Do Firms Pay Bonuses to Protect Jobs?*

by

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Abstract

A large share of workers receives bonus payments besides their base wage. The benefits of flexible wage components in renumeration are twofolded: 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 importance of these two factors to assess their respective importance. First, I show that bonus payments flexibly adjust to the revenue shocks of firms. At the same time, the separation rate of workers without bonuses do not react more to revenue changes than the separation rate of workers with bonuses. Bonus paying firms are shown to be financially more stable, larger and more productive, and they have less volatile revenue than firms not paying bonuses. These facts are consistent with a wage posting model with incentive contracting, but they are hard to reconcile with models emphasizing the role of bonus payments in alleviating wage rigidity. These results indicate that wage flexibility regulations may not affect the employment responses of firms to negative shocks.

JEL: J31, J42 ,M5

1   Introduction

Bonus compensations are widespread at workplaces. Recent evidence shows that half of the workers receive bonus payments in addition to their base wage in the United States (Bloom et. al. 2011). The share of workers with bonuses has increased over time both in the United States and in Western European countries (Lawler and Mohrman, 2003; Lazear and Shaw, 2008).

The causes and consequences of bonus payments are not well understood. One strand of the literature argues that bonuses are paid to incentivize workers (Holmström 1979; 1982; Card and Hyslop, 1997; Grossman and D, 1981; Levin, 2003)[1]. By linking wage compensation to output, firm owners reduce the moral hazard in their workers' effort. As a result, the total compensation of bonus receiving workers co-moves with the changes in revenues of firms. These models also imply that firms with less volatile revenue shocks are more likely to pay bonuses.

In other papers, bonuses are perceived as a way to cushion the effects of negative revenue shocks on employment (Weitzman, 1983; 1985; Jerger and Michaelis 1999; Koskela and Stenbacka 2006). In these models, flexible wages allow firms to react at the level of the wage margin rather than the employment margin in response to negative revenue shocks. When adjusting employment is costly, these models predict that firms with more volatile revenues are more likely to have flexible wage components.

While both of these explanations might play a role in paying bonuses, estimating their relative importance has major policy implications. If the flexibility of bonuses leads to lower separation rates in case of negative revenue shocks then public policies subsidizing bonus payments can "grease the wheels" and decrease frictional unemployment when inflation is low (Tobin, 1972; Weitzman, 1987). By contrast, if bonus payments do not protect jobs, such policies are unlikely to impact the level of employment.

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[1] Field experiments showed also that the productivity of workers significantly increases after the introduction of output-based compensation (Lazear, 000a; Shearer, 2004; Bandiera et al., 2005).

In this paper, I distinguish these two explanations by exploiting a unique linked employer-employee database that contains detailed worker-level information on the structure of earnings (and bonus payments) and also firm-level income statement information. These data allow me to estimate employment and wage responses to idiosyncratic revenue shocks, and to test whether these responses are different for workers with and without bonuses. First, I demonstrate that bonus payments are flexibly adjusted to firm-level revenue shocks, while base wages are more rigid. Second, I show that workers with bonuses are not more likely to keep their job in response to negative revenue shocks compared to fixed-wage workers. This reduced-form evidence indicates that while bonuses make wages more flexible, the flexibility of bonus payments does not protect jobs in case of negative revenue shocks.

Still, the incidence of bonus payments is not random but an endogenous decision of firms. To incorporate the choice of firms on pay structure into my analysis, I develop a tractable wage posting model that distinguishes formally between the consequences of wage flexibility and the incentive contract explanation for bonus payments. I build on the standard wage posting model of Manning (2003; 2004) that examines optimal wage setting in an equilibrium framework. In this model, firms offering a higher wage are able to fill their jobs more quickly, but they earn less profit per worker. In equilibrium, wages are determined by the level of unemployment, the (exogenous) job separation rate and the productivity of firms.

In the standard wage posting model, firms are restricted to offer fixed-wage contracts. To analyze bonus payments, I extend the model in two directions. First, I capture the incentivizing effect of bonuses by assuming that the effort of workers is unobserved. Accordingly, as in the hidden action model of Hölmstrom (1979), firms make inferences about the effort of workers by observing the actual output (total revenue). However, the more volatile the revenue shocks are, the harder it is to draw such an inference, and if the revenue is too noisy, firms simply opt for a fixed-wage contract. In the model, firms (exogenously) differ in the volatility of revenue shocks which also explains why some firms choose to pay bonuses, while others do not.

The second extension to the model introduces endogenous job separation by allowing firms to fire workers. A temporary negative shock in revenue pushes firms to reduce employment at least temporarily. However, laying off employees is costly, because finding a worker later takes time. Therefore, firms will keep their workers even if their marginal product is somewhat lower than their actual wage. While flexible wages allow firms to adjust wages to the marginal product of labor, and so reduce employment fluctuations, they also create fluctuations in wages that workers dislike. Again, the volatility of revenue plays a crucial role in determining whether bonus payments are optimal. When volatility is low, fixed wages are offered and firms do not react to temporary revenue shocks. For medium-sized shocks, bonus payments are provided, and as a result, employment fluctuations are attenuated relative to the fixed contract arrangement. Finally, for very high volatility in revenue, a fixed-wage contract is chosen and firms respond to negative shocks at the level of the employment margin.

While both hidden action and endogenous job separation can explain why some firms pay bonuses while others do not, they have radically different predictions for the type of firms paying bonuses. The incentive contract model predicts that firms with bonuses have less volatility in revenue, they are more productive and are larger in general. By contrast, endogenous job separation anticipates that firms with bonuses will be smaller and predicts an inverted U-shape relationship between bonus payments and revenue volatility.

I compare these theoretical predictions with the pattern of bonus payments in Hungary. My empirical results are in line with the incentive contract explanation. Bonus paying firms are more productive, and they have more employees and less volatile growth rates than firms without bonuses. The relationship between the prevalence of bonus payments and revenue volatility is strictly decreasing in contrast to the non-monotonic relationship implied by the endogenous separation model. Bonus paying firms adjust wages more but they do not smooth employment more in the event of negative revenue shocks. This observation, again, is very hard to reconcile with the endogenous job separation proposed above.

I also carry out several robustness checks of the empirical findings. Using a broad set of

control variables and alternative sample selections barely affects the point estimates. The results are also robust to changing the definition of bonus payments. Bonuses have similar effects across the various subsamples.

At the end of the paper, I briefly discuss alternative explanations for bonus payments. First, firms may pay bonuses to screen the best workers. In this case, the optimal strategy for firms is to offer a menu of wages and let workers choose between a fixed wage and revenue sharing. However, I find that a high share of firms pay bonuses to all of their workers. Second, firms may pay bonuses mainly to cope with outside wage offers. However, in this case, it is hard to understand why bonus paying firms are more productive than firms without bonuses. Third, firms may be larger and more productive, and decide to pay bonuses because they have a more able management. I used firm-fixed effects to control for the differences in time-invariant managerial skills and the results remained the same.

