1997). To relate my results to these papers, Table A-14 shows wage adjustment conditional on change in revenue per worker.[15] Using the change in revenue per worker as the measure of firm-level shocks confirms also that flexible-wage firms adjust average wages more. Furthermore, the point estimates are between 0.04 and 0.07 which is the same magnitude as in previous results.

[15] Note: The percentage change in revenue per worker ($\Delta \log(revenue/worker) = \Delta \log(Revenue) - \Delta \log(employment)$ is mechanically negatively correlated with the change in employment. That is why I use the change in total revenue in the main specification to measure the employment and wage reaction of firms.

5. The employment reaction of firms

5.1. Estimation strategy

To compute the employment response of firms with and without flexible wage components, I estimate Eq. (5) where the dependent variable is the percentage change in employment between year $t-1$ and t.[16]

$$\frac{\Delta emp_{jt}}{emp_{jt-1}} = \beta_1 \Delta \log(sales_{jt}) + \beta_2 flex_{jt-1} + \beta_3 flex_j \cdot \Delta \log(sales_{jt}) + \beta X_{j,t-1} + \mu_j + \mu_t + \varepsilon_{it} \quad (5)$$

If the downward rigidity of the base wage leads to job losses, we expect that firms with flexible wage components adjust employment less than firms without flexible components. This implies that β_1 is positive, while β_3 is negative. In contrast, if there is no trade-off between cutting flexible wage components and separations, we do not expect a significantly negative relationship between the interaction term and the change in employment ($\beta_3 \geq 0$). Again, this is a first-differenced specification and I add firm fixed effects to the regression which means that I control for unobserved firm-specific trends in revenue and employment growth that may be correlated with the flexible wage structure.

In addition to the problems discussed in the previous section, there are two additional threats to the identification. First, if changing employment is costly, firms may absorb negative temporary or idiosyncratic shocks and maintain their initial employment level even if their wages are downward rigid. I investigate this issue by re-estimating the employment regressions using long differences instead of year-to-year changes and by restricting the sample to the Great Recession. In particular, I estimate how the change of revenue between year $t-2$ ($t-3$) and year t affects wages and employment growth in this two- (three-) year period. We may expect that during the recession financial constraints are more binding and adverse revenue shocks force rigid-wage firms to lay off more workers. The other identification threat relates to the unobserved idiosyncratic shocks which are correlated with the change of revenue and employment at the same time. More specifically, flexible-wage firms may be hit by unobserved shocks if their revenue declines which force them to decrease employment more than rigid-wage firms. To solve this issue, I instrument the revenue growth of the firm with the leave-out-mean industry-level growth rate. Moreover, I also re-estimate the employment reactions of firms as the function of the change in aggregate demand instead of idiosyncratic revenue changes. I follow the empirical strategy of Lemieux et al. (2012) and estimate the employment reaction of firms if local unemployment changes by one percent:

$$\frac{\Delta emp_{jt}}{emp_{jt-1}} = \beta_1 \Delta unemp_{jt} + \beta_2 flex_j + \beta_3 flex_j \cdot \Delta unemp_{jt} + \beta X_{j,t-1} + \mu_t + \varepsilon_{it} \quad (6)$$

where $\Delta unemp_{jt}$ denotes the change in the local unemployment rate between year $t-1$ and t. We expect that β_1 is negative, which means that rigid-wage firms decrease employment if local unemployment increases. If flexible wage components protect jobs, flexible-wage firms lay off less workers if the unemployment rate increases. This argument implies that β_3 is positive.

The identification assumptions are that the increase of local unemployment decreases the product demand of firms (Mian et al., 2018; Verner and Gyöngyösi, 2020) and the increase of local unemployment decreases the product demand for flexible- and rigid-wage firms to the same degree. Panel A of Table A-16 confirms that these assumptions hold empirically. If local unemployment changes by one percentage point, the revenue of rigid and flexible-wage firms likewise decreases by 0.2–0.3 percent.

[16] The results are virtually the same when I use average employment in year $t-1$ and t, as in Davis and Haltiwanger (1999).

I also re-estimate Eq. (5) using the share of new workers[17] and the separation rate as the measure of employment reactions. This exercise is motivated by two facts. First, Lemieux et al. (2012); Stokes et al. (2017) and Pischke (2018) argue that flexible wages protect jobs as workers with flexible wages have longer average tenure under a recession while Adamopoulou et al. (2016) and Ehrlich and Montes (2018) found a negative relationship between wage flexibility and separation rates. Second, Schoefer (2015) argues that hiring has a monetary cost (e.g. the salary during the non-productive training period), so liquidity-constrained firms hire fewer workers during economic downturns. This relationship may hold even if the crisis has no effect on separation rates.

