Bonus Cuts or Firing - The Role of Flexible Wage Components in Firm Competition and Protecting Jobs

Balázs Reizer

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Abstract

A large share of workers receives bonus payments besides their base wage. The benefits of flexible wage components in remuneration are twofold: they can incentivize workers and make it easier to adjust wages downward in response to negative shocks. Using data on bonus payments of Hungarian workers from linked employer-employee data, I disentangle the these two factors to assess their respective importance . First, I show that bonus payments flexibly adjust to revenue shocks of firms. However, this flexibility does not smooth employment . In addition to that, bonus paying firms are financially more stable, larger and more productive and have less volatile revenue than firms not paying bonuses. These facts can be explained by a wage posting model with incentive contracting, but they are hard to reconcile with models emphasizing the role of bonus payments alleviating wage rigidity. These results indicate that wage flexibility regulations are unlikely to attenuate employment responses to negative shocks.

1 Introduction

A longstanding concern among policy makers is that downward wage rigidity has employment costs if inflation is low (Tobin, 1972). Recent research (Card and Hyslop, 1997; Devereux, 2000; Dickens et al., 2006; Kátay, 2011; Daly et al., 2012) shows ample evidence of downward wage rigidity in many countries and industries. The additional elements besides the wage base (hereafter “bonuses”) are more responsive on aggregate shocks (Oyer 2005; Messina et al. 2010; Anger 2011). However little is known why firms decide on paying bonuses and how they react with wages and employment on idiosyncratic shocks.

The literature of downward wage rigidity stresses the role of “fair wages”. Worker may reduce their effort after wage cuts if their reference point is the past wage (Akerlof, 1982; Akerlof and Yellen, 1990; Chemin and Kurmann, 2014). Managers appear also to be unwilling to decrease wages because they think that the wage cuts would hit the morale and the productivity of workers (Bewley, 1999; Campbell III and Kamlani, 1997; Du Caju et al., 2015). If workers do not feel to be entitled to bonuses then bonuses decreases the downward wage rigidity but it is not clear why firms use different wage structure.

On the other hand contract theory stresses “efficiency” and shows that output dependent wages can ease the moral hazard problem and raise profitability without any cyclical considerations (Hölmstrom 1979; 1982; Grossman and D, 1981; Levin, 2003). Field experiments showed also that the productivity of workers significantly increased after the introduction of output based compensation (Lazear, 000a; Shearer, 2004; Bandiera et al., 2005). This literature concluded that firms try to motivate workers with incentives contract if they can observe the productivity of the workers precisely enough (see Bloom and Van Reenen 2011; Paul and Scott 2011for reviews) but does not consider the general equilibrium effects of bonus payments.

To compare the wage flexibility and incentive contract explanations of bonus payment I make use of a linked employer-employee database, the Hungarian Wage Survey between 1995 and 2008. Similarly to Lemieux et al. (2009) I define a worker as receiving bonus if she gets extra compensation elements over the base wage at least once during the years observed[1] and I document that bonuses are flexible and only the base wage is rigid downward. I am the first who connects the firm level idiosyncratic shocks to wage adjustment of incumbents

[1]It is possible that some workers do not receive bonuses because of unsatisfactory performance under an incentive contract.

and demonstrate that the "bonus” part of the wages is much more responsive to revenue shocks than the "base wage". On the aggregate level the firms without bonuses adjust wages less than bonus paying firms even if I take into account that firms can fire workers and hire new ones with a lower entry wage. Surprisingly the firms paying bonuses adjust employment more to revenue shocks than firms without bonuses even in low inflation periods[2].Moreover I find that the firms which pay bonuses are larger, more productive and experience growth rates which are similar in magnitude but less volatile than the growth rates of firms without bonuses. These findings suggest that the main motivation of bonus payments is not to enhance wage flexibility.

Bonuses may affect the selection of workers as well. For example, Oyer (2004) and Oyer and Schaefer (2005) show that state-dependent payments can decrease turnover of workers which does not contradicts my results. Firms may also want to use state-dependent contracts to screen workers (Lazear 1986; 000b Park and Sturman, 2015) but empirical results are not conclusive whether this type of contract attracts the most productive (Bandiera et al., ming) or the least risk-averse workers (Kandilov and Vukina, 2015). Although it is possible that bonus paying firms are more profitable because they can find the most productive workers, sorting of the best workers cannot explain why bonus paying firms have more worker and lower variance in their growth rates. What is more I find that the observable characteristics of workers such as sex ratio, average educational level and experience are similar at firms with and without bonuses. That is why I ignore the productivity differences among workers and I develop a simple job posting model which helps to distinguish between the wage flexibility and the incentive contract explanation of bonus payments.

First I augment the wage posting model of Manning (2003; 2004) with endogenous separations. I assume that the firm can fire workers if the match is hit by a large negative revenue shocks. Firms with very low revenue offer fixed wages and absorb the revenue shocks. If

[2] I separate my sample into a high and a low inflation period and I re-estimate the wage and employment reactions on both subsamples. I define the period 1995 and 2001 as the the high inflation period when average inflation was 13.9 percent while I call the years after 2001 as low inflation period when the average inflation was 4.7 percent.

the variance in sales is larger than firms put part of the uncertainty on the worker by binding wages to sales revenues, even if the workers are risk-averse. In this case, the firm can decrease the total compensation paid without firing workers. Since the firms have to compensate workers for tolerating income fluctuations these firms will be less profitable and have lower employment than the firms having the less volatile shocks. Finally the firms with the largest volatility in sales cannot smooth employment even with using revenue sharing so they offer fixed wages and fire workers in case of negative revenue shocks. The net effect of these is that bonus paying firms adjust employment less often due to sales revenue shocks than firms without bonuses.

To integrate the incentive contract explanation of bonus payment I augment the baseline wage posting model with the hidden action oHölmstrom (1979). Firms can link wages to their sales revenue by paying bonuses or they can offer fixed wage contracts. I assume that firms do not differ in productivity, but they are heterogeneous in the volatility of their sales revenues, and firms having a lower variance in their sales revenues can measure effort of workers more precisely. As a result, these firms can incentivize workers with bonus payments without creating great income uncertainty for them. By contrast, firms that cannot observe worker-level output have no other choice than providing fixed wage contracts. Since fixed wage contracts will lead to lower worker effort, these firms will pay less in wages, and will be smaller and less productive. In this setup, bonus payment reduces downward wage rigidity but does not affect the employment adjustment of the firm because the reason for bonus payment is to offer incentive contracts and not to increase wage flexibility.

My empirical results suggest that bonus paying firms are more productive have more employee and lower variance in their revenues. As bonus paying firms adjust wages more but they do not smooth employment more in the event of negative revenue shocks, I conclude that incentive contracts provide a better explanation for bonus payment than the demand for wage flexibility.

In spite of policy relevance there are hardly any research looking for direct evidence on the negative effect of wage rigidity on the employment level. The only exceptions are Fehr and Goette (2005) and Schoefer (2015). On the contrary, Elsby (2009) argues that firms only increase wages if they think that the new wage level will not need to be decreased and that is why downward wage rigidity does not have significant employment costs. I augment the reasoning of Elsby (2009) as my results suggest that firms have instruments to ease the effects of negative revenue shocks and firms would be able to achieve wage flexibility if they wanted to but they choose a rigid wage structure independently of cyclical considerations. That is why the employment cost of downward nominal wage rigidity (DNWR) is overestimated and the main reason of decreasing employment in recessions is not the wage rigidity of incumbents.

2 Model

I develop a model with the oligopsonistic power of firms. The analysis is based on the dynamic job search model of Burdett and Mortensen (1998). For analytical convenience, I use the discrete-time version of the model presented by Manning (2003; 2004). I only describe the steady-state characteristics of the economy without evaluating model dynamics, so the time indexes are suppressed in the derivations.

2.1 Setup

Workers

There are M_w identically productive workers. The workers seek for the job with the highest expected utility. The outside option of workers ensures U_0 which can be conceived of as the amount of the unemployment benefit or the value of leisure. The effort of workers is denoted by e and it can be either high or low. Low effort level is normalized to 0 while high effort makes $\bar{e}$ profit to the firm and $c\bar{e}$ costs to the worker. The expected utility of workers over their income has mean variance form $(W)^3$:

$$U(W(e),e) = E(W) - r * var(W) - ce \tag{1}$$

Firms

The number of firms is M_f. The relative number of workers and firms is described as $M = M_f/M_w$. Every firm is infinitesimally small compared to the labor market. The firms observe only the gross profit but do not observe the effort level of workers directly. The gross profit produced by one worker is expressed as follows:

$$\pi_j = \begin{cases} p + \bar{e} + \varepsilon_j & if\, the\, worker's\, effort\, is\, high \\ p + \varepsilon_j & if\, the\, worker's\, effort\, is\, low \end{cases}, \tag{2}$$

For analytical convenience, I assume that the revenue shock ε_j is a zero-mean and normally distributed random variable[4]. The shocks are independent between workers but they have the same variance within firms. $H(var(\varepsilon_j))$ stands for the distribution of the variance of revenue shocks across firms. The only cost of production is the wage paid to employees. Firms can offer only linear contracts:

$$W_j = w_j + b_j * \pi_j$$

where $w_j \geqslant 0$ is the fixed wage and the firms share $b_j \in [0,1]$ part of the gross profit with the workers. $b_j * \pi_j$ can be interpreted as the bonus part of worker compensation. $Var(\varepsilon_j)$ is

[3] If the worker has constant absolute risk aversion with coefficient r and her income is exposed to normally distributed shocks then the certainty equivalent value of the expected utility has mean variance form Bolton and Dewatripont (2005).

[4] The predictions of the results are robust against the changing the distribution of shocks and the utility function of the workers until the workers are risk averse

common knowledge, so workers know the expected utility of wage offers before they accept or reject them. Firms are risk-neutral and aim at maximizing expected profit:

$$\underset{w_j, b_j}{max} E((1 - b_j) * \pi_j - w_j) * N_j(w_j, b_j) \tag{3}$$

where N_j is the number of workers at the firm, which in turn depends on the wage, as firms engaging in oligopsonistic competition have more workers if they pay higher wages[5].

U_j is used to denote the expected utility of workers at firm j. In this case the following equality applies:

$$b_j * (p + e_j) - c * e_j - r * b_j^2 var(\varepsilon_j) = U_j \tag{4}$$

where e_j denotes the effort level of workers at firm j. Substituting Equation 4 into 3 we get the following profit maximizing problem:

$$\underset{U_j, b_j}{max} E((\pi_j + e_j - c * e_j - r * b_j^2 var(\varepsilon_j) - U_j) * N_j(U_j, b_j) \tag{5}$$

This form of the profit maximization problem is more convenient as I will show below that the size of the firm depends only on the utilities offered by firm j and by other firms.

Matching

Individuals receive a wage offer described by $\{w_j, b_j\}$ in every period with probability λ from a random firm[6]. The probability of getting an offer is independent from the labor market status

[5] Note: The workers and their expected output is identical so firms will offer the same contract for every individual.