This paper draws on the extensive literature on downward wage rigidity. Recent research (Card and Hyslop, 1997; Altonji and Devereux, 2000; Dickens et al., 2006; Kátay, 2011; Daly et al., 2012) provides ample evidence of downward wage rigidity in many countries and industries[2]. Bonuses, however, have been found to respond more to aggregate shocks (Oyer 2005; Messina et al. 2010; Anger 2011; Lemieux et al. 2012). My results confirm these previous findings, but also extend them by connecting the flexibility of bonus payments to firm-level revenue shocks.

In spite of its policy relevance, there is little direct evidence on the negative effect of wage rigidity on the level of employment. The only exceptions are Fehr and Goette (2005); Stokes et al. (2014) and Schoefer (2015). On the contrary, Elsby (2009) argues that firms only increase wages if they expect that the new wage level will not need to be decreased, and for this reason, downward wage rigidity does not have significant employment costs. I present an other argument for the limited relevance of wage flexibility to employment fluctuations.

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[2]The corresponding theoretical models mostly assume that wage cuts decrease the effort of workers (Akerlof, 1982; Akerlof and Yellen, 1990; Chemin and Kurmann, 2014) or that wages can be adjusted only costly (MacLeod and Malcomson, 1993; Arseneau and Chugh, 2008).

My results suggest that firms have instruments to ease the effects of negative revenue shocks and would be able to achieve wage flexibility if they wanted to, but they choose a rigid wage structure independent of cyclical considerations. Consequently, the employment cost of downward nominal wage rigidity (DNWR) may be overestimated and the main reason of unemployment in a low-inflation environment is in fact not the wage rigidity of incumbents.

My results also relate to wage posting models involving heterogeneous jobs. Postel-Vinay and Turon (2010); Robin (2011); Moscarini and Postel-Vinay (2013); Bagger et al. (2014) develop wage posting models with productivity shocks while (Pinheiro and Visschers, 2015; Jarosch, 2014) directly assume that jobs differ in the probability of separations. These papers include important predictions for separation rates and wage dynamics. My model complements these results by predicting cross-sectional differences in wage structure as well.

The paper is organized as follows: Section 2 sets forth a simple wage posting model with incentive contracts and endogenous separations. Section 3 describes the Hungarian institutional context. Section 4 introduces the database. Section 5 shows the wage adjustment and separation rates of workes with and without bonuses. Section 6 tests the implications of the model for the volatility of firm revenue. Section 7 assesses alternative explanations for bonus payment, and finally Section 8 presents the conclusions of the paper.

2   Model

In this section, I provide a theoretical framework for analyzing why firms pay bonuses and what empirically testable consequences the underlying reasons have. In Section 2.1, I introduce the wage posting model of Manning (2003; 2004) with worker-level productivity shocks. My contribution to the literature is that I describe the optimal strategy for bonus payments if bonuses have incentive effects (Section 2.2) and firms can separate workers in case of negative revenue shocks (Section 2.3).

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 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 time. The expected utility of worker i employed by firm j over her income has mean variance form $(W)^3$:

$$U(W_{ij}(e_i), e_i) = E(W_{ij}) - r * var(W_{ij}) \tag{1}$$

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 gross profit but do not observe the effort level of workers directly. The gross profit produced by one worker is expressed as follows:

$$\pi_j = p + \varepsilon_j$$

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 across workers but they have the same variance within firms. $H(var(\varepsilon_j))$ stands for the distribution of the variance of revenue

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[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 expected utility has mean variance form Bolton and Dewatripont (2005).

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

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 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:

$$\max_{w_j, b_j} E((1 - b_j) * \pi_j - w_j) * N_j(w_j, b_j) \tag{2}$$

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.

U_j is used to denote the expected utility of workers at firm j[5]. In this case, the following equality applies:

$$b_j * \pi_j - r * b_j^2 var(\varepsilon_j) = U_j \tag{3}$$

Substituting Equation 3 into 2 we get the following profit maximiziation problem:

$$\max_{U_j, b_j} E((\pi_j - r * b_j^2 var(\varepsilon_j) - U_j) * N_j(U_j, b_j) \tag{4}$$

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 utility offered by firm j.

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

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 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. 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 if firms pay bonuses to incentivize workers or if firms can fire workers in case of negative revenue shocks..

Lemma 1:

The cumulative distribution function of U_j is strictly increasing and continuous between the minimum and the maximum of U_j

Lemma 1 is equivalent with the wage posting model of Burdett and Mortensen (1998) involving heterogeneous firms if $E(\pi_j) - r * b_j^2 var(\varepsilon_j)$ denotes the productivity of firm j and U_j denotes the wage offer of the firm.

If the distribution of U_j is not strictly increasing, 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 infinitesimally 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

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[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.

[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.

different $var(\varepsilon_j)$ also offer a different utility and have a different number 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.

2.2 Bonus payment as a tool of incentive contracts

In this section, I prove that if firms cannot separate workers, the firms which can observe the 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.

$$b_j = \begin{cases} c & if \ \frac{\bar{e}*(1-c)}{c^2*r} \geq var(\varepsilon_j) \\ 0 & otherwise \end{cases} \tag{5}$$

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 workers (e) is more valuable, firms with a larger variance in their revenue 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

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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 revenue at bonus paying firms is lower than in the case of firms not paying bonuses.

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

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

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 6 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. Using the notation P_j the profit maximization problem in Equation 4 can be rewritten in the following way:

$$(P_j - U_j) * N(U_j', F) \geq (P_j - U_j') * N(U_j', F) \quad for \ any \ U_j \neq U_j' \tag{7}$$

Equation 7 suggests 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, they 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

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[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 $U_j = w_j + c(p + e) - c * r * var(\varepsilon_j)$.

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.

Proof: see Appendix

As Equation **??** 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

In this section, I derive the optimal strategy for bonus payments if firms can fire workers in case of negative revenue shocks. For the sake of simplicity, I assume that revenue sharing does not have incentive effects and the interest rate is 0. Now, suppose that firm-level revenue shocks have binary outcomes, and they take the value of $-\varepsilon_j$ or ε_j randomly with equal probability. This setup is equivalent with a simple Markov-chain process where there is a "recession" state and a "boom" state and the probability of regime change is 50 percent. 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:

$$P_j - U_j + (1 - b_j)\varepsilon_{jt} + \sum_{s=1}^{\infty}(\lambda(1 - F(U_j)) + \delta_j)^s E(P_j - U_j + (1 - b_j)\varepsilon_{j,t+s}) < 0 \qquad (8)$$

As the expected profit of firms is always positive, Equation 8 formalizes the intuition that firms want to separate workers only in a "recession" period when ε_{jt} is negative. Separation is also more likely if the variance of revenue shocks is larger. On the contrary, firms can increase their profit during recession if they apply larger revenue sharing. Since the expected value of revenue shocks in the next period is zero , the revenue sharing parameter decreases the chance of layoffs. On the other hand, larger revenue sharing decreases the utility of the worker who will therefore want to leave voluntarily with a higher probability. Similarly, firms will be more likely to fire workers 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 firms are more profitable, a 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 on the other, it decreases the probability of separations.