I use the following identity for the estimation of entry and separation rates:

$$\frac{\Delta emp_{jt}}{emp_{jt-1}} = \frac{\#\, new\ entrants_{jt}}{emp_{jt-1}} - \frac{\#\, separations_{jt}}{emp_{jt-1}}$$

which means that the percentage change in employment is the share of new entrants minus the separation rate. As only 70 percent of the workers who do not leave the firm can be tracked between years, I use the following proxy of separation rates between year t and $t-1$:[18]

$$\frac{\#\, separations_{jt}}{emp_{jt-1}} = 1 - \frac{emp_{jt|tenure \geq 12month}}{emp_{jt-1}}$$

where the numerator denotes the number of workers who have at least 12 months of tenure in year t[19], while emp_{jt-1} in the denominator measures the number of employees at firm j in year $t-1$. To validate this proxy, I show in Appendix B that this measure is very similar to the actual separation rates computed from the administrative linked employer-employee data set. Finally, I compute the entry rate as the sum of the actual employment change and the separation proxy.

After defining the separation rate, I estimate the following equation:

$$\frac{\#\, separations_{jt}}{emp_{jt-1}} = \gamma_1 \Delta \log(sales_{jt}) + \gamma_2 flex_j + \gamma_3 flex_j \cdot \Delta \log(sales_{jt}) + \gamma X_{j,t-1} + \mu_t + \varepsilon_{it} \quad (7)$$

where the independent variables are the same as in Eq. (5). Again, we expect that γ_1 is negative as the separation rate is larger if firms lay off more workers in the event of negative revenue changes, and we expect γ_3 to be positive if downward flexibility helps firms to cushion the effects of negative revenue changes. γ_2 has an immediate economic interpretation as well: when γ_2 is negative (positive), firms paying flexible wage components have smaller (larger) average separation rates than firms with fixed wages.

5.2. Results

The point estimates for the employment equation are summarized in Table 6. Column (1) shows that employment at fixed-wage firms changes approximately by 0.32 percent (s.e. 0.01) when the revenue of the firm changes. The point estimates remain the same when I include control variables (Column (2)) or instrument the revenue with industry-level leave-out-mean average growth (Column (4)), while it is a bit smaller when I add firm-specific time trends in revenue (Column (3)) or use the matched sample only (Column (5)).

[17] Since the entry rate is the sum of the separation rate and employment change, I do not discuss it in detail in the main text. Still, the estimation results show that firms with and without flexible wages adjust the entry rate. See Figure A7 in Appendix D5 for a graphical analysis and Appendix D10 for regression results.

[18] The results are qualitatively similar when I use the share of workers who cannot be linked between years as the proxy of separation.

[19] The Structure of Earnings Survey has direct information on the actual tenure of workers.

Table 6
Employment adjustment as the function of revenue change.

	(1)	(2)	(3)	(4)	(5)
	Change in employment				
Share of workers	−0.023***	−0.006**	0.012	0.013*	−0.010
with flex. wage	(0.002)	(0.003)	(0.008)	(0.007)	(0.022)
Change in sales	0.319***	0.316***	0.214***	0.297***	0.156***
	(0.011)	(0.010)	(0.016)	(0.054)	(0.024)
Interaction	0.068***	0.061***	0.067***	−0.050*	0.065
	(0.013)	(0.013)	(0.019)	(0.029)	(0.050)
Controls	No	Yes	Yes	Yes	No
Firm fixed trends	No	No	Yes	No	No
Estimation method	OLS	OLS	OLS	IV	Matched sample
Observations	55,069	53,808	50,709	50,709	16,989
R-squared	0.161	0.186	0.583	0.165	0.773

Note: Table 6 shows the effect of flexible wage components and sales changes on employment. Columns (1)–(3) differ in the control variables. Every column includes year dummies to eliminate the effect of inflation. Column (2) controls for log-capital per worker and log-sales per worker, the age of the firm and 2-digit industry categories, the share of women, average years of education, experience, square of experience, a dummy indicator for being a new entrant and 2-digit occupation categories. Column (3) controls for firm-specific trends in revenue and employment. Column (4) uses the industry-level leave-out-mean growth rate as the IV of revenue change and Column (5) uses the matched sample. Standard errors are clustered at firm level. Table 6 highlights that firms with flexible wage components do not adjust employment less than firms without flexible wages.