[6] Although the firms are infinitesimally small compared to the labor market, they have some monopsony power over workers as the probability of receiving a better wage offer than the current wage is less than 1.

of individuals. Unemployed workers always accept the wage offer[7] while current employees only accept a wage offer if its expected utility is higher than the expected utility provided by their current job. Workers lose their job and become unemployed with a probability of δ_j. The separation rate is independent from the characteristics of firms and individuals.

First, I show that the steady-state equilibrium of the economy can be characterized by a non-degenerate wage offer distribution $\{U_j, b_j\}$ which ensures that the size of the firms remains constant over time. Then, I present how $var(\varepsilon_j)$ and b_j are connected under different assumptions.

Lemma 1:

The cumulative distribution function of U_j is strictly increasing and continuous between the minimum and the maximum of U_j *(proved by Manning (2003), proposition 2.2).*

Lemma 1 is a basic property of the Burdett and Mortensen (1998) model. If the distribution of U_j is not strictly increasing then there is a $(\underline{U}, \bar{U})$ interval without a corresponding wage offer. In this case, it is profitable for firms offering $\bar{U}$ utility to decrease wages. Similarly, if the distribution of U_j is non-continuous, it means that a non-negligible share of firms would offer the same utility to their workers (U_j^*). However, in this case, it is profitable for any firm offering U_j^* utility to increase the offered utility with an infinitesimal small amount and attract part of the employees from the firms still offering U_j^* utility. That is why, in equilibrium, the wage offer distribution is dispersed, which ensures that firms having a different $var(\varepsilon_j)$ also offer a different utility and have a different amount of workers. Burdett and Mortensen (1998) also show that the result is the same if firms are heterogeneous and the firms which have higher revenue per worker also offer higher wages. In the next sections, I also demonstrate how the profit sharing parameter depends on the variance of the revenue of firms under different assumptions.

[7] If a firm offers a lower expected utility to the worker than her outside option, no worker would accept that offer. That is why any wage offer should provide at least U_0 utility to the worker.

2.2 Bonus payment as a tool of incentive contracts

In this section, I prove that if firms cannot separate workers than the firms which can observe effort of workers more precisely will offer incentive contracts. In equilibrium, the wage offer distribution of firms has to meet the condition under Proposition 1 regardless of the distribution of wage offers.

Proposition 1

In equilibrium, there are two possible values of the profit sharing parameter b_j.

$$b_j = \begin{cases} c & if \ \frac{\bar{e}*(1-c)}{c^2*r} \geq var(\varepsilon_j) \\ 0 & otherwise \end{cases} \tag{6}$$

Proof: see Appendix

According to Proposition 1, firms which are able to measure workers' performance precisely can incentivize their labor force by sharing the gross profit with their workers. If the effort of worker (e) is more valuable, firms with a larger variance in their revenues can also incentivize workers. However, if workers are more risk-averse (r is larger) or the cost of making higher effort (c) is larger, fewer firms will want to choose incentive contracts. The second implication of Proposition 1 is that firms using incentive contracts share the same proportion of their gross profit with their workers, independent of $var(\varepsilon_j)$. The lowest threshold of the profit sharing parameter is pinned down by the incentive compatibility constraint of workers. If b_j is too low, workers will shirk; if b_j is too high, the firm has to pay a risk premium for the workers unnecessarily. Therefore, in equilibrium, workers should be indifferent to shirking and making a high effort even if they are offered a positive b_j. By contrast, if firms cannot observe the effort of workers precisely enough it is optimal for them to provide fixed wage contracts. Since I interpret profit sharing as bonus payment, Proposition 1 suggests that the volatility of sales revenues at bonus paying firms are lower than in the case of firms not paying bonuses.

Using the results of Proposition 1, the following notation can be applied:

$$P_j = \begin{cases} p + \bar{e} - c^2 * r * var(\varepsilon_j) & if \ \frac{\bar{e}*(1-c)}{c^2 * r} \geq var(\varepsilon_j) \\ p & otherwise \end{cases} \tag{7}$$

P_j is the social surplus provided by a worker of the firm. It can also be interpreted as a measure of productivity as this is the output per worker remaining after compensating workers for income uncertainty. Equation 7 suggests that firms characterized by a lower uncertainty in their output can achieve higher profit per worker. The strength of this approach is that the distribution of P_j is a deterministic function of $H(var(\varepsilon_j))$. Using P_j we can also write up the firms' problem only as the function of the utility provided and the distribution of utilities[8] offered by other firms (F). As mentioned before, in the equilibrium of the economy, the size of firms is constant and the following inequality should apply. Using the notation P_j the profit maximization problem in Equation 5 can be rewritten in the following way.

$$(P_j - U_j) * N(U_j', F) \geq (P_j - U_j') * N(U_j', F) \quad for\ any\ U_j \neq U_j' \tag{8}$$

Equation 8 suggest that for any productivity level there is a given utility level which maximizes firms' profits. If firms offer a higher expected utility profit per worker will be smaller but the number of workers will be larger. The reason for this is that they can attract the workers of firms offering a lower expected utility. That is why the size of firm j is endogenous in this model and it depends positively on U_j as well as on the share of firms offering a lower expected utility than firm j. Burdett and Mortensen (1998) revealed that there is no general formula for F but derived the sufficient conditions for equilibrium. The empirically testable characteristics of the equilibrium in my extended model are as follows:

Proposition 2

Firms using incentive contracts offer a higher utility to the worker and have larger size than firms offering fixed wage contracts.

[8]Note: At firms offering fixed wage contracts $b_j = 0$ and $U_j = w_j$ while at firms offering incentive contracts $b_j = c$ and $U_j = w_j + c(p + e) - c * r * var(\varepsilon_j)$.

Proof: see Appendix

As Equation 2 illustrates, firms offering incentive contracts can achieve higher gross profit per worker even after compensating the workers for the uncertainty in their wage. In an oligopsonistic environment, more productive firms offer higher wages to attract the workers of less productive firms. Although it is possible that these firms will have an even lower profit per worker, as they will have more workers, their total profit will be higher. As another consequence of Proposition 2, if a worker having an incentive contract got a fixed wage offer she would not accept it as the fixed wage contract would provide her lower utility. On the contrary, workers who have a fixed wage contract always accept wage offers which come with an incentive contract.

2.3 Bonus payment as a tool of wage flexibility

Now, suppose that the firm level revenue shocks have binary outcomes, and they take the value $-\varepsilon_j$ or ε_j randomly with equal probability. This setup is equivalent with a simple Markov-chain process where there are a "recession" state and a "boom" state and the probability of regime change is 50 percent. For case of simplicity I set the effort level of workers and the interest rate to 0. I also assume that first firms observe the actual state of ε_{jt} and they can decide whether they want to separate the workers before the payoffs are realized. So firms can separate workers if the expected value of the match turns negative

$$P_j - U_j + (1-b_j)\varepsilon_{jt} + \sum_{s=1}^{\infty}(\lambda(1-F(U_j)) + \delta_j)^s E(P_j - U_j + (1-b_j)\varepsilon_{j,t+s}) < 0 \qquad (9)$$

As the expected profit of firms is always positive equation 9 formalizes the intuition that firms want to separate workers only in "recession" period when ε_{jt} is negative. The separation is also more likely if the variance of the revenue shocks is larger. On the contrary, firms can increase their profit during recession if they use larger revenue sharing. Since the expected value of next periods revenue shocks are zero, the revenue sharing parameter decreases the chance of layoffs. On the other hand the larger revenue sharing decreases the utility of the worker so they want to leave voluntarily with a higher chance. Similarly the firms want to fire workers more likely if the exogenous separation rate is larger because in this case the discounted value of profit decreases. On the contrary the social surplus of the worker decreases the likelihood of separations. If the firms are more profitable then more extreme negative shock is needed to change the sign of the present value of the job. At least, it is not obvious how the utility provided by the firm affects the likelihood of separations. On the one hand it decreases the per period profit of the firm but decreases the probability of separations as well.

Using equation 9 proposition 3 follows:

Proposition 3

Firms with medium size variance in their sales pay bonuses and never fire their workers. The firms with lowest variance do not share their sales and do not fire workers either. If $var(\varepsilon_j)$ is above a certain threshold level than firms offer fixed wage contracts and fire their workers if the matches are hit by negative shocks.

Proof: see Appendix

The first order conditions of equation 5 shows that total profit of the firm is deceasing in b_j. So firms smoothing employment choose the smallest b_j which ensures that the expected value of the match is not negative in recession. If the $var(\varepsilon_j)$ is small enough than the expected value of the match is positive during recession even without any profit sharing but if $var(\varepsilon_j)$ exceed a certain threshold then firms need to share their sales with the worker to increase the expected value of the match during recession. The revenue sharing decreases the utility of workers and firms have lower profit per worker after compensating them for the uncertainty in wages. As Burdett and Mortensen (1998) show, these firms will offer lower utility to the worker which implies smaller employment and larger turnover. Finally if the variance of the sales revenue is very large than it is not profitable to share the sales because the utility cost of uncertainty is to large. In this case firms offer fixed wage but fire workers if the match is hit by a negative revenue shock.

The testable implications of this extension to the model are as follows:

Proposition 4

If profit sharing does not affect the effort of workers, firms without bonuses have (a) a larger variance in their sales revenues and pro-cyclical separation rate or (b) lower variance in their sales revenues and acyclical separation rate.

Proposition 3 shows that there are two type of firms without bonuses. One type are the firms having so large variance in their sales revenues which they cannot counterweight with profit sharing and these firms fire their workers at the case of negative shocks. On the other hand firms with the lowest variance in their sales can smooth employment without profit sharing even in case of negative revenue shocks. As these firms do not need to compensate their workers for the uncertainty they can offer the highest utility and will be the largest as well. The net effect of these two channels can be estimated empirically. If there are firms which cannot smooth employment than separation rate of firms without bonuses have to be more more negatively correlated with the sales than the separation rate of firms paying bonuses. On the contrary if every firms can smooth employment than the firms without bonuses have the lowest variance in their sales revenues. These firms will offer the highest utility to their workers and will have the largest employment.

Although there may be multiple motivations behind bonus payment, we can compare the "wage flexibility" explanation and the "incentive contract" explanation for bonus payment. If firms pay bonuses mainly to enhance worker effort, we may expect that firms paying bonuses are larger, more productive and have lower variance in their sales revenues subject to their employment size[9]. If the most important motivation for paying bonuses is to smooth revenue

[9] If sales revenue shocks are not perfectly correlated across workers, the relative volatility in sales revenue is decreasing with the size of the employment. That is why I also control for the number of workers in the regressions.

shocks then the largest firms do not pay bonuses. On the contrary bonus paying firms have a larger variance in their sales revenues but they are smaller on the average and adjust their employment less due to sales revenue shocks. After introducing the data, I outline the empirical tests of these predictions.

3 Institutional background

Employment contracts in Hungary have to specify the amount of the monthly base wage which can be decreased only with the consent of workers. However, if worker compensation is based on piece rate or is paid on an hourly basis, the minimum amount of monthly payment has to exceed only half of the base wage [10]. According to the Wage Dynamics Network survey, Hungarian firms adjust base wage every 13.8 months and 80 per cent of firms adjust wages once a year. The frequency of wage changes is slightly lower in other European countries, for example, firms in the Euro zone change wages every 15 month on average (Druant et al., 2012). Firms can modify other elements in the compensation package of workers without any legal constraints. The share of additional monetary elements in addition to the base wage account for approximately 10 per cent of total worker compensation. This share is close to the Western European average (Kézdi and Kónya, 2011).