Using Equation 8, Proposition 3 follows:

Proposition 3

Firms with medium-size variance in their sales pay bonuses and never fire their workers. Firms with the lowest variance do not share their sales and do not fire workers either. If $var(\varepsilon_j)$ is above a certain threshold level, 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 4 show 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 $var(\varepsilon_j)$ is small enough, the expected

value of the match is positive during recession even without any profit sharing, but if $var(\varepsilon_j)$ exceeds a certain threshold then firms need to share their sales with the worker to increase the expected value of the match during recession. 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, it is not profitable to share sales because the utility cost of uncertainty is too large. In this case, firms offer a 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 revenue and a pro-cyclical separation rate or (b) lower variance in their sales revenue and an acyclical separation rate.

Proposition 4 reveals that there are two types of firms without bonuses. Firms of the first type have so large a variance in their sales revenue that they cannot counterbalance it with profit sharing. These firms fire their workers in the case of negative shocks. By contrast, 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 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 then the separation rate of firms without bonuses will have to be more negatively correlated with sales than the separation rate of firms paying bonuses. On the contrary, if every firm can smooth employment, firms without bonuses will have the lowest variance in their sales revenue. These firms will offer the highest utility to their workers and will have the highest employment numbers.

Although there may be multiple motivations behind bonus payment, we can compare the

"wage flexibility" explanation and the "incentive contract" explanation for bonus payments. 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 revenue subject to their size of employment[9]. If the most important motivation for paying bonuses is to smooth revenue shocks then the largest firms do not pay bonuses. On the contrary, bonus paying firms have a larger variance in their sales revenue 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 percent of firms adjust wages once a year. The frequency of wage changes is slightly lower in other European countries, for example, firms in the eurozone 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. Additional monetary elements over the base wage account for approximately 10 percent 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

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

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

agreements of the unions (Rigó, 2012). The share of union members is approximately 20 percent, 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 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 afterwards. As inflation greatly affects wage adjustment, I repeat my estimations on these two subsamples 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 before 2008.

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 percent 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 percent of their employees. Sample selection

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[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).

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 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 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 bins 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 subsample 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 2010 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

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[12]The sum of the base wage and other wage parts do not need to be equal to 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.

at firms with very large changes in sales revenue. More precisely, I use only observations where sales revenue of the firm changes by less than 50 percent from one year to the next. This affects approximately the largest and smallest 5 percentile of sales growth distribution.

Table 1 summarizes the descriptive statistics of the different wage elements. The first column shows that approximately 78 percent of workers receive at least one type of additional wage element 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, provided that they receive such a 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. For this reason, 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 percent 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

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[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 percent of workers changes occupation without leaving the firm. The probability of changing occupation is uncorrelated with bonus payments.

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 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 conclusion to be drawn from the right panel is that workers remaining at the firm are similar to the total sample. The only difference is that workers in this subsample 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 downward rigid, 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 a 50 percent change. The brown-filled 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 a 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 the 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 either a spike or bunching around 0. This graph suggests that wages in Hungary are only nominally rigid but not in real terms[15].The employment and wage response of firms

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

5 Employment and wage reaction of the firms

5.1 Estimation strategy

To determine the effect of bonus payments on separation rates and wage adjustment I estimate the following equation:

$$\Delta log(wage_{jit}) = \alpha_1 \Delta log(sales_{j(it)}) + \alpha_2 bonus_{ji} + \alpha_3 bonus_{ji} * \Delta log(sales_{j(it)}) + \alpha X_{jit-1} + \mu_t + \varepsilon_{it}$$

(9)

where the dependent variable is the change in the wage of worker i at firm j between year $t-1$ and t. $\Delta log(sales_{j(i,t)})$ stands for the change of the nominal sales revenue of firm j between year $t-1$ and t. This variable is the same for every worker of the firm. $Bonus_{ij}$ indicates whether worker i at firm j received extra compensation elements in addition to the base wage at least once during the observed periods. denotes the control variables while μ_t stand for year dummies to get rid of the effect of inflation. The main variable of interest is the interaction between bonuses and changes in sales revenue. If α_3 is positive, firms can adjust the wages of incumbents more by paying bonuses.

$$I(sep_{jit} = 1) = \beta_1 \Delta log(sales_{j(it)}) + \beta_2 bonus_{ji} + \beta_3 bonus_{ji} * \Delta log(sales_{j(it)}) + \beta X_{jit-1} + \mu_t + \varepsilon_{it}$$

(10)

To compute the employment response of firms, I estimate Equation 10 with a dummy variable on the left hand side denoting whether the worker of the firm is separated between year $t-1$ and t. If firms pay bonuses to decrease wage rigidity then we expect that the probability of separations at the firm co-moves with sales revenue more tightly in the case of workers without bonuses. This implies thatβ_1 is negative while β_3 is positive. In contrast, the incentive contract explanation for bonus payments suggests that the probability of separation

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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 to distinguish between the two explanations of bonus payments. The incentive contract explanation for bonus payments suggests that the expected utility of workers with bonuses is higher, so they are less likely to leave the firm, which implies that β_2 is negative. By contrast, the wage flexibility explanation suggests that bonus receiving workers have lower utility than workers with fixed wages which implies that β_2 is positive.

Individual-level estimations have two important weaknesses. First, they implicitly assume that workers are independent within firms in the sense that the wage rigidity of one worker does not affect the separation rate of other workers. In addition, 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 provides wage flexibility at 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 Equations 9 and 10 at firm level and estimate the following equations:

$$\Delta log(wage_{jt}) = \gamma_1 \Delta log(sales_{jt}) + \gamma_2 bonus_{jt-1} + \gamma_3 bonus_{jt-1} * \Delta log(sales_{jt}) + \gamma X_{jt-1} + \mu_t + \varepsilon_{it}$$
$$(11)$$

$$\Delta log(emp_{jt}) = \delta_1 \Delta log(sales_{jt}) + \delta_2 bonus_{jt-1} + \delta_3 bonus_{jt-1} * \Delta log(sales_{jt}) + \delta X_{jt-1} + \mu_t + \varepsilon_{it}$$
$$(12)$$

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 revenue between years $t-1$ and t while $bonus_{jt-1}$ denotes the share of workers receiving a

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[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).

bonus at year $t-1$. If bonus payments provide the firms additional flexibility then we expect that γ_3 is positive in 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 exogenous reasons, the output of the firms will change as well because workers are one of the production factors of firms. Still, if firms pay bonuses to smooth employment, we expect that δ_3 is negative, but if firms pay bonuses to incentivize workers, we expect that δ_3 is not negative[17].