Table 7
Adjustment of wages and employment in the long term and during the crisis.

	(1)	(2)	(3)	(4)	(5)	(6)
	2 years	wages 3 years	crisis	2 years	employment 3 years	crisis
Share of workers	−0.043***	−0.076***	−0.034	0.020**	0.027**	8,911
with flex. wage	(0.010)	(0.014)	(0.054)	(0.010)	(0.012)	0.013
Change in sales	0.006	−0.005	−0.083	0.315***	0.288***	0.122**
	(0.013)	(0.016)	(0.052)	(0.021)	(0.022)	(0.057)
Interaction	0.031**	0.028*	0.130**	0.014	0.000	0.082
	(0.015)	(0.017)	(0.061)	(0.022)	(0.024)	(0.061)
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Worker composition	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	31,670	25,889	8653	37,958	25,947	8653
R-squared	0.266	0.342	0.555	0.716	0.734	0.857

Note: Table 7 estimates the effect of long-run revenue changes on the wage and employment reaction of firms with and without flexible wage components. Columns (1) and (4) estimate the effect of the change in revenue between $t-2$ and t on two-year growth while Columns (1) and (3) estimate the effect of the change in revenue between $t-3$ and t on the three-year change of wages and employment. Columns (3) and (6) estimate the effect of the change of revenue during the Great Recession. Every column controls for log-capital per worker and log-sales per worker, the age of the firm and 2-digit industry categories, the share of women, blue-collar workers and college graduates, the average years of education and experience of workers, and firm-specific time trends. Standard errors are clustered at firm level.

The most important variable is the interaction term which shows the effect of flexible wages on firm-level employment. Column (1) shows that firms paying flexible wage components to every worker adjust employment 0.068 percent (s.e. 0.013) more than firms without flexible wages. This point estimate is robust against including additional control variables or firm-specific fix trends in revenue to the regression. The point estimates, however, are not different from zero at a 5 percent significance level if I instrument the revenue with industry-level growth or restrict attention to the matched sample. Even though point estimates for the interaction term differ across specifications, none of the point estimates is significantly negative. Thus, I do not find evidence that firms with flexible wages adjust employment less than firms without flexible wages if their revenue changes.

Long-term adjustment and firm behavior during the Great Recession Table 7 shows that the reactions of firms in the longer term and in recession are remarkably similar to the main specifications. The first column shows that flexible-wage firms adjust wages 0.3 percent more between year $t-2$ and t during this time period than rigid-wage firms if their revenue changes by one percent. Similarly, flexible-wage firms adjust wages more on the 3-year time horizon (Column (2)) or during the Great Recession (Column (3)). However, this additional flexibility in wages does not convert into more stable employment. Columns (4)–(6) highlight that firms without flexible wage structures adjust employment by 0.12–0.31 percent when their revenue changes by one percent in these specifications, and we do not find a significant difference between employment changes at firms with and without flexible wages. To sum up, the regressions show that flexible-wage firms do not adjust employment or separations less than rigid-wage firms either in the long run or in crisis.

The results are also robust to using the share of workers with bonuses as a measure of flexible wages (Appendix D4) and dummyTXdummy- (to alternative measures of wage flexibility (Appendix D6) as well as to including firms in the sample which fall out of the HSES survey between year $t-1$ and year t (Appendix D8).

Table 8
Change of separation rate if the revenue changes.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Change of separation rate if revenue drops				Change of separation rate if revenue increases			
Share of workers	−0.004	−0.053***	−0.039**	−0.030***	0.001	−0.053***	−0.040***	−0.031***
with flex. wage	(0.004)	(0.007)	(0.019)	(0.009)	(0.004)	(0.006)	(0.014)	(0.008)
Change in sales	−0.191***	−0.166***	−0.093*	−0.183***	0.021	0.115***	0.086**	0.166***
	(0.014)	(0.025)	(0.049)	(0.022)	(0.014)	(0.023)	(0.040)	(0.021)
Interaction	−0.058***	0.020	−0.087	0.020	0.022	−0.004	−0.038	0.008
	(0.018)	(0.029)	(0.055)	(0.037)	(0.018)	(0.028)	(0.045)	(0.038)
Controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Firm fixed trends	No	No	Yes	No	No	No	Yes	No
Estimation method	OLS	OLS	OLS	Matched sample	OLS	OLS	OLS	Matched sample
Observations	32,538	20,414	22,534	7446	44,417	29,376	31,292	9551
R-squared	0.039	0.117	0.700	0.111	0.007	0.112	0.613	0.103