Employment protection institutions in general are more similar to the Anglo-Saxon regimes than to those found in Continental countries. It is relatively simple to dismiss workers (Riboud et al., 2002; Tonin, 2009) and collective wage bargaining is also based on the firm-level agreements of the unions (Rigó, 2012). The share of union members is approximately 20 per cent which is relatively low compared to other OECD countries (OECD, 2004). Apart from firm level bargaining, industry-level agreements are rare and set only very week requirements (Neumann, 2006). The unions participate also in the country-level bargaining forum

[10] According to the Wage Survey, 15 per cent of the workers are paid on a hourly basis or based on a piece rate.

called National Interest Reconciliation Council. The Council is a tripartite forum of union federations, employer associations and the government and it makes recommendations for wage increases and sets an obligatory minimum wage for the next year [11]. The recommendations for wage increases are not legally enforced and the share of firms using automatic wage indexation policies is also low (Druant et al., 2012).

The macroeconomic environment can be divided into two different periods. As Panel (a) of Figure 1 in the Appendix demonstrates, the inflation rate was relatively high before 2001 and moderately low afterward. As inflation greatly affects wage adjustment, I repeat my estimations on these two sub-samples separately. My results are robust to changes in inflation. Panel (b) shows real GDP growth and the employment-population ratio. This figure reveals that the economy was relatively stable and there was no recession during the period under scrutiny.

4 Data

I use the Hungarian linked employer-employee survey for estimation. The wage information comes from the Hungarian Wage Survey. The survey is repeated every year and involves a quasi-random 6% sample of Hungarian employees and their income in May. A random sample of firms having at least 5 workers but less than 20 workers and all firms having at least 20 workers have to report detailed information about their employees. Companies having less than 20 workers have to report information about each employee and firms having more than 20 workers have to report about 10% of their employees. The sample selection is based on date of birth, as employers have to report on blue collar workers born on the 15th or 25th day and white collar workers born on the 5th, 15th or 25th day of the month. The database contains a wide range of personal information (age, gender, education, 4-digit

[11] While the government can set the minimum wage unilaterally, the parties managed to agree on the minimum wage in every year except for 2001Rigó (2012).

occupation codes). The database is unique as it contains information not only about total compensation but also about the different wage parts. In addition to the base wage, the Wage Survey records extra payments for overtime, night and weekend shifts, allowances for special working conditions, knowledge of foreign languages, premia as well as regular and irregular bonuses[12]. Moreover, wage information is reported by the firms and not by the individuals so measurement error is a less of an issue. I define workers as receiving bonus if they got at least one type of extra payment in addition to their base wage in any year during the periods observed Lemieux et al. (2009).

Graph 1 outlines the relationship between the size of the firm and bonus payments. I grouped the worker-year observations into 20 categories by firm size and plotted the average share of workers receiving a bonus in every bin. This non-parametric estimate shows that the larger the firms are the more likely it is that their workers receive a bonus. This result is in line with the wage flexibility explanation for bonus payments. To ensure common support for workers receiving a bonus, I confine my attention to firms having less than 2500 workers. For the purpose of robustness checks, I repeat every estimation also on the sub-sample of firms with less than 500 employees. I also drop observations where the firm has less than 20 workers so it cannot be followed automatically over time. The vertical lines show sample restrictions[13]. Due to data availability issues, I use the waves of wage surveys conducted between 1995 and 2008 for the present analysis. The analysis is restricted to private sector firms since the wage and employment decisions of public sector firms are substantially affected by politics in Hungary (Telegdy 2013a, 2013b). To rule out extreme shocks, I drop individuals who work at firms with very large changes in sales revenues. More precisely, I use only observations where the firm's sales revenue changes by less than 50% from one year to the next. This affects approximately the largest and smallest 5 percentile of sales growth distribution.

[12] The sum of the base wage and other wage parts do not need to be equal the total compensation in the database. Such difference is defined by paid and unpaid leaves.

[13] My results are robust to the inclusion of the smallest and the largest firms.

Table 1 summarizes the descriptive statistics of the different wage elements. The 1st column shows that workers approximately 78 per cent of workers receive at least one type of additional wage elements. and workers earn usually more than one type of additional wage elements. The most widespread type of additional elements are occasional bonuses while monthly bonuses have the largest share in the compensation package of workers conditional on receiving the wage element.

Firm-level data come from the corporate income tax returns collected by the National Tax and Customs Administration. The database contains the balance sheet and income statement of every double book-keeping firm. The firms also have a unique identifier so they can be followed over time and firm-level revenue shocks can also be measured. The weakness of the database is that it has information only about the total labor cost incurred and average employment during the year but it has no information on the structure of worker compensation or the individual level of wages. That is why I construct an individual-level panel from the repeated cross-sectional data of the Wage Survey. First, I construct cells within firms using the year and month of birth, gender, the highest level of education completed and the 4-digit occupational code. Using this method, 97% of the workers are alone in their cells. It is improbable that firms fire somebody and hire a new worker with exactly the same characteristics. Therefore, the cells allow me with high certainty to link workers between the years if workers do not change employer or occupation between the years[14].

Table 2 shows the means and standard deviations for the final sample. As the change of wages can be computed only for workers remaining at the same firm over the years, I show the means for this group as well. The summary statistics are also in line with the incentive contract explanation for bonus payments. Bonus-receiving workers have a higher wage and work at larger, more productive and more profitable firms. Workers receiving bonuses work at firms where the share of new entrants is lower. This is not surprising as in equilibrium

[14] Between 2002 and 2008, the tenure of workers is also observable. When I used tenure instead of occupation code for matching workers I found that less then one per cent of workers changes occupation without leaving the firm. The probability of changing occupation is uncorrelated with bonus payments.

firm size is constant so the separation rate and the share of new entrants are equal in every firm. As firms offering fixed wage contracts are less attractive to workers of bonus paying firms, the separation rate for bonus paying firms will be lower. We cannot see considerable differences in the case of other characteristics. Workers receiving a bonus have a similar age, years of education and there is no great difference in the sex ratio either. The main message of the right panel is that workers remaining at the firm are similar to the total sample. The only difference is that workers in this sub-sample work at slightly larger firms.

Using the individual-level panel, I construct the distribution of wage changes for workers with and without a bonus. These distributions are able to reflect the downward nominal rigidity of the different wage elements. If wages are rigid downward, firms can only decrease average labor compensation by firing their workers and hiring new ones for a lower wage. If replacing workers is costly, wage rigidity results in upward pressure on wages and positive excess mass or "bunching" may be expected at small increases and a spike at 0 in the distribution of wage changes. By contrast, if 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. Graph **??** presents the log-changes of wages. The distributions are winsorized at 50% change. The brown solid bars show the changes of wages for employees who do not get a bonus while the red empty bars indicate the distribution for workers receiving a bonus. Panel A shows that the nominal wage of workers without a bonus is completely rigid downward while the wage of workers receiving a bonus is flexible. Panel B shows that the base wage is downward rigid for workers with and without bonus alike. Consequently, we can conclude that bonus payments are the reason for wage flexibility.

Inflation can ease the effects of wage rigidity as firms can decrease real wages without cutting the nominal value of compensation of workers if the inflation rate is higher. Therefore, I compare the wage change distribution of workers in a low and high-inflation environment. As inflation was much higher in Hungary before 2001, Panel (a) and (b) of Figure **??** in the

Appendix plots the distribution of wage changes by decade. Panel (a) shows the distribution of wage changes for workers without a bonus. In the high-inflation period before 2001, the median of the wage changes was larger and the spike at 0 was smaller than in the low-inflation period. In addition, nominal wage drops were scarce irrespective of the inflation rate. We can conclude that higher inflation eases but does not eliminate downward nominal wage rigidity in the case of workers without a bonus. On the other hand, Panel (b) shows that the wages of bonus receiving workers are flexible regardless of the inflation rate. If the inflation rate is higher, average wage growth is also higher and nominal wage drops are less frequent. At the same time, there is no large spike at 0 and the probability of small wage decreases is approximately the same as the probability of small wage increases. Last but not least, Panel (c) of Figure **??** in the Appendix shows the distribution of real wage changes for workers with and without a bonus. It is clearly observable that wage change distribution is continuous around 0, and we cannot find neither spike nor bunching around 0. This graph suggest that wages in Hungary are only nominally rigid but not in real terms[15].

5 Employment and wage reaction of the firms

5.1 Estimation strategy

To get the reactions of firms with and without bonuses to revenue shocks I estimate the following equation:

$$\Delta y_{jit} = \beta_1 \Delta log(sales_{j(it)}) + \beta_2 bonus_{ji} + \beta_3 bonus_{ji} * \Delta log(sales_{j(it)}) + \gamma X_{jit-1} + \mu_t + \varepsilon_{it} \quad (10)$$

[15] This result is in line with the estimates of Kátay (2011) who also found a very low downward real wage rigidity in Hungary.

where the dependent variable is the change in the wage of worker i at firm j between year $t-1$ and t. $\Delta log(sales_{j(i,t)})$ stand for the change of nominal sales revenues of firm j between year $t-1$ and t. This variable is the same for every worker of the firm. $Bonus_{ij}$ indicates whether the worker i at firm j received extra compensation elements in addition to the base wage at least once during the observed periods. X_{it} denotes the control variables why μ_t are year dummies to get rid of the effect of inflation. The main variable of interest is the interaction of bonuses and changes in sales revenues. If β_3 is positive then firms can adjust the wages of the incumbents more by paying bonuses.

To compute the employment reaction of the firms I re-estimate equation 10 with a dummy variable on the left hand side denoting whether the worker remained between year $t-1$ and t at the firm. If the firms pay bonuses to decrease wage rigidity than we expect that the probability of remaining at the firm co-moves with sales revenues more tightly at the case of workers without bonuses. This implies thatβ_1 is positive while β_3 is negative. In contrast, the incentive contract explanation for bonus payments suggest that the probability of separation is independent from firm level revenue shocks which implies that β_1 and β_3 are both zero in this case. Finally the sign of β_2 can be used two distinguish between the two explanations of bonus payments as well. As incentive contract explanation of bonus payments suggest that expected utility of workers with bonuses are higher so they less likely leave the firms which implies that β_2 is positive. On the contrary the wage flexibility explanation suggest that bonus receiving workers have lower utility than workers with fixed wages which implies that β_2 is negative.