5.2   Results

Panel A in Figure 3 shows a non-parametric estimate for Equation 9 . I grouped 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 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, their sales revenue 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 revenue and wages. This phenomenon is true independent from the structure of wages.

In contrast to wages, the probability of separation does not co-move with the change of the sales revenue 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 separations is lower if the worker receives a bonus in a given year. This contradicts the wage flexibility explanation

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

for bonus payments but 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 survival rate of jobs, which is conditional on the employing firm remaining in the Wage Survey the next year. As a firm can only participate in the Wage Survey if it had not gone bankrupt earlier, 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 survival rates of jobs regardless of the participation of the firms in the Wage Survey. In this graph, I consider a job as separated if the firm is not observed in the Wage Survey the next year. As firms do not necessary go bankrupt if they do not participate in the Wage Survey, this method underestimates the survival rate of jobs. In line with the expectations, the estimated probability of job survival dropped but the results are qualitatively similar. Survival rates are almost uncorrelated with the changes in revenue and workers without bonuses are more likely to be separated.

The point estimates for Equation 9 are shown in Panel (a) of Table 3 and the first column corresponds to Figure 3(a). The sales revenue of the firm increases by 10 percent while the wages of workers without a bonus increase by approximately 0.3-0.4 percent. Conditional and unconditional wage adjustment are approximately the same but 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 sales revenue of firms changes by 10 percent, the wages of workers receiving a bonus changes by 0.7-0.8 percent 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. Similarly, the first column shows the slope parameters of the lines in Figure 3(b). It is observable

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[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.

that the probability of separation is approximately 25 percent lower if the worker received a 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 of the incentive contract explanation for 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 revenue is very weak in the case of moderate revenue shocks. Furthermore, the separation rate of workers receiving a bonus is negatively correlated with the revenue shocks hitting firms. The estimated coefficient for the interaction term suggests that if the revenue of firms increases by 10 percent, the separation rate of workers receiving a bonus decreases by 0.6 percent 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 the same wage structure. Therefore, I re-estimate Equation 9 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 in 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 tradeable and non-tradeable sectors. As Hungary is a small open economy this separation is motivated by the assumption that the firms in tradeable sectors face more fierce competition which may affect the wage and employment adjustment of firms[20]. The point estimates are qualitatively the same in all of the subgroups.

Robustness The bonus definition I use in the main analysis is arbitrary, so Table A-2

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[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.

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

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 in the previous 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 revenue of the firm changes. 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 a 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 separation rate of workers with a bonus increased compared to workers without a bonus. The result 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 workers as receiving a bonus if the additional compensation elements over their base wage comprised at least 10 percent of their total wages (Column 2) 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. 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.

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

Accordingly, 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 non-financial remuneration does not co-move with sales revenue so firms without bonuses do not smooth employment costs by adjusting non-financial remuneration.

Table A-3 concerns robustness to changing the estimation sample. In the first column, I include 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 arbitrarily trimmed the distribution of sales revenue shocks at 50 percent. For this reason, Column (3) and Column (4) take into account revenue changes which are lower than 30 and 20 percent, 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 to decrease tax liability. In Column (6), I re-estimate Equation 9, using firm-fixed effects. The implicit assumption here is that there is no heterogeneity in wage under-reporting within firms. 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-move more tightly with the sales revenue 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 revenue of the firm. I re-estimated the model also by omitting firms with less than 100 employees because it is more like that smaller firms 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 firm-level estimations. Similarly to the individual-level analysis, the average wages received at firms not paying a bonus increase by 0.3 percent in the aftermath of a 10 percent 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 (Columns (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 percent change in sales revenue corresponds to a 0.3 percent 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 for an exogenous reason, firm output will also change as labor is one of the inputs of production[22]. On the other hand, the interaction between bonus payments and sales revenue is very close to zero and has small standard error, indicating that firms paying a bonus do not smooth employment more[23]. In Columns (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 a bonus if she got additional elements besides the wage base in the previous 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.

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[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.

[23]Note: It may be possible that the labor share is larger in the production function of bonus paying firms. That is why the interaction term may 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 revenue of the firm and interact it with changes in sales revenue. The results remained the same.

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 a 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:

$$\Delta log(sales_{j(it)}) = \lambda_0 + \lambda_1 bonus_{ji} + \lambda X_{jit} + \varepsilon_{it} \tag{13}$$

where the dependent variable is the growth rate of sales revenue and $bonus_{ij}$ indicates whether the worker received a bonus. X_{it} refers to the control variables, including year dummies . For a better understanding, I demean the control variables so λ_0 shows the conditional growth rate of firms employing workers without paying a bonus[24]. The main coefficient of interest is λ_1, showing whether workers receiving a bonus work at firms with a lower growth rate.

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 13 and estimate the following equation:

$$\hat{\varepsilon}_{it}^2 = \kappa_0 + \kappa_1 bonus_{it} + \lambda X_{it} + \nu_{it} \tag{14}$$

where the control variables are exactly the same as in Equation 13. 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 firms where the conditional volatility of the growth rate is lower. As opposed to this,

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[24]Note: I demean the control variables in Equations 13 and 14.

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.

6.2   Results

The parameter estimates for Equation 13 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 percent 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.

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 for the bonus payment dummy means that the variance of the growth rate is more than 10 percentage points lower in the case of firms employing workers with bonus payment. Based on the results, we can reject the hypothesis that firms pay a bonus to counterbalance the larger uncertainty in sales revenue.

The model with endogenous separations suggests that the relationship between the volatil-

ity of growth rates and the prevalence of bonuses is not linear. Therefore, Figure 4(a) shows the probability of receiving bonuses as a function of the volatility of growth rates. I grouped the worker-year observations into twenty bins by unconditional variance in the growth rates of the employer and plotted the share of workers receiving a bonus in every bin. In line with the incentive contract explanation of bonus payments, the probability of bonus payments is strictly decreasing with the volatility of growth rates. It is unlikely that the model with endogenous separations can explain this relationship as the model predicts that firms with very low volatility in growth rates do not pay bonuses. Figure 4(b) controls for confounding factors but the result is qualitatively unchanged.

7   Assessing alternative explanations for bonus payments

Screening of workers: Some theoretical models (Lazear 1986; 000b Park and Sturman, 2015) show that 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 volatility of sales is too large, sales are not informative enough to differentiate between employees. However, in this case, every firm should offer a menu of wages and let the worker choose between the fixed-wage and the 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 the outside options of workers. It is possible that firms with the lowest variance try to cope with outside wage offers by paying state-dependent wages. This theory can explain the lower

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separation rates of bonus paying firms but cannot explain why the bonus receiving workers are more productive.

Managerial practices: Differences in the skills of the management can be one important factor in the 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 a better management use incentive contracts. These kinds of differences in managerial practices do not contradicts the incentive contract explanation for bonus payments. On the other hand, managerial practices can affect the firm-level outcome through other channels as well. Therefore, Table A-3, Column 5 includes firm-fixed effects to control for managerial differences which are constant over time. In addition, Bloom and Van Reenen (2007); Bloom et al. (2013) showed that better management practices lead to a higher growth rate. As Table5 shows that average sales growth is not larger at bonus paying firms, I conclude that differences in managerial practices which are conditional on contract types 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 either.