Note: Table 8 shows the effect of flexible wage components and sales changes on employment and separation rates. Columns (1)-(4) show observations when the revenue drops and Columns (5)–(8) when the revenue increases. The control variables are the same as in Table 7. Standard errors are clustered at firm level. Table 8 highlights that firms with flexible wages do not adjust the separation rate less than firms without flexible wages, while their average separation rate is lower independent of the change of revenue.

Employment adjustment in the case of aggregate shocks Table A-16 estimates the effect of local unemployment rates on firm outcomes. First of all, Panel (A) confirms that local unemployment affects firms with and without flexible wages to the same extent. Panel (B) shows that flexible firms adjust average wages more when local unemployment changes. If the local unemployment rate increases by one percentage point, rigid-wage firms do not adjust wages significantly, while firms paying flexible-wages to every worker adjust average wages by 0.042-0.302= -0.26 percent (Column 1). Moreover, flexible-wage firms adjust wages significantly more even if I control for firm-specific trends in Column (3). By contrast, we do not find significant differences between the employment and separation reactions of flexible- and rigid-wage firms. However, the point estimates are less precise than in the specifications which used firm-specific revenue changes.

Do rigid-wage firms adjust separations more when their revenue changes? As explained in the estimation strategy, flexible-wage firms may react less with the separation rate when their revenue changes than firms without flexible wages, even if they adjust their employment to the same extent. I test this possibility directly in Table 8. Since firms are more likely to separate workers if their revenue drops, I estimate a separate parameter for a revenue decrease and for a revenue increase.[20]

In line with our intuition, Columns (1)–(4) show that rigid-wage firms have higher separation rates by approximately 0.09–0.19 percentage point when their revenue decreases by one percentage point. Most importantly, if wage flexibility would help firms to cushion the effects of negative revenue shocks, the interaction between wage flexibility and revenue change should be positive. As opposed to this, I do not find evidence that flexible-wage firms adjust their separation rate less than firms without flexible wages if their revenue drops. In particular, the estimated parameter is not significantly different from 0 in two specifications and it is even negative in other cases. Finally, Columns (5)–(8) highlight that the separation rate of firms increases when their revenue goes up while I do not find evidence that flexible wage firms adjust their separation rate less than firms without flexible wages.

In this specification, the parameter of wage flexibility has an important economic interpretation as well. Once we control for composition effect, firms paying flexible wages to every worker have lower separation rates by approximately 3–5 percentage points than firms without flexible wages. Appendix Figure A-6 shows that this difference can be observed at large revenue drops and increases as well. Furthermore, flexible-wage firms do not only have lower separation rates but also lower entry rates (Appendix Figure A-7) which implies that flexible-wage firms have a lower churn rate than rigid-wage firms independent of the sign and magnitude of revenue changes. I show the potential explanation for this fact in the next section.

To sum up, I find that firms with flexible wage structures do not adjust employment and separation less if their revenue drops, but have significantly lower separation rates than rigid-wage firms.

6. Discussion

If flexible wage components protect jobs, we expect flexible-wage firms to decrease total employment and increase separation rates less when firm revenue drops. In contrast, I find that flexible-wage firms adjust employment by at least the same magnitude as rigid-wage firms when facing changes in revenue. These results speak clearly against the positive employment effects of flexible wage components. In this section, I discuss three possible explanations for these findings. These are related to the adjustment of non-labor costs, the magnitude of flexible wage components compared to the whole wage bill and to a potential trade-off between quits and lay-offs.

Adjustment of non-labor costs. Besides the wage bill, the most important cost type of firms is the purchasing of intermediate inputs. It is possible that rigid-wage firms do not dismiss more workers because they can adjust these intermediate inputs more than firms with flexible wages. To test this hypothesis, I proxy intermediate inputs with material costs and re-estimate Eq. (5) using material costs as the dependent variable. Table A-17 demonstrates that the elasticity of material costs to the change in revenue is 0.9 for firms with and without flexible wages alike. I do not find any difference in the adjustment of material costs when I consider only the crisis years either. Similarly, Table A-17 highlights that rigid-wage firms do not cut investment more than flexible-wage firms when facing negative revenue shocks. These results suggest that rigid-wage firms cannot smooth employment by adjusting non-labor costs or investment more.