The individual level estimations have two important weaknesses. First they implicitly assumes that the workers are independent within firms in the sense that the wage rigidity of one worker does not effect the separation rate of other workers. Besides, firms may be able to decrease average wages without adjusting the number of employees if they fire workers and hire new ones at lower wages. This mechanism provide wage flexibility at the firm level even if individual wages are downward rigid and the separation rate is independent from sales revenue shocks[16]. To control for this mechanism I aggregate equation 10 on the firm level and estimate the following equation

$$\Delta y_{jt} = \beta_1 \Delta log(sales_{jt}) + \beta_2 bonus_{jt-1} + \beta_3 bonus_{jt-1} * \Delta log(sales_{jt}) + \gamma X_{jt-1} + \mu_t + \varepsilon_{it} \quad (11)$$

where the dependent variable is either the change of average wages or the change of employment at firm j between year $t-1$ and t. $\Delta log(sales_{jt})$ denotes the change of sales revenues between years $t-1$ and t while $bonus_{jt-1}$ denotes the share of workers receiving bonus at year t-1. If bonus payments provide the firms additional flexibility than we expect that β_3 is positive at the wage equation. In the employment equation we expect that β_1 is positive due to reserve causality. If the number of workers changes due to any exogenous reasons the output of the firms will change as well because workers are one of the production factors of the firms. Still if firms pay bonuses to smooth employment than we expect that β_3 is negative but if firms pay bonuses to incentives worker than we expect that β_3 is not negative[17].

5.2 Results

Panel A in Figure 3 shows a non-parametric estimate for the wage adjustments of workers with and without bonus. I grouped the worker year observations in twenty equally sized bins by the change of the sales revenue of the employers and plotted the average change of wages for workers with and without a bonus. It is clear that the wages of workers receiving a bonus change more due to revenue shocks than the wages of workers without a bonus. The only

[16] A large body of literature shows that the wages of newly hired workers are more pro-cyclical than the wages of incumbents (Pissarides, 2009; Carneiro et al., 2012; Haefke et al., 2013; Kudlyak, 2014).

[17] Note: the firm level estimations are not sufficient either to compare the different explanations of bonus payments as only individual level regressions can show the wage adjustment of incumbents and the lower separation rate of bonus receiving workers.

difference between the theoretical and empirical investigation is that the wages of workers without a bonus also co-moves with the revenue of the firms to some extent. Contrary to the model, the sales of firms are not stationary over time. If the productivity of firms shows a positive trend the sales revenues of the firms and wages increase over time as well. If there are differences in firm-level growth rates, the time dummies cannot control for the positive correlation between the growth rate of sales revenues and wages. This phenomenon is true independently from the structure of wages.

In contrast to wages, the probability of separation does not co-move with the change of sales revenues of the firm if the size of the shock is not very large. As panel B in Figure 3 illustrates, the probability of remaining at the firm is approximately constant for workers receiving and not receiving a bonus alike. Moreover, the probability of remaining at the firm is larger if the worker receives bonus in a given year. This contradicts the wage flexibility explanation for bonus payments but it is in line with the incentive contract explanation as the latter model suggests that bonus paying firms offer a higher utility to their workers so they can attract the workers of firms not paying bonuses.

Panel B in Figure 3 shows the survivor rate of jobs conditional on that the employing firm remained at the Wage survey next year. As a firm can only participate in the Wage Survey if it had not gone bankrupt earlier on, estimates for job survival rates are biased if the probability of bankruptcy is correlated with the decision to pay bonuses. To control for this possibility graph A-4 shows the survivor rates of jobs unconditional on the participation of the firms in the Wage Survey. At this graph I consider a job as separated if the firm is not observed at the wage survey next year. As firms do not necessary go bankrupt if they do not participate in the Wage Survey this method underestimates the survivor of jobs. In line with the expectations the estimated probability of job survivor dropped but the results are qualitatively similar. The survivor rates are almost uncorrelated with the changes in revenue and the workers without bonuses are separated more likely.

The point estimates for equation 10 are shown in Table 3. As the upper panel reveals, the sales revenue of the firm increases by 10 per cent while the wages of workers without a bonus increase by approximately 0.3-0.4 per cent. The conditional and unconditional wage adjustment are approximately the same but the wage adjustment is slightly lower depending on the observables. More importantly, wage adjustment in the case of workers receiving a bonus is almost three times as large as wage adjustment in the case of workers without a bonus. If the firm's sales revenue changes by 10 per cent, the wages of workers receiving a bonus changes by 0.7-0.8 per cent more than the wages of workers without bonuses.[18] In addition, this result is highly significant and robust to the inclusion of control variables and sample restrictions.

Panel B in Table 3 summarizes the point estimates for the employment equation. It is observable that the probability of separation is approximately 25 per cent lower if the worker received bonus in a given year. This difference is robust to including control variables and to omitting firms with more than 500 employees. These point estimates are in line with the predictions the incentive contract explanation of bonus payments, as bonus payments are connected with a higher utility and lower separation rate of workers. By contrast, the connection between the separation rate and changes in sales revenues is very weak in the case of moderate revenue shocks. Furthermore, the separation rate of workers receiving a bonus is positively correlated with the revenue shocks hitting firms. The estimated coefficient for the interaction term suggests that if the firm's sales revenue increases by 10 per cent, the separation rate of workers receiving a bonus decreases by 0.6 per cent more than the separation rate of workers without a bonus. Thus, the empirical findings definitely contradict the wage flexibility explanation for bonus payments as bonus payments do not help firms to smooth employment[19].

It may be possible that workers with different characteristics cannot be incentivized with

[18] These results are similar to the estimates of Kátay (2008). He found that wage elasticity to productivity shocks is between 0.05 and 0.1.

[19] Theoretically, it is possible that one type of the firms can smooth employment without smoothing wages while another type of the firms cannot smooth employment even by paying bonuses and having downward flexible wages. However, in this case, we would expect that bonus paying firms have a larger separation rate as well.

the same wage structure that is why I re-estimate equation 10 by different worker groups separately. The result are shown in table A-1. First I do not find any difference in the effect of bonuses at the case of males and females. Second I estimate the parameters of interest differently for blue and white collar workers because the effort of blue collar workers may be observed more easily and their employment dropped more during the Great Recession (Köllő, 2011). Finally I estimate the model separately for trade-able and non trade-able sectors. As Hungary is a small open economy this separation is motivated by the assumption that the firms at trade-able sectors face a more fierce competition which may affect the wage and employment adjustment of firms[20] The point estimates qualitatively the same at all of the subgroups.

Robustness The bonus definition I use in the main analysis is arbitrary so table A-2 shows the robustness of my results to different bonus definitions. In column (1), a worker is defined as receiving a bonus if she got a bonus last year. Although the point estimates changed, the results qualitatively remained the same since the wage response of workers receiving a bonus is larger if the sales revenues of the firm change. In comparison, the average wage growth of workers without a bonus is 5 percent lower than the wages of workers receiving a bonus. The reason for this is that although some workers do not receive a bonus because of temporary weak performance they expect to get bonus in the next year. This effect increases the average wage growth of workers who are categorized in this specification as not receiving a bonus. Similarly, the conditional probability of remaining at the firm if workers received bonus decreased compared to workers without a bonus. This also suggests that this definition of bonus payment mistakenly categorizes some workers as not receiving a bonus. Still, in the case of this definition, the partial effect of sales revenue changes on the probability of the separation of workers receiving a bonus is not lower either. The results are qualitatively the same if I define I define workers as receiving a bonus if the additional compensation elements over the base comprised at least 10% of the total wages (column 2)

[20] I estimated the model separately for exporters and non-exporters but the results were similar so I do not show them.

or if their base wage is lower than their total compensation even if they did not receive any additional elements over the base wage (column 3)[21].

Column (4) of Table A-2 regards workers as receiving extra elements over their base wage if they got monthly or occasional bonuses or premia. Under this specification, I do not consider overtime payment, reimbursements and allowances for special working conditions as extra elements over the base wage. The reason for this is that one could argue that overtime can be directly controlled by the firms and firms only pay them because of legal obligations. The requirements for allowances and reimbursements can also be independent of the unobserved effort of individuals; that is why these wage elements may similarly have only weak incentive effects. The point estimates are very close to the main results and they are in line with the incentive contract explanation for bonus payments.

Finally column 5 shows that firms that the non-financial remuneration does not co-moves with sales revenues so firms without bonuses do not smooth employment costs by adjusting non-financial remuneration

Table A-3 concerns the robustness to changing the estimation sample. In the first column, I include the firms with less than 20 or more than 2500 workers in the sample and in column (2) I re-estimate the model without weighting. The point estimates are basically unchanged. Another concern about the results may be that I arbitrary trimmed the distribution of sales revenue shocks at 50 percent. For this reason, column (3) and column (4) takes into account revenue changes which are lower than 30 and 20 per cent, respectively while column (5) winsorizes the wage distribution instead of trimming. The results remained the same.

In the last three columns of Table A-2 I deal with the issue of wage under-reporting in Hungary. Previous research in Hungary highlighted that some employers under-report wages

[21] If the worker is partly or completely paid on a hourly basis or based on a piece rate then the Wage Survey reports a base wage lower than the total compensation, even without any additional elements over the base wage indicated

to decrease tax liability. In column (6) I re-estimate Equation 10, using firm-fixed effects. The implicit assumption here is that there is no within firm heterogeneity in wage under-reporting. In column (7) I omit workers receiving a minimum wage. The assumption here is that if the wage of a worker is under-reported, the reported wage is the lowest possible, i.e. the minimum wage. These specifications are in line with the previous results. The wages of workers receiving a bonus co-moves more tightly with the sales revenues of firms and the flexibility of wages does not help firms in smoothing employment. Interestingly, under this specification, the wages of workers without a bonus are conditionally uncorrelated with the sales revenues of the firm. I re-estimated the model also by omitting firms with less than 100 employees because smaller firms are more likely try to evade taxes (Kleven et al., 2011). As each of these specifications produce results similar to the main specifications, I conclude that my results are not driven by wage under-reporting.

Firm level evidence Table 4 shows the firm-level estimations. Similarly to the individual-level analysis, the average wages received at firms not paying a bonus increase by 0.3% in the aftermath of a 10 per cent sales revenue shock and wages at bonus paying firms are adjusted by 0.3-0.7 percent more. This results is robust to introducing control variables (column (3) and (4)) and to weighting with employment. On the other hand, average nominal wage growth is sightly lower at bonus paying firms. To sum up, we can reject the hypothesis that firms not paying bonuses adjust wages as much as bonus paying firms by firing workers and hiring new ones for a lower wage. The most important difference between the firm-level and the individual-level analysis is in the employment equation. I find that a one per cent change in sales revenues corresponds to a 0.3 per cent change in employment level although the separation rate is nearly uncorrelated with sales revenue shocks. The difference between the two results is caused by reserve causality. For example, if the employment level changes accidentally due to an exogenous reason, firm output will also change as labor is one of the inputs of production[22]. On the other hand, the interaction of the bonus payment and the

[22]If we assume that the production function of the firms is Cobb-Douglas then these estimates are consistent with a labor share of 1/3.

sales revenues is very close to zero and has small standard error, indicating that firms paying bonus do not smooth employment more[23]. In column (5) and (6) I omit firms with more than 500 workers and in the last two columns of Table 4 I define a worker as receiving bonus if she got additional elements besides the wage base last year. The results remained the same. Therefore, we can conclude that the firm-level analysis is in line with individual-level results and supports the incentive contract explanation for bonuses.

6 The expected value and volatility of growth rates

6.1 Estimation strategy

It can be argued that the probability of separation is independent from revenue shocks because workers without bonus work at firms which have a larger and less volatile growth rate. In this case, firms not paying bonuses smooth employment because their prospects are better than those of firms not paying any bonus. To test this hypothesis, I run the following regressions:

$$\Delta log(sales_{it}) = \beta_0 + \beta_1 bonus_{it} + \gamma X_{it} + \varepsilon_{it} \tag{12}$$

where the dependent variable is the growth rate of sales revenues and $bonus_{it}$ indicates whether the worker received additional compensation elements over the base wage in the reference period. X_{it} refers to the control variables while including year dummies controlling for the inflation. For a better understanding, I demean the control variables so β_0 shows the conditional growth rate of firms employing workers without paying a bonus[24]. The main coefficient of interest is β_1 showing whether workers receiving a bonus work at companies with a lower growth rate.

[23]Note: It may be possible that the labor share is larger in the production function of the bonus paying firms. That is why the interaction term max be upward biased. To rule out this possibility, I control for the share of labor with the ratio of the total wage bill and the sales revenues of the firm and interact it with changes in sales revenues. The results remained the same.

[24]Note: I demean the control variables in Equation 12 and 13.

I also estimate the conditional variance of growth rates using a method similar to White (1980). First, I predict the residuals $\hat{\varepsilon_{it}^2}$ from Equation 12 and estimate the following equation:

$$\hat{\varepsilon_{it}^2} = \kappa_0 + \kappa_1 bonus_{it} + \lambda X_{it} + \nu_{it} \tag{13}$$

where the control variables are exactly the same as in Equation 12. κ_0 shows the conditional variance of the growth rate of firms employing workers without bonus payment. The most important parameter is again the coefficient of the bonus indicator. If firms pay a bonus to motivate high effort with profit sharing, we may expect that workers receiving a bonus work at companies where the conditional volatility of the growth rate is lower. As opposed to this, if firms pay a bonus to smooth their profit, it is expected that bonus receiving employees work at firms with a more volatile growth rate.

The parameter estimates for the Equation 12 are shown in the upper panel of Table 5. The most important finding is that workers receiving a bonus do not work at companies with a lower growth rate. Based on the raw difference, workers receiving a bonus work at firms which have a 1% larger growth rate than the firms of workers without a bonus. The difference disappears if we take into account firm-level control variables; the estimated coefficient is very close to zero and not significant. Based on these results, we cannot conclude that firms pay a bonus to smooth the effect of lower growth rates.

6.2 Results

The lower panel of Table 5 shows the conditional volatility of growth rates. The dependent variable is the square-residual of equations from the upper panel. The upper and lower panel feature the same control variables in their columns. According to the first column, workers not receiving a bonus work at firms where the unconditional variance of growth is approximately 4 percentage point. In contrast, in the case of workers receiving a bonus, the unconditional variance is 1 percentage point lower. The point estimates do not change significantly if we take into account the differences in firm-level characteristics. However, the difference in variance more than halves if we include every control variable. By contrast, the conditional variance of the growth rate is approximately the same in the case of both smaller and larger firms. Although the point estimates are small, they are significant in economic terms. The -0.0035 coefficient in the last two columns means that the variance of the growth rate is more then 10 percentage points lower in the case of firms employing workers with bonus payment. Having regard to the results, we can reject the hypothesis that firms pay a bonus to counterbalance the larger uncertainty in sales revenues.

7 Assessing Alternative Explanations of Bonus Payment

Screening of workers: Some theoretical models show that (Lazear 1986; 000b Park and Sturman, 2015) firms may use state-dependent contracts to screen workers but empirical results are not conclusive as to whether this type of contract attracts the most productive (Bandiera et al., ming) or the least risk-averse workers (Kandilov and Vukina, 2015). In my setup, it is possible that firms share the revenue with the workers to select the best of them but if the the volatility of sales is too large than the sales is not enough informative to differentiate between employees. However in this case the every firm should offer a menu of wages and let the worker to choose between the fixed wage and output dependent wage structure. On the contrary Figure 1shows that almost every worker of the largest firms receives bonuses. This suggests that the largest firms do not maximize profit by only offering wages with bonus payments or the main motivation of paying bonuses is not to screen workers.

Retention effect: Oyer (2004); Oyer and Schaefer (2005) show that stock options decrease turnover if the value of stock options are correlated with labor market conditions and with outside options of workers. It is possible that the output of firms with the lowest variance try to cope with outside wage offers by paying state dependent wages. This theory can explain the lower separation rates of bonus paying firms but cannot explain why the bonus receiving workers are more productive.

Managerial practices: The differences in skills of the management can be one important factor of decision about bonus payment. It is possible that high ability managers can monitor workers effort more precisely or they can more efficiently anticipate and avoid sales revenue shocks and that is why firms with better management use incentive contracts. These kind of differences in managerial practices does not contradicts the incentive contract explanation of bonus payment. On the other hand managerial practices can affect the firm level outcome on other channels as well. That is why table A-3 column 5 includes firm fixed effects to control for managerial differences which are constant over time. BesidesBloom and Van Reenen (2007); Bloom et al. (2013) showed that better management practices lead to a higher growth rate. As table5 shows the average sales growth is not larger at bonus paying firms so I conclude that differences in managerial practices which are independent from incentive contracting cannot drive the results.

Tax optimization: Oyer and Schaefer (2005) suggests that stock options may be paid partly because they are taxed at lower average rates. However, the base wage and bonuses are taxed exactly the same way, so tax optimization cannot explain bonus payments. Also, this is why personal income tax rates cannot account for the cross sectional differences in bonus payments

Wage Under-reporting: Some firms under-report wages to evade taxes in Hungary (Elek et al., 2009, 2012; Tonin, 2011). It may be possible that firms without bonuses adjust unreported wages in case of negative revenue shocks. I address this concern first by re-estimating the main results without the minimum wage earners (table A-3, column 6). This controls for wage under-reporting if a worker gets unreported wage than her wage is the lowest possible i.e. the minimum wage. In column 7 I re-estimate the model after omitting the firms having less then 100 workers because the smallest firms engage in tax evasion activities the most likely (Kleven et al., 2011)[25]. Finally, firm fixed effects also control for wage under-reporting if the wages of all workers within firms are under-reporters to the same extent. As my results are robust against these changes I conclude that not wage under-reporting helps firms to smooth employment in case of negative revenue shocks

Real vs nominal wage rigidity Firms can decrease real wages when inflation is high so nominal rigidity is an important issue only if the inflation rate is low. Therefore, I divide the sample into a time period before and after 2001. With an average 13.9 per cent, inflation before 2001 was high in Hungary , followed by a moderately low 4.8 per cent afterward. The results are shown in column (7) and (8) of Table A-3 and are very similar in both cases. The only difference between the two sub-sample is that the wages of workers without bonuses co-moves with sales revenues in the high-inflation sample only. This results is in line with Elsby (2009) as in a high-inflation environment downward nominal wage rigidity is less binding so firms are more willing to raise wages even for workers with rigid wages.

8 Conclusion

I proposed a new equilibrium search model to better understand the different explanations for bonus payments. If the main motivation for bonus payments is to smooth the wage bill without firing workers, the model predicts that bonus paying firms will be smaller, with larger variance in their sales revenues. By contrast, if firms pay bonuses to provide incentive for high worker effort, the model predicts that bonus paying firms will be larger and more productive but they will also have a lower variance in their sales revenues and lower separation rates. In the second case, the downward wage flexibility of bonus payment is only the side effect of incentive contracts. I also tested the predictions of my model using the Hungarian linked employer-employee database and found that the data support the incentive contract

[25] I cannot omit medium-size firms because in this case I would also omit almost every workers without a bonus.

explanation for bonus payments. The policy relevance of my results is that decision of firms about wage flexibility is not driven by cyclical considerations which means that the employment effects of wage rigidity are overestimated.

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Appendix

Proof of Proposition 1 It is assumed that the expected utility of workers at firm j is U_j. It is obvious that firms want to set $b_j = 0$ and $w_j = U_j$ if they do not want to incentivize workers. If they intend to incentivize workers, they have to solve the following profit maximization problem:

$$max \prod(b_j, w_j) = (1 - b_j)(p + \bar{e}) - w_j$$

such that: $(1 - b_j)(p + \bar{e}) - w_j \geq p - U_j$

$$w_j + b_j(p + \bar{e}) - b_j^2 * r * var(\varepsilon_j) - c\bar{e} \geq U_j$$

The two constraints are the incentive compatibility constraints which have to be met at optimum. The first condition states the profit per worker of firms should be at least as large in the case of incentive contracts as in the case of fixed wage contracts. The second constraint ensures that workers exerting high effort cannot have a lower utility than shirking workers.

As firms want to maximize profit, they should decrease the expected value of wages until the incentive compatibility condition of the worker allows. In this case, $b_j = c$ and $c^2 * r * var(\varepsilon_j) + c\bar{e} + U_j = w_j^e$. If this is combined with the incentive compatibility constraint of the firm, it is optimal to use incentive contracts, if and only if $\frac{\bar{e}*(1-c)}{c^2 * r} \geq var(\varepsilon_j)$.

Proof of Proposition 2 b is used to denote a firm offering an incentive contract and f for one that offers a fixed wage contract. In this case, the following inequalities apply:

$(P_b - U_b) * N(U_b, F) \geq (P_b - U_f) * N(U_f, F) \geq (P_f - U_f) * N(U_f, F) \geq (P_f - U_b) * N(U_b, F)$

The first and the third inequalities are implied by the equilibrium condition of Equation 5. The second inequality applies as $P_b \geq P_f$[26]. These inequalities imply that

$(P_b - P_f) * N(U_b, F) \geq (P_b - P_f) * N(U_f, F) \Rightarrow N(U_b, F) \geq N(U_f, F)$

As firm size is a strictly monotonous function of wages, the last inequality implies that $U_b \geq U_f$.

Proof of Proposition 3

The first order condition of the profit maximization is the following:

$$\frac{dProfit_j}{dU_j} = 0 \Rightarrow (P_j - U_j) * \frac{\partial N((F(U_j), b_j, var(\varepsilon_j))/\partial w_j}{N((F(U_j), b_j, var(\varepsilon_j))} = 1 \tag{14}$$

Using equation 14 and the fact that $\frac{\partial F(U_J)}{\partial b_j} = \frac{\partial F(U_J)}{\partial U_j} * (-2b_j r var(\varepsilon))$ we get that

$$\frac{dProfit_j}{db_j} = -4rbvar(\varepsilon_j) * N((F(U_j), b_j, var(\varepsilon_j)) \tag{15}$$

Equation 15 shows that the profit of the firm is decreasing in the profit sharing parameter. So the firms which smooth employment choose the lowest b_j which satisfies equation 9. If

[26] The equality holds if and only if $\frac{e*(1-c)}{c^2 * r} = var(\varepsilon_j)$.

the $var(\varepsilon_j)$ is small enough than equation 9 holds even if $b_j = 0$. That is why the firms with less volatile revenue can offer fixed wages but do not fire workers during recession.

Firms do not fire workers if the expected profit of revenue sharing is also larger than the expected profit of offering fixed wage and firing workers during recessions. To compute this incentive compatibility constraint I derive the expected profit of firms if they offer a fixed wage and do not smooth employment. After hiring a worker the firm have $p - U_j + \varepsilon_j$ profit with 50 percent probability and 0 otherwise. The probability that the worker get a better wage offer is $\lambda(1 - F(U_j))$ so the worker wants to stay at the firms with at next period with probability $(1 - \lambda(1 - F(U_j)) - \delta)$. The probability of a negative shock is 50 percent so the worker remains at the firm with $0.5 * (1 - \lambda(1 - F(U_j)) - \delta)$ probability. To sum up, the expected present value of a worker is

$$E(prof.|not\, smooth) = \sum_{t=0}^{\infty}(0.5*(1-\lambda(1-F(U_j))-\delta))^t*(\frac{p - U_j + \varepsilon_j}{2}) = \frac{p - U_j + \varepsilon_j}{1 + \lambda(1 - F(U_j)) + \delta} \tag{16}$$

If the firm smooths employment by revenue sharing than the expected per period profit is $P_j - U_j$. Now the firms do not want to fire workers so the the probability of remaining at the firm is $1 - \lambda(1 - F(U_j)) - \delta)$ which implies that the expected profit is :

$$E(prof.|smooth) = \sum_{t=0}^{\infty}(1 - \lambda(1 - F(U_j)) - \delta)^t * (P_j - U_j) = \frac{P_j - U_j}{\lambda(1 - F(U_j)) + \delta} \tag{17}$$

To some up the firm do not fire workers if and only if

$$\frac{p - U_j + \varepsilon_j}{1 + \lambda(1 - F(U_j)) + \delta} \leq \frac{P_j - U_j}{\lambda(1 - F(U_j)) + \delta} \tag{18}$$

After plugging in equation 9 we get the following expression:

$$rvar(\varepsilon_j)\left[b(1-b)(1+\lambda(1-F(U_j))+\delta)-b\right] \leq P_j - U_j \tag{19}$$

It is easy to see that the left hand side is increasing and the right hand side is linearly decreasing in $var(\varepsilon_j)$ so there if the variance of the individual level shocks are large enough than firms do not pay bonuses but fire workers in case of negative sales revenue shocks

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

	prob. of receiving the wage element	share of wage parts conditional on receiving			
		mean	sd	p25	p75
overtime payments	0.202	0.105	0.081	0.047	0.141
monthly bonuses and premia	0.210	0.216	0.189	0.078	0.300
occasional bonuses	0.440	0.085	0.078	0.033	0.112
allowances for special work conditions	0.387	0.124	0.094	0.054	0.175
reimbursements	0.368	0.054	0.075	0.020	0.061
total	0.778	0.221	0.182	0.082	0.312

Note: This table shows the probability of receiving additional wage elements over the base wage and the share of these in total worker compensation.

Table 2: Descriptive statistics: comparing the main characteristics of workers receiving and not receiving a bonus

	Total sample				Conditional on remaining at the firm until next May			
	no bonus	bonus	diff	t-stat	no bonus	bonus	diff	t-stat
Average wage (log)	11.25	11.64	0.4	39.22	11.21	11.64	0.4	35.30
	(0.0)	(0.00)			(0.0)	(0.00)		
Share of males	0.61	0.60	-0.01	-1.27	0.63	0.61	-0.02	-1.54
	(0.00)	(0.00)			(0.00)	(0.00)		
Years of education	10.8	10.8	-0.02	-1.04	10.8	10.8	0.03	0.98
	(0.02)	(0.01)			(0.03)	(0.01)		
Average age	38.77	39.83	1.054	9.06	39.86	40.47	0.609	3.79
	(0.10)	(0.08)			(0.15)	(0.07)		
Number of employees	216.8	550.6	333.8	17.76	198.8	562.9	364.13	15.40
	(12.7)	(17.8)			(15.83)	(19.91)		
Value added per worker (log)	7.494	7.870	0.38	15.49	7.309	7.786	0.48	15.34
	(0.022)	(0.019)			(0.027)	(0.021)		
Earnings Before Interest & Tax (Million HUF)	22511	67741	4523	4.41	12574	63638	5106	5.20
	(6851)	(1011)			(3976)	(1063)		
Share of exporting firms	0.371	0.528	0.16	15.94	0.374	0.573	0.20	14.32
	(0.007)	(0.008)			(0.011)	(0.010)		
Proportion of new entrants last year	0.194	0.124	-0.07	-24.59	0.148	0.097	-0.05	-13.75
	(0.002)	(0.001)			(0.003)	(0.001)		
Age of firms	10.11	11.17	1.05	3.92	10.33	10.97	0.64	2.18
	(0.18)	(0.25)			(0.22)	(0.25)		
Number of observations	205,871	717,831			41,722	324,307		

Note: This table shows the weighted means and standard deviations for the worker-level data in the Wage Survey. Firm-level variables show the characteristics of the employing firms.

Table 3: Main results

VARIABLES	(1)	(2)	(3)	(4)
Panel A: change in wages				
worker got bonus	0.000324	-0.000612	0.00246	0.000532
	(0.00201)	(0.00205)	(0.00209)	(0.00220)
change in sales revenues	0.0392***	0.0365***	0.0315***	0.0310***
	(0.0105)	(0.0104)	(0.0105)	(0.0110)
interaction	0.0764***	0.0748***	0.0756***	0.0798***
	(0.0114)	(0.0114)	(0.0115)	(0.0119)
Observations	382,155	382,155	376,579	256,814
R-squared	0.051	0.054	0.059	0.051
Panel B: probability of remaining at the firm next year				
worker got bonus	0.244***	0.248***	0.256***	0.241***
	(0.00512)	(0.00489)	(0.00466)	(0.00472)
change in sales revenues	-0.0440***	-0.0326**	-0.0109	-0.000225
	(0.0157)	(0.0151)	(0.0147)	(0.0146)
interaction	0.0694***	0.0620***	0.0661***	0.0442***
	(0.0189)	(0.0182)	(0.0174)	(0.0167)
year fe.	x	x	x	x
firm-level controls		x	x	x
individual-level controls			x	x
without large firms*				x
Observations	716,061	716,061	701,580	484,250
R-squared	0.033	0.043	0.062	0.067

Note: The table shows the effect of bonus payment and sales revenue changes on different outcomes. Column 1 shows the changes of sales revenue,

estimated coefficients of Equation 10. Panel A shows the effect of bonus payment and sales revenue changes on the wages of workers. Panel B shows the effect of these variables on the probability of remaining at the firm. Columns (1) to (3) differ in the control variables. Every column includes year dummies to get rid of 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 while Column (3) also controls for sex, years of education, experience, experience^2, a dummy indicator for being a new entrant and 2-digit occupation categories. In Column (4), I restrict the sample to the firms having less than 500 employees. Standard errors are clustered at firm level.

Table 4: main results - firm-level evidence

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	raw effects		conditional effects		less than 500 workers		received bonus last year	
Panel A: percentage change in wages								
Share of workers with bonus	-0.0296***	-0.0297***	-0.0378***	-0.0336***	-0.0352***	-0.0333***	-0.0469***	-0.0465***
	(0.00375)	(0.00298)	(0.00415)	(0.00324)	(0.00367)	(0.00329)	(0.00454)	(0.00292)
change in sales revenues	0.00362	0.0311**	0.000410	0.0300**	0.0132	0.0321**	0.0141	0.0389***
	(0.0182)	(0.0143)	(0.0183)	(0.0143)	(0.0149)	(0.0144)	(0.0203)	(0.0119)
interaction	0.0708***	0.0399**	0.0661***	0.0363**	0.0649***	0.0353**	0.0533**	0.0262*
	(0.0192)	(0.0170)	(0.0191)	(0.0170)	(0.0174)	(0.0173)	(0.0225)	(0.0151)
Observations	53,174	53,174	52,479	52,479	48,845	48,845	52,479	52,479
R-squared	0.054	0.032	0.060	0.039	0.048	0.038	0.063	0.042
Panel B: percentage change in employment								
Share of workers with bonus	0.00213	0.00475	0.00697	0.00324	0.00440	0.00259	0.00160	-0.00188
	(0.00423)	(0.00289)	(0.00430)	(0.00297)	(0.00390)	(0.00299)	(0.00366)	(0.00254)
change in sales revenues	0.374***	0.348***	0.358***	0.338***	0.355***	0.337***	0.340***	0.319***
	(0.0188)	(0.0129)	(0.0178)	(0.0126)	(0.0168)	(0.0127)	(0.0147)	(0.0101)
interaction	0.00484	0.000430	0.0144	-0.00165	0.00403	-0.00545	0.0398**	0.0290**
	(0.0225)	(0.0154)	(0.0212)	(0.0152)	(0.0197)	(0.0154)	(0.0188)	(0.0132)
Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Weights	Yes	No	Yes	No	Yes	No	Yes	No
Observations	53,142	53,142	52,447	52,447	48,814	48,814	52,447	52,447
R-squared	0.141	0.120	0.179	0.153	0.166	0.152	0.180	0.153

Note: The table shows the firm level estimates for Equation 10. Panel A shows the effect of bonus payment and sales revenue changes on the average wages of workers. Panel B shows the effect of these variables on the average change in employment. In Columns (1) to (6), I worker receiving bonus if she received bonus at least once during the observed periods. In Columns (5) and (6) I omit firms with less then 500 workers. In column (7) and (8), I define a worker receiving bonus if she received bonus last year. The first two columns include no controls. In Columns (3) to (8) I control for log-capital per worker and log-sales per worker, the age of the firm, 2-digit industry categories, the share of females and new entrants, average years of education, experience and year dummies to get rid of the effect of inflation. Columns (2), (4), (6) and (8) are weighted with the number of workers. Standard errors are clustered at firm level.

Table 5: Growth rate of firms

VARIABLES	(1)	(2)	(3)	(4)
Panel A: change in sales revenues				
constant	0.0501***	0.0716***	0.110***	0.0505***
	(0.00211)	(0.00314)	(0.00617)	(0.00224)
worker got bonus	0.0105***	-0.00257	-0.00121	-0.00256
	(0.00228)	(0.00233)	(0.00231)	(0.00231)
Observations	925,657	903,827	903,670	663,027
R-squared	0.076	0.098	0.100	0.079
Panel B: conditional variance of sales revenues				
constant	0.0394***	0.0329***	0.0327***	0.0367***
	(0.000568)	(0.000628)	(0.000555)	(0.00161)
worker got bonus	-0.0106***	-0.00401***	-0.00384***	-0.00348***
	(0.000650)	(0.000619)	(0.000547)	(0.000527)
year fe.	x	x	x	x
firm-level controls		x	x	x
individual-level controls			x	x
without large firms*				x
Observations	925,838	903,977	903,820	742,768
R-squared	0.009	0.062	0.065	0.053

Note: The table shows the estimated coefficients of Equation 12 and 13. Panel A shows the difference in the growth rate of firms employing workers with and without bonuses. In Panel B, the dependent variable is the square of the predicted residual of Panel A. The coefficients in panel B show the conditional variance of the growth rate of firms employing workers with and without bonuses. Columns (1) to (3) differ in the control variables. Every column includes year dummies to get rid of 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 while Column (3) also controls for sex, years of education, experience, experience^2, a dummy indicator for being a new entrant and 2-digit occupation categories. In Column (4), I restrict the sample to firms having less than 500 employees. Standard errors are clustered at firm level.

Table A-1: Heterogeneity in the wage and employment reactions of the firm

	females	males	tradeable industries	non tradable industries	white collar	blue collar
Panel A: percentage change in wages						
Share of workers with bonus	0.0114***	-0.00283	0.00118	0.00594*	0.0182***	-0.00428*
	(0.00283)	(0.00266)	(0.00282)	(0.00325)	(0.00319)	(0.00249)
change in sales revenues	0.0544***	0.0201	0.0223	0.0413***	0.0520***	0.0244**
	(0.0147)	(0.0130)	(0.0148)	(0.0153)	(0.0182)	(0.0123)
interaction	0.0475***	0.0903***	0.0914***	0.0478***	0.0322*	0.0926***
	(0.0161)	(0.0141)	(0.0160)	(0.0168)	(0.0189)	(0.0136)
Observations	149,113	227,466	227,696	136,172	148,960	227,619
R-squared	0.071	0.054	0.066	0.050	0.070	0.056
Panel B: percentage change in employment						
Share of workers with bonus	0.260***	0.253***	0.273***	0.235***	0.264***	0.253***
	(0.00674)	(0.00517)	(0.00645)	(0.00693)	(0.00556)	(0.00558)
change in sales revenues	-0.0138	-0.00795	0.0158	-0.0446**	-0.0234	-0.00458
	(0.0211)	(0.0170)	(0.0203)	(0.0220)	(0.0200)	(0.0173)
interaction	0.0820***	0.0551***	0.0411*	0.0929***	0.0774***	0.0613***
	(0.0246)	(0.0197)	(0.0230)	(0.0278)	(0.0233)	(0.0202)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	283,171	418,409	405,920	270,828	270,879	430,701
R-squared	0.066	0.061	0.056	0.071	0.068	0.062

Note: The table shows the heterogeneous effects of bonus payments. Panel A shows the effect of bonus payment and sales revenue changes on the average wages of workers. Panel B shows the effect of these variables on the probability of remaining at the firm. Every column shows the effects of bonus payments on a different sub-sample. Column (1) shows the effect of bonuses on females, column (2) on males. Column (3) restrict attention on on workers in tradeable industries and column (4) on worker in non tradeable industies. Finally column (5) shows the white collar worker and column (6) the blue collar workers. Every column includes the the full set of control variables: log-capital per worker and log-sales per worker, the age of the firm, 2-digit industry categories, sex, years of education, experience, experience^2, a dummy indicator for being a new entrant and 2-digit occupation categories and year dummies to get rid of the effect of inflation. Standard errors are clustered on the firm level.

Table A-2: Robustness to different bonus definitions

VARIABLES	(1) got bonus last year	(2) bonus>0.1 wage	(3) wage>base wage	(4) only perform. pay.	(5) non-financial remuneration
Panel A: percentage change in wages					
worker got bonus	- 0.0461***	-0.0584***	- 0.0470***	0.00502**	0.00391
	(0.00203)	(0.00159)	(0.00224)	(0.00195)	(0.00318)
change in sales revenues	0.0596***	0.0851***	0.0591***	0.0498***	0.0106
	(0.00920)	(0.00628)	(0.0101)	(0.00953)	(0.0174)
interaction	0.0500***	0.0260***	0.0484***	0.0609***	-0.00432
	(0.0105)	(0.00872)	(0.0112)	(0.0108)	(0.0179)
Observations	363,868	363,868	363,868	363,868	329,233
R-squared	0.064	0.071	0.063	0.058	0.289
Panel B: probability of remaining at the firm next year					
worker got bonus	0.0836***	0.0547***	0.0822***	0.270***	
	(0.00433)	(0.00352)	(0.00423)	(0.00485)	
change in sales revenues	0.0597***	0.0545***	0.0601***	-0.0165	
	(0.0147)	(0.0109)	(0.0150)	(0.0142)	
interaction	-0.0229	-0.0246	-0.0221	0.0843***	
	(0.0178)	(0.0156)	(0.0179)	(0.0179)	
controls	yes	yes	yes	yes	
Observations	676,748	676,748	676,748	676,748	
R-squared	0.037	0.035	0.036	0.075	

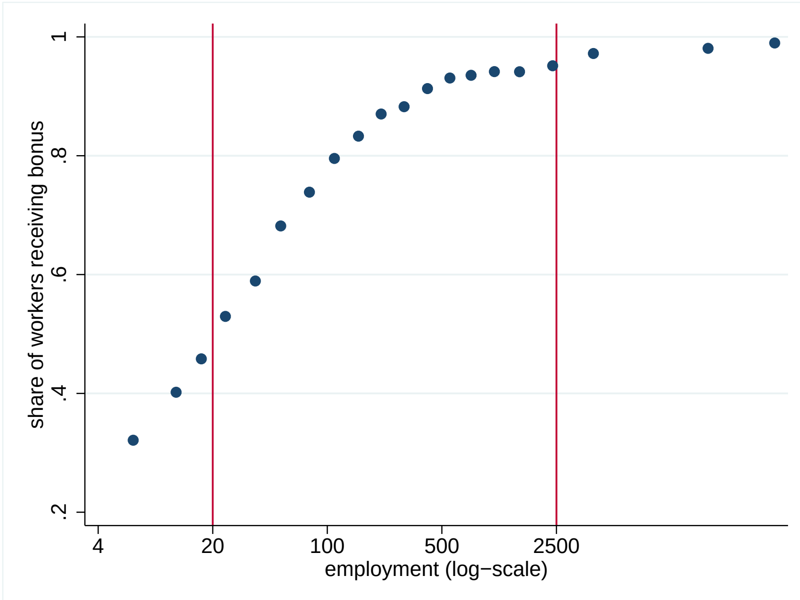
Note: The table shows the estimated coefficients of Equation 10. Panel A shows the effect of bonus payment and sales revenue changes on the wages of workers. Panel B shows the effect of these variables on the probability of remaining at the firm. columns (1) to (4) show different bonus definitions. In column (1), I define a worker as receiving a bonus if she received a bonus last year, in column (2) if the bonus part was more than 10 per cent of base wage, in column (3) if the base wage was less than the total wage and in column (5) if the worker received any performance payment except overtime payments. The dependent variable in the last column is the amount of non financial renumeration at the firm. Every column includes the the full set of control variables: log-capital per worker and log-sales per worker, the age of the firm, 2-digit industry categories, sex, years of education, experience, experience^2, a dummy indicator for being a new entrant and 2-digit occupation categories as well as year dummies to get rid of the effect of inflation. Standard errors are clustered at firm level.

Table A-3: Robustness to alternative samples

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	full sample	change in sales<30%	change in sales<20%	winsorized at 50% dlog(sales)	firm-fixed effects	above MW	# emp >100	before 2001/ high infl.	after 2001/ low infl.
Panel A: percentage change in wages									
worker got bonus	-0.00144	0.00124	0.00107	0.00253	0.00137	0.0154***	0.00893***	0.00417	-0.00521*
	(0.00184)	(0.00227)	(0.00306)	(0.00195)	(0.00317)	(0.00255)	(0.00339)	(0.00335)	(0.00281)
change in sales revenues	0.0258***	0.0575***	0.0628**	0.0316***	0.00196	0.0387***	0.0516***	0.0382***	0.0167
	(0.00852)	(0.0138)	(0.0244)	(0.00780)	(0.0132)	(0.0119)	(0.0166)	(0.0134)	(0.0162)
interaction	0.0765***	0.0444***	0.0522**	0.0716***	0.0930***	0.0703***	0.0613***	0.0763***	0.0562***
	(0.0101)	(0.0151)	(0.0245)	(0.00885)	(0.0140)	(0.0128)	(0.0176)	(0.0143)	(0.0170)
Observations	512,093	318,516	259,956	404,014	363,868	350,953	245,281	166,404	197,464
R-squared	0.059	0.052	0.047	0.058	0.136	0.062	0.069	0.028	0.022
Panel B: probability of remaining at the firm next year									
worker got bonus	0.239***	0.241***	0.243***	0.253***	0.297***	0.259***	0.298***	0.270***	0.223***
	(0.00422)	(0.00509)	(0.00566)	(0.00432)	(0.00479)	(0.00486)	(0.00743)	(0.00548)	(0.00679)
change in sales revenues	-0.0156	-0.0416*	-0.000943	0.0273***	0.00836	-0.0124	0.00766	-0.0125	-0.0125
	(0.0126)	(0.0249)	(0.0396)	(0.0106)	(0.0159)	(0.0157)	(0.0254)	(0.0194)	(0.0250)
interaction	0.0597***	0.121***	0.110**	0.0726***	0.0587***	0.0652***	0.0495*	0.0501**	0.0685**
	(0.0171)	(0.0286)	(0.0441)	(0.0139)	(0.0172)	(0.0183)	(0.0275)	(0.0232)	(0.0287)
controls	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	969,394	596,706	484,400	765,323	676,748	643,865	444,772	296,061	380,687
R-squared	0.059	0.065	0.063	0.063	0.160	0.059	0.062	0.074	0.064

Note: The table shows the estimated coefficients of Equation 10. Panel A shows the effect of bonus payment and sales revenue changes on the wages of workers. Panel B shows the effect of these variables on the probability of remaining at the firm. The first column shows includes the firms having less than 19 or more than 2500 employees. In Columns (2) and (3) I confine my attention to observations where the sales revenue of the firms changed by less than 30 and 20 per cent, respectively. Column 4 winsorize the data at 50% wage change instead of trimming. Column (5) has firm fixed effects. Column (6) omits minimum wage earners and column (6) focuses on firms having more than 100 workers. Columns (8) and (9) separate the sample by time. Every column includes the the full set of control variables: log-capital per worker and log-sales per worker, the age of the firm, 2-digit industry categories, sex, years of education, experience, experience^2, a dummy indicator for being a new entrant and 2-digit occupation categories and year dummies to get rid of the effect of inflation. Standard errors are clustered on the firm level.

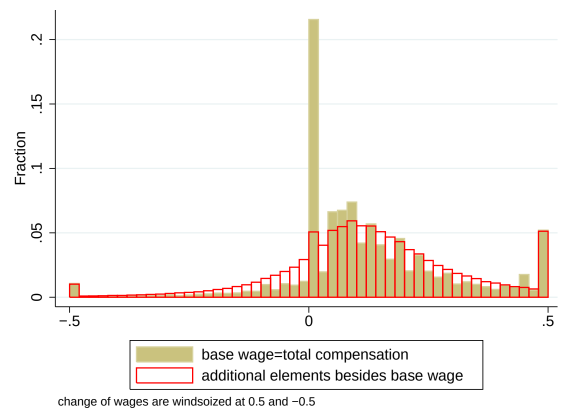
Figure 1: The share of workers receiving a bonus by the size of the firm

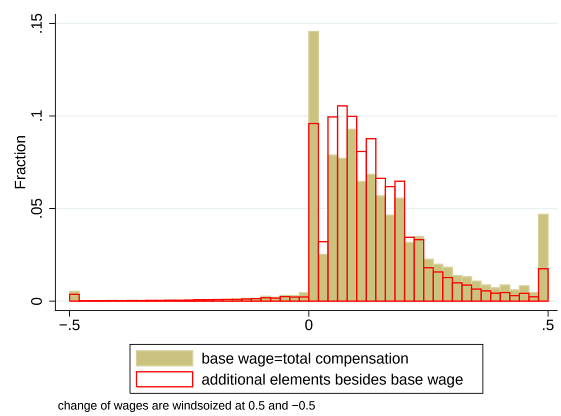


Note: In this figure, worker-year observations are grouped into 20 equally-sized categories by the size of the firm. The figure plots the share of workers receiving a bonus in every bin. The vertical lines show sample restrictions.

Figure 2: The distribution of changes in worker compensation

(a) Total worker compensation



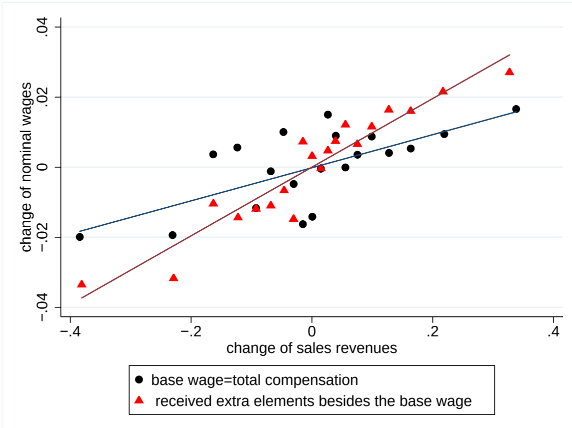


(b) Base wage

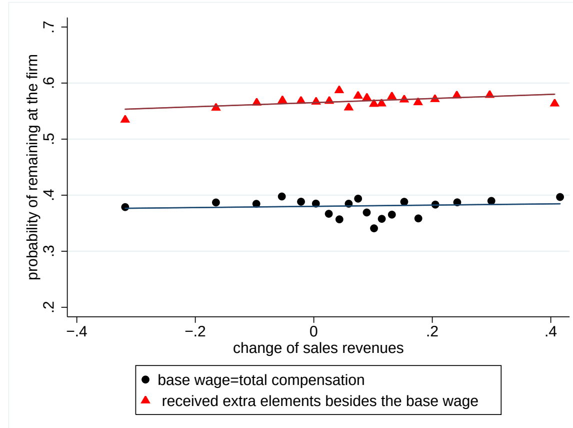
Note: The first figure shows the distribution of wage changes for workers who do and do not receive extra elements in addition to the base wage. The second panel shows the distribution of changes of the base wage for this two groups. The graphs demonstrate that base wage is nominally rigid downward although the bonus part of the wages is flexible.

Figure 3: The effect of change in sales revenues on wage and employment

(a) Wage change



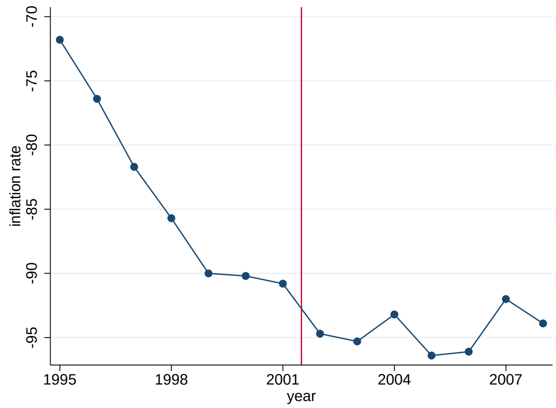
(b) Probability of remaining at the firm

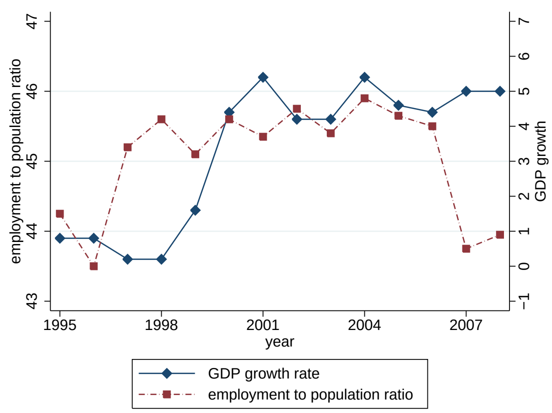


Note: In these figures, workers are grouped into equally-sized bins based on the change of the employing firm's sales revenues. Panel A shows the average change of wages for workers with and without bonuses. Panel B shows the conditional probability of remaining at the firm if the firm remained at the sample next year. Both panels control for sex, experience, experience^2, years of education, capital and sales revenues per worker, 2-digit occupation codes (ISCO 88), 2-digit industry codes (NACE) and year dummies. The wage of workers receiving a bonus co-moves with the sales revenue of firms more tightly than the wages of workers without a bonus but there is no such a difference in the probability of separations.

Figure A-1: Macroeconomic environment

(a) Inflation

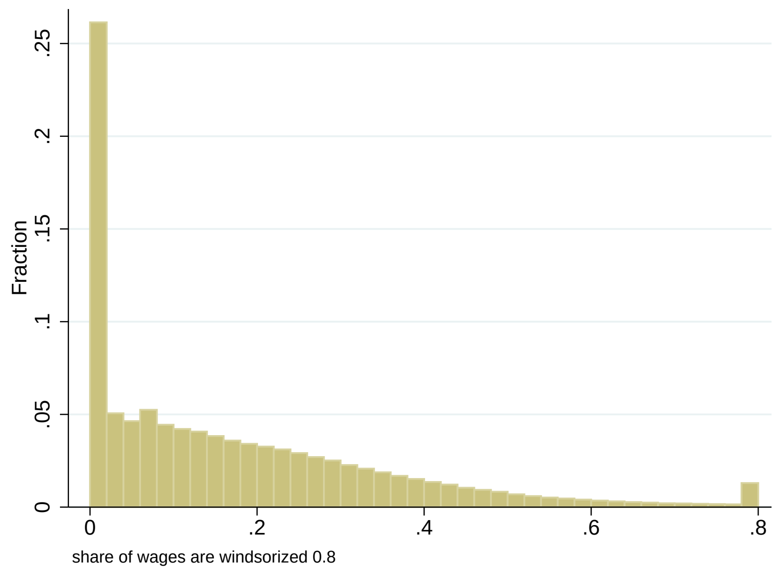




(b) GDP growth and unemployment rate

Note: Panel (a) show the annual inflation rate. I refer to the years before 2001 as the high-inflation period and the the years after 2001 as the low-inflation period in the robustness checks. Panel (b) shows that the economy was relatively stable and there was no recession during the period under scrutiny. The source of the data are the Central Bank of Hungary and the Hungarian Labor Force Survey.

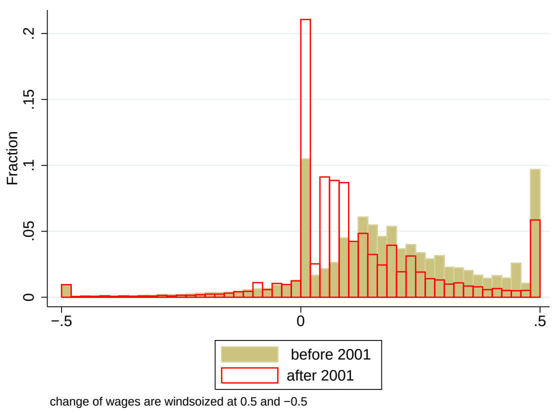
Figure A-2: The share of workers receiving a bonus by the size of the firm



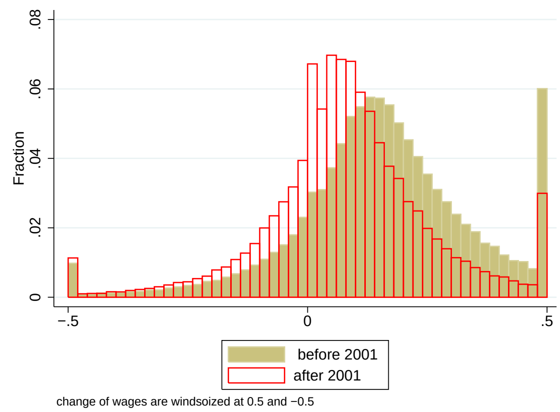
Note: This figure presents the distribution of workers by the share of additional elements in addition to the base wage.

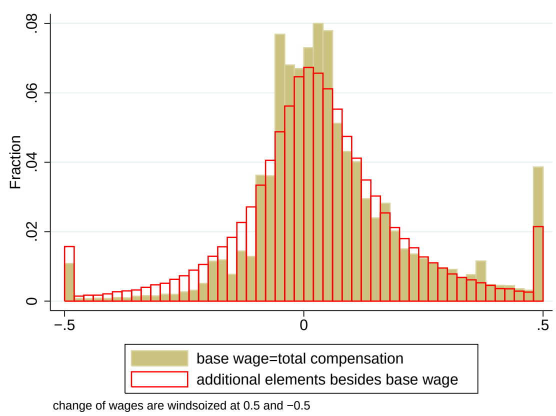
Figure A-3: The change of worker compensation and inflation

(a) workers without bonus



(b) Workers receiving bonus

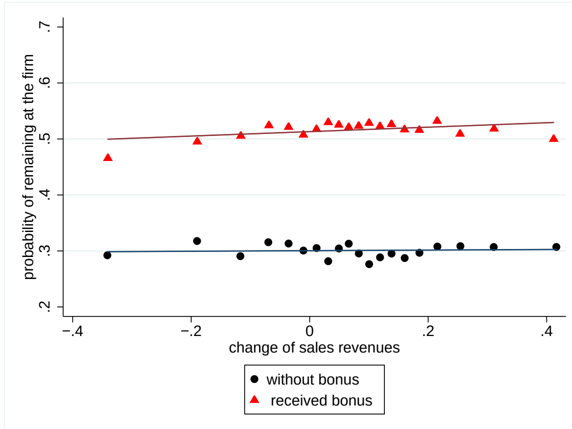




(c) The change of real wages

Note: Figure (a) show the distribution of wage changes by decade for workers who do not receive a bonus. Panel (b) shows the same for workers receiving a bonus. Changes of wages before 2001 when the inflation was higher than 10 per cent are included and Panel (b) shows the changes of wages after 2001 when the inflation was below 8 per cent. The third panel shows the distribution of changes in real wages for the two worker groups. The graphs demonstrate that only nominal wages are downward rigid.

Figure A-4: The effect of change in sales revenues on employment



Note: Workers are grouped into equally-sized bins based on the change of the employing firm's sales revenues. The graph shows the conditional probability of remaining at the firm. At this graph I consider a job to be separated if the firm is not observed in the next year. The control variables are sex, experience, experience^2, years of education, capital and sales revenues per worker, 2-digit occupation codes (ISCO 98), 2-digit industry codes (NACE) and year dummies. The graph shows that the probability of job survivor is not correlated with the change in sales revenues and the probability of job survivor is larger if the worker received bonus. .