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 minimum wage earners (Table A-3, Column 6). This controls for wage under-reporting, since if a worker gets unreported wage, her wage is the lowest possible, i.e. the minimum wage. In Column 7, I re-estimate the model after omitting firms having less then 100 workers because the smallest firms are the most likely to engage in tax evasion activ-

ities (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-reported to the same extent. As my results are robust against these changes, I conclude that it is not wage under-reporting that 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 wage 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 rate of 13.9 percent, inflation before 2001 was high in Hungary, followed by a moderately low 4.8 percent afterwards. The results are shown in Columns (7) and (8) of Table A-3 and are very similar in both cases. The only difference between the two subsamples is that the wages of workers without bonuses co-move with sales revenue in the high-inflation sample only. This result 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 compare the incentive contract and wage flexibility 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 a larger variance in their sales revenue. By contrast, if firms pay bonuses to provide an 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 revenue 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

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

support the incentive contract explanation for bonus payments. The policy relevance of my results is that the decision of firms about wage flexibility is unlikely to be 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 opt for $b_j = 0$ 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 that 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 profit maximization is the following:

$$\frac{dProfit_j}{dU_j} = 0 \Rightarrow (P_j - U_j) * \frac{\partial N((F(U_j), b_j, var(\varepsilon_j))/\partial w_j}{N((F(U_j), b_j, var(\varepsilon_j))} = 1 \qquad (15)$$

Using Equation 15 and the fact that $\frac{\partial F(U_J)}{\partial b_j} = \frac{\partial F(U_J)}{\partial U_j} * (-2b_j rvar(\varepsilon))$ we arrive at the following equation:

$$\frac{dProfit_j}{db_j} = -4rbvar(\varepsilon_j) * N((F(U_j), b_j, var(\varepsilon_j)) \qquad (16)$$

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

Equation 16 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 8. If the $var(\varepsilon_j)$ is small enough then Equation 8 holds even if $b_j = 0$. That is why 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 a 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 has $p - U_j + \varepsilon_j$ profit with 50 percent probability and 0 otherwise. The probability that the worker gets a better wage offer is $\lambda(1 - F(U_j))$ so the worker wants to stay at the firm in the next period with a probability of $(1 - \lambda(1 - F(U_j)) - \delta)$. 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

$$E(prof.|not\ smooth) = \sum_{t=0}^{\infty}(0.5*(1-\lambda(1-F(U_j))-\delta))^t*(\frac{p - U_j + \varepsilon_j}{2}) = \frac{p - U_j + \varepsilon_j}{1 + \lambda(1 - F(U_j)) + \delta} \tag{17}$$

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

$$E(prof.|smooth) = \sum_{t=0}^{\infty}(1 - \lambda(1 - F(U_j)) - \delta)^t * (P_j - U_j) = \frac{P_j - U_j}{\lambda(1 - F(U_j)) + \delta} \tag{18}$$

To sum up, the firm does not fire workers if and only if

$$\frac{p - U_j + \varepsilon_j}{1 + \lambda(1 - F(U_j)) + \delta} \leq \frac{P_j - U_j}{\lambda(1 - F(U_j)) + \delta} \tag{19}$$

After plugging in Equation 8, we get the following expression:

$$rvar(\varepsilon_j)\left[b(1-b)(1+\lambda(1-F(U_j))+\delta)-b\right] \leq P_j - U_j \tag{20}$$

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 if the variance of the individual level shocks are large enough then 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 | share of wage parts conditional on receiving | | | |
	the wage element	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	221,881	903,411			49,528	393,957		

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.

VARIABLES	(1)	(2)	(3)	(4)
Panel A: change in wages				
worker got bonus	0.000456	-0.000575	0.00222	0.000499
	(0.00204)	(0.00210)	(0.00213)	(0.00224)
change in sales revenue	0.0393***	0.0365***	0.0315***	0.0310***
	(0.0106)	(0.0104)	(0.0106)	(0.0111)
interaction	0.0766***	0.0752***	0.0763***	0.0796***
	(0.0115)	(0.0115)	(0.0116)	(0.0120)
Observations	379,998	379,998	374,488	254,680
R-squared	0.049	0.051	0.057	0.049
Panel B: probability of job separation				
worker got bonus	-0.244***	-0.247***	-0.255***	-0.240***
	(0.00507)	(0.00484)	(0.00461)	(0.00472)
change in sales revenue	0.0478***	0.0365**	0.0146	0.00551
	(0.0157)	(0.0152)	(0.0148)	(0.0146)
interaction	-0.0714***	-0.0638***	-0.0693***	-0.0501***
	(0.0187)	(0.0180)	(0.0173)	(0.0167)
year fe.	x	x	x	x
firm-level controls		x	x	x
individual-level controls			x	x
without large firms*				x
Observations	711,945	711,945	697,676	480,763
R-squared	0.033	0.043	0.062	0.066

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 9. 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 job separation. 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 codes (NACE) while Column (3) also controls for sex, years of education, experience, square of experience, a dummy indicator for being a new entrant and 2-digit occupation codes (ISCO 88). 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 a bonus last year	
Panel A: percentage change in wages								
Share of workers with bonus	-0.0303***	-0.0308***	-0.0386***	-0.0350***	-0.0366***	-0.0347***	-0.0464***	-0.0466***
	(0.00345)	(0.00279)	(0.00388)	(0.00305)	(0.00352)	(0.00309)	(0.00421)	(0.00278)
change in sales revenue	-0.000436	0.0260*	-0.00262	0.0256*	0.0112	0.0280**	0.0111	0.0361***
	(0.0168)	(0.0136)	(0.0169)	(0.0137)	(0.0139)	(0.0138)	(0.0187)	(0.0114)
interaction	0.0721***	0.0437***	0.0674***	0.0394**	0.0609***	0.0377**	0.0553***	0.0272*
	(0.0177)	(0.0159)	(0.0178)	(0.0160)	(0.0162)	(0.0163)	(0.0207)	(0.0143)
Observations	59,872	59,872	58,809	58,809	54,711	54,711	55,616	55,616
R-squared	0.076	0.046	0.080	0.052	0.065	0.050	0.080	0.052
Panel B: percentage change in employment								
Share of workers with bonus	0.00320	0.00599**	0.00788*	0.00431	0.00422	0.00357	0.00333	-0.000277
	(0.00395)	(0.00274)	(0.00407)	(0.00282)	(0.00368)	(0.00284)	(0.00349)	(0.00243)
change in sales revenue	0.372***	0.350***	0.360***	0.342***	0.356***	0.340***	0.345***	0.323***
	(0.0177)	(0.0123)	(0.0167)	(0.0121)	(0.0158)	(0.0122)	(0.0140)	(0.00977)
interaction	0.00649	-0.00403	0.0112	-0.00579	0.00276	-0.00883	0.0364**	0.0255**
	(0.0208)	(0.0146)	(0.0197)	(0.0144)	(0.0184)	(0.0146)	(0.0178)	(0.0126)
Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Weights	Yes	No	Yes	No	Yes	No	Yes	No
Observations	59,826	59,826	58,764	58,764	54,668	54,668	55,580	55,580
R-squared	0.146	0.122	0.176	0.149	0.163	0.148	0.180	0.152

Note: The table shows the firm level estimates for Equation 9. 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 define a worker as receiving a bonus if she received a bonus at least once during the observed periods. In Columns (5) and (6), I omit firms with less then 500 workers. In Columns (7) and (8), I define a worker receiving bonus if she received a 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.

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Table 5: Growth rate of firms

VARIABLES	(1)	(2)	(3)	(4)
Panel A: change in sales revenue				
constant	0.0454***	0.0564***	0.0556***	0.0474***
	(0.00199	(0.00222)	(0.0022)	(0.00179)
worker got bonus	0.0124***	-0.00138	-0.000363	-0.00159
	(0.00214	(0.00204)	(0.00202)	(0.00185)
Observations	1,075,581	1,049,736	1,049,586	774,539
R-squared	0.072	0.094	0.095	0.072
Panel B: conditional variance of sales revenue				
constant	0.0394***	0.0331***	0.0330***	0.0363***
	(0.000565)	(0.000564)	(0.000558)	(0.000489)
worker got bonus	-0.0101***	-0.00367***	-0.00359***	-0.00298***
	(0.000633)	(0.000542)	(0.000535)	(0.000508)
year fe.	x	x	x	x
firm-level controls		x	x	x
individual-level controls			x	x
without large firms*				x
Observations	1,075,581	1,049,736	1,049,586	774,539
R-squared	0.008	0.063	0.064	0.047

Note: The table shows the estimated coefficients of Equation 13 and 14. 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, square of experience, 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 responses 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	0.00991***	-0.00234	0.00115	0.00514	0.0169***	-0.00397
	(0.00299)	(0.00267)	(0.00286)	(0.00332)	(0.00330)	(0.00252)
change in sales revenue	0.0495***	0.0226*	0.0230	0.0402***	0.0494***	0.0252**
	(0.0151)	(0.0130)	(0.0148)	(0.0155)	(0.0183)	(0.0123)
interaction	0.0515***	0.0893***	0.0919***	0.0491***	0.0380**	0.0913***
	(0.0165)	(0.0142)	(0.0159)	(0.0172)	(0.0192)	(0.0136)
Observations	148,384	226,104	226,479	135,457	148,296	226,192
R-squared	0.066	0.053	0.064	0.046	0.068	0.053
Panel B: probability of job separation						
Share of workers with bonus	-0.258***	-0.252***	-0.271***	-0.234***	-0.262***	-0.252***
	(0.00668)	(0.00514)	(0.00642)	(0.00687)	(0.00554)	(0.00551)
change in sales revenue	0.0221	0.00908	-0.0126	0.0489**	0.0272	0.00845
	(0.0212)	(0.0170)	(0.0203)	(0.0222)	(0.0201)	(0.0174)
interaction	-0.0906***	-0.0552***	-0.0435*	-0.0972***	-0.0803***	-0.0648***
	(0.0245)	(0.0196)	(0.0229)	(0.0276)	(0.0233)	(0.0201)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	281,707	415,969	403,970	269,123	269,348	428,328
R-squared	0.065	0.061	0.056	0.070	0.067	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 subsample. Column (1) shows the effect of bonuses on females and Column (2) on males. Column (3) restricts attention on on workers in tradeable industries and Column (4) on worker in non tradeable industies. Finally, Column (5) shows white collar workers and Column (6) 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 codes (NACE), sex, years of education, experience, square of experience, a dummy indicator for being a new entrant and 2-digit occupation codes (ISCO 88) 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	-0.0467***	-0.0586***	-0.0478***	0.00487**	0.00338
	(0.00207)	(0.00163)	(0.00229)	(0.00199)	(0.00286)
change in sales revenue	0.0656***	0.0876***	0.0650***	0.0493***	0.00610
	(0.00935)	(0.00641)	(0.0103)	(0.00972)	(0.0163)
interaction	0.0433***	0.0225**	0.0420***	0.0623***	0.00687
	(0.0106)	(0.00882)	(0.0114)	(0.0109)	(0.0167)
Observations	361,936	361,936	361,936	361,936	365,616
R-squared	0.061	0.069	0.061	0.056	0.302
Panel B: probability of job separation					
worker got bonus	-0.0827***	-0.0545***	-0.0812***	-0.269***	
	(0.00431)	(0.00350)	(0.00421)	(0.00481)	
change in sales revenue	0.0574***	0.0532***	0.0582***	-0.0206	
	(0.0146)	(0.0109)	(0.0151)	(0.0142)	
interaction	0.0215	0.0246	0.0212	-0.0884***	
	(0.0177)	(0.0154)	(0.0178)	(0.0178)	
controls	yes	yes	yes	yes	
Observations	673,093	673,093	673,093	673,093	
R-squared	0.037	0.035	0.036	0.074	

Note: The table shows the estimated coefficients of Equation 9. 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 separation. 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 percent 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

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
worker got bonus	-0.00193	-4.99e-05	0.000817	0.000717	0.00137	0.0154***	0.00893***	0.00549	0.00635**
	(0.00185)	(0.00212)	(0.00228)	(0.00308)	(0.00317)	(0.00255)	(0.00339)	(0.00427)	(0.00290)
change in sales revenue	0.0265***	0.0286***	0.0590***	0.0608**	0.00196	0.0387***	0.0516***	0.0281*	0.0361**
	(0.00856)	(0.0104)	(0.0138)	(0.0245)	(0.0132)	(0.0119)	(0.0166)	(0.0156)	(0.0161)
interaction	0.0772***	0.0681***	0.0443***	0.0537**	0.0930***	0.0703***	0.0613***	0.0838***	0.0429**
	(0.0101)	(0.0111)	(0.0152)	(0.0247)	(0.0140)	(0.0128)	(0.0176)	(0.0159)	(0.0167)
Observations	517,347	364,414	321,603	262,568	363,868	350,953	245,281	167,584	196,830
R-squared	0.056	0.053	0.050	0.045	0.136	0.062	0.069	0.028	0.020

Panel B: probability of job separation

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
worker got bonus	-0.237***	-0.240***	-0.240***	-0.243***	-0.297***	-0.259***	-0.298***	-0.269***	-0.220***
	(0.00423)	(0.00466)	(0.00502)	(0.00559)	(0.00479)	(0.00486)	(0.00743)	(0.00547)	(0.00666)
change in sales revenue	0.0186	0.0303*	0.0431*	0.00427	-0.00836	0.0124	-0.00766	0.0146	0.0175
	(0.0125)	(0.0164)	(0.0249)	(0.0393)	(0.0159)	(0.0157)	(0.0254)	(0.0193)	(0.0249)
interaction	0.0636***	0.0803***	-0.118***	-0.108**	0.0587***	0.0652***	-0.0495*	-0.0531**	-0.0704**
	(0.0170)	(0.0187)	(0.0284)	(0.0437)	(0.0172)	(0.0183)	(0.0275)	(0.0231)	(0.0282)
controls	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	964,968	677,663	593,146	481,248	676,748	643,865	444,772	298,006	379,657
R-squared	0.058	0.065	0.064	0.063	0.160	0.059	0.062	0.073	0.063

Note: The table shows the estimated coefficients of Equation 9. 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 separation. The first column shows 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 percent, respectively. Column 4 winsorizes the data at a 50 percent wage change instead of trimming. Column (5) indicates firm-fixed effects. Column (6) omits minimum wage earners and Column (7) 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 codes (NACE), sex, years of education, experience, square of experience, a dummy indicator for being a new entrant, 2-digit occupation codes (ISCO 88) and year dummies to get rid of the effect of inflation. Standard errors are clustered at firm level.

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Figure 1: The share of workers receiving a bonus by the size of the firm
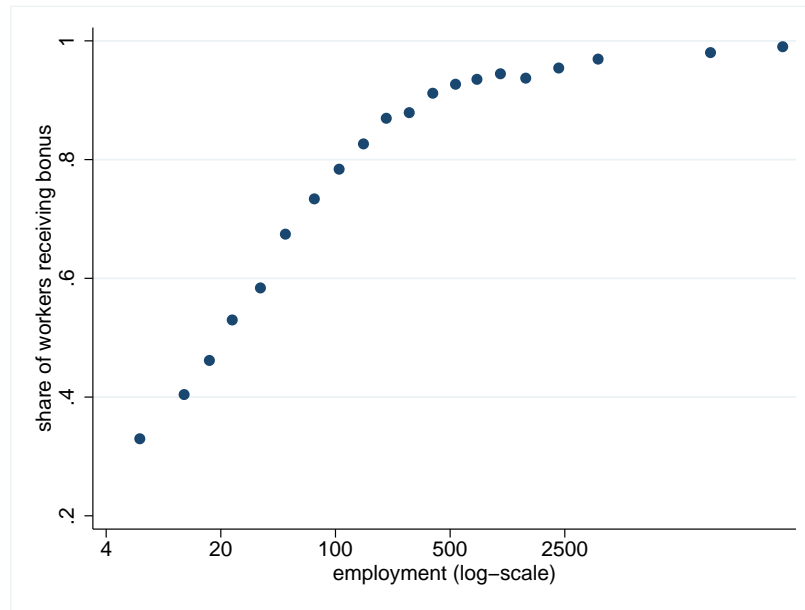
Note: In this figure, worker-year observations are grouped into 20 equally-sized categories by the size of the firm. The figure plots the share of workers receiving a bonus in every bin.

Figure 2: The distribution of changes in worker compensation

(a) Total worker compensation

change of wages are windsoized at 0.5 and −0.5

change of wages are windsoized at 0.5 and −0.5
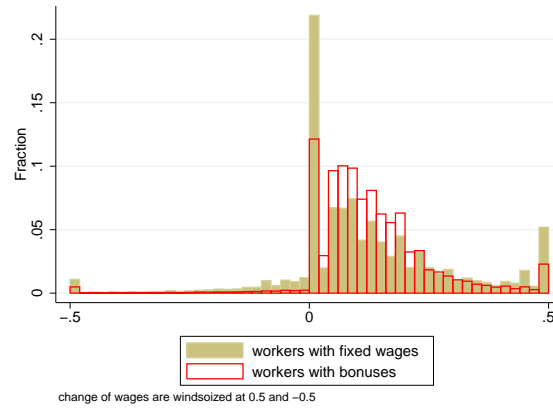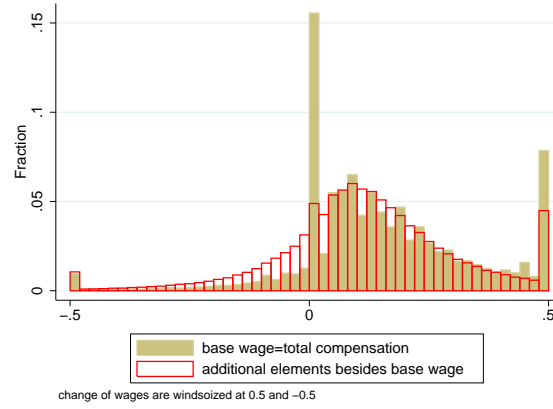
(b) Base wage

Note: Panel (a) shows the distribution of wage changes for workers who do and do not receive bonuses. Panel (b) shows the distribution of changes in base wage for both types of workers. The graphs show that workers with a fixed wage (brown-filled bars) only occasionally experience a nominal wage decline. Moreover, the large spike at zero suggests that many firms prefer to keep wages intact to decreasing them. In contrast to this, workers with bonuses (red bars) often experience a negative decline in their wages.

Figure 3: The effect of a change in sales revenue on wage and employment
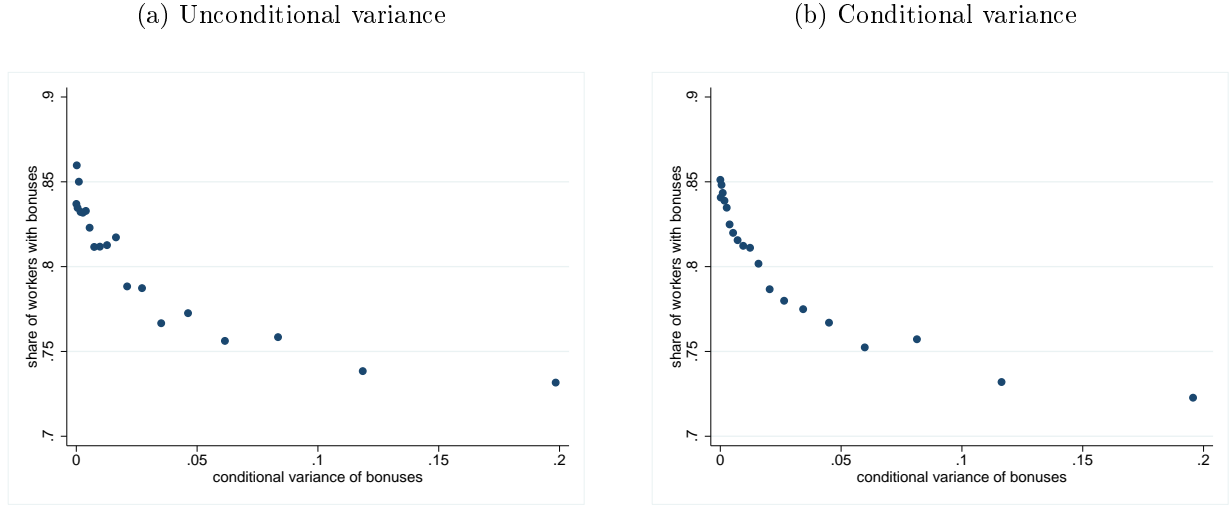
(a) Wage change
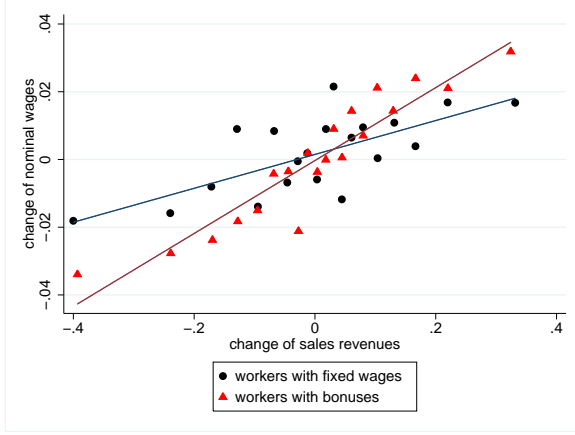
(b) Probability of job separation
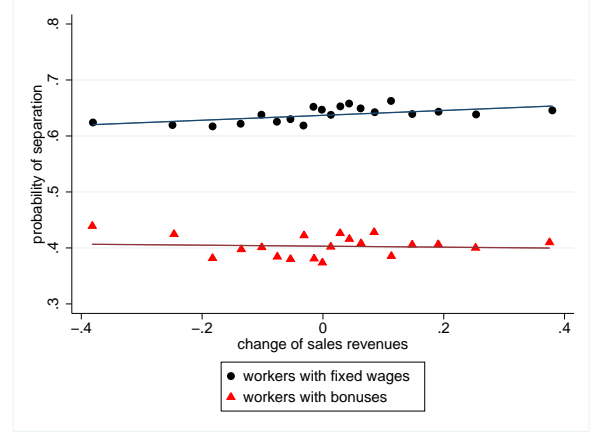
Note: In these figures, workers are grouped into equally-sized bins based on the change in the sales revenue of their firms. Panel (a) shows the average change of wages for workers with and without bonuses. Panel B shows the conditional probability of remaining at the firm if the firm remained in the sample the next year. Both panels control for sex, experience, square of experience, years of education, capital and sales revenue per worker in the base year, 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 wage of workers without a bonus, but there is no such difference in the probability of separations.

Figure 4: The relationship between bonus payments and the volatility of growth rates

(a) Unconditional variance
(b) Conditional variance

Note: In these figures, workers are grouped into equally-sized bins based on the volatility of the growth rates of their firms. The vertical axis shows the share of workers with bonuses. Panel (a) has no controls while Panel (b) controls for sex, experience, square of experience, years of education, capital and sales revenue per worker in the base year, 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 wage of workers without a bonus, but there is no such difference in the probability of separations. The figures show that workers are less likely to get bonuses if the growth rate of the firm is more volatile. See Section 6.1 for the estimation procedure.

Figure A-1: Macroeconomic environment
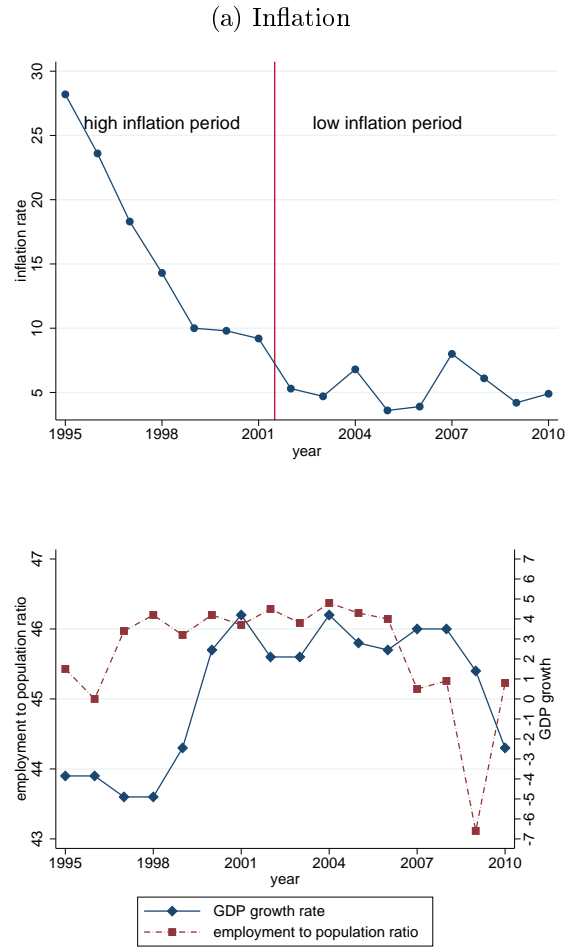
(a) Inflation

(b) GDP growth and unemployment rate

Note: Panel (a) shows the annual inflation rate. I refer to the years before 2001 as the high-inflation period and 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 bonuses over the base wage

share of wages are windsorized 0.8
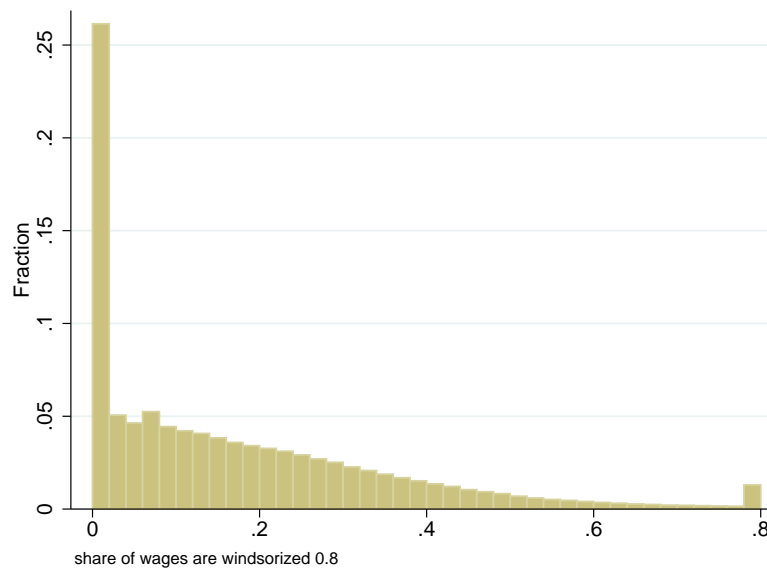
Note: This figure presents the distribution of workers by the share of bonuses over the base wage.

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

(a) workers without bonus

(b) Workers receiving bonus