Magnitude of flexible wage components. Flexible wage components cannot make the total wage bill perfectly elastic even though firms can decide about them unilaterally.[21] As the base wage is rigid downward, firms cannot cut wages more than the amount of the flexible components. Flexible wage components only amount to 9.1 percent of the total wage bill and to 2.4 percent of total revenue. To show the extent to which flexible wage components contribute to the cushion against revenue changes I compute the wage adjustment of flexible-wage firms compared to the total change of revenue. The median ratio of the wage bill to the total revenue of firms is 23.5 percent. The 6 percent elastic-

[20] Note: Since I separate the sample based on the sign of the revenue change, I cannot use leave-out-mean industry-level growth as an instrument.

[21] Firms cannot cut the total amount of flexible wage components in case their revenue drops if the terms of the employment contract connect some of the flexible components to individual achievements (Kruse, 1993).

ity of wages to revenue implies that flexible-wage firms can decrease their total cost 0.05*0.235=0.013 percent more than rigid-wage firms if their revenue decreases by one percent. Such low magnitude of wage flexibility may not be enough to prevent lay-offs if revenue drops. As an additional robustness check, Table Table A-13 Columns (7) and (8) investigate employment adjustment among firms with below and above median labor share, respectively. Although the average labor share is 41.1 percent above the median, flexible-wage firms do not adjust employment less than rigid-wage firms in this sub-group either.

Trade-off between voluntary quits and lay-offs. If there are search frictions on the labor market, workers might quit and search for another job when wages decrease (Coles and Mortensen, 2016; Mortensen and Pissarides, 1994; Moscarini and Postel-Vinay, 2013). As a consequence, firms may not be able to protect jobs if they implement large wage cuts when their revenue drops because large wage cuts would induce voluntary quits. I formalize this idea in Appendix A by extending the standard wage posting model of Manning (2003, 2004) with worker-level revenue shocks. I assume that workers are risk-averse so worker utility is lower under the flexible regime and voluntary quits are more frequent. In the model, the benefit of flexible wages is that they incentivize the effort of workers. In line with Holmström (1979), firms do not observe their workers' effort directly, but they can decide to share their revenue with workers by offering flexible wages as an incentive. Finally, I assume that both firms and workers have equal productivity conditional on worker effort, but firms exogenously differ in the volatility of their revenue.

This simple model has rich predictions for the employment and productivity effects of flexible wages. As firms with low volatility can easily infer worker effort, they can use revenue sharing to incentivize high levels of it. Thus, in equilibrium, low-volatility firms have a flexible wage structure, adjust wages more to revenue shocks, and incentive contracting makes these firms more productive. As a consequence, low-volatility firms which become more productive by incentivizing workers can offer higher wages and attract the workers of high-volatility firms (which offer fixed-wage contracts and thus become less productive).[22] This mechanism leads to lower turnover and larger firm size among flexible-wage firms, as documented in the empirical analysis. Lastly, revenue sharing does not protect jobs in the model as small firms with high volatility in revenue opt for fixed wages. The reason for this is that wage flexibility would increase voluntary quits in high-volatility firms too much, so they are better off by offering fixed wages.

7. Conclusion

I presented new empirical facts about the economic consequences of flexible wage components using a unique Hungarian linked employer-employee database. I documented that (i) firms paying flexible wage components are larger, more productive and have lower volatility in growth; (ii) the wages of firms with flexible wage components are adjusted more when their revenue changes; (iii) firms with flexible wage components have a smaller turnover, but firms with and without flexible wages do not have different employment reactions when their revenue changes. These results suggest that flexible wage components in their current state are unlikely to protect jobs in the event of revenue drops. The most likely explanation for this negative finding is that flexible wage components constitute a too low amount compared to the total costs of firms. Finally, I investigated the trade-off between lay-offs and voluntary quits using a simple wage posting model. The model predicts that small firms with high volatility in revenue opt for fixed wages to decrease voluntary quits.

[22] The workers of fixed-wage firms quit if they receive an offer from a flexible-wage firm, while workers at flexible-wage firms reject the offers received from fixed-wage firms.

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Supplementary material

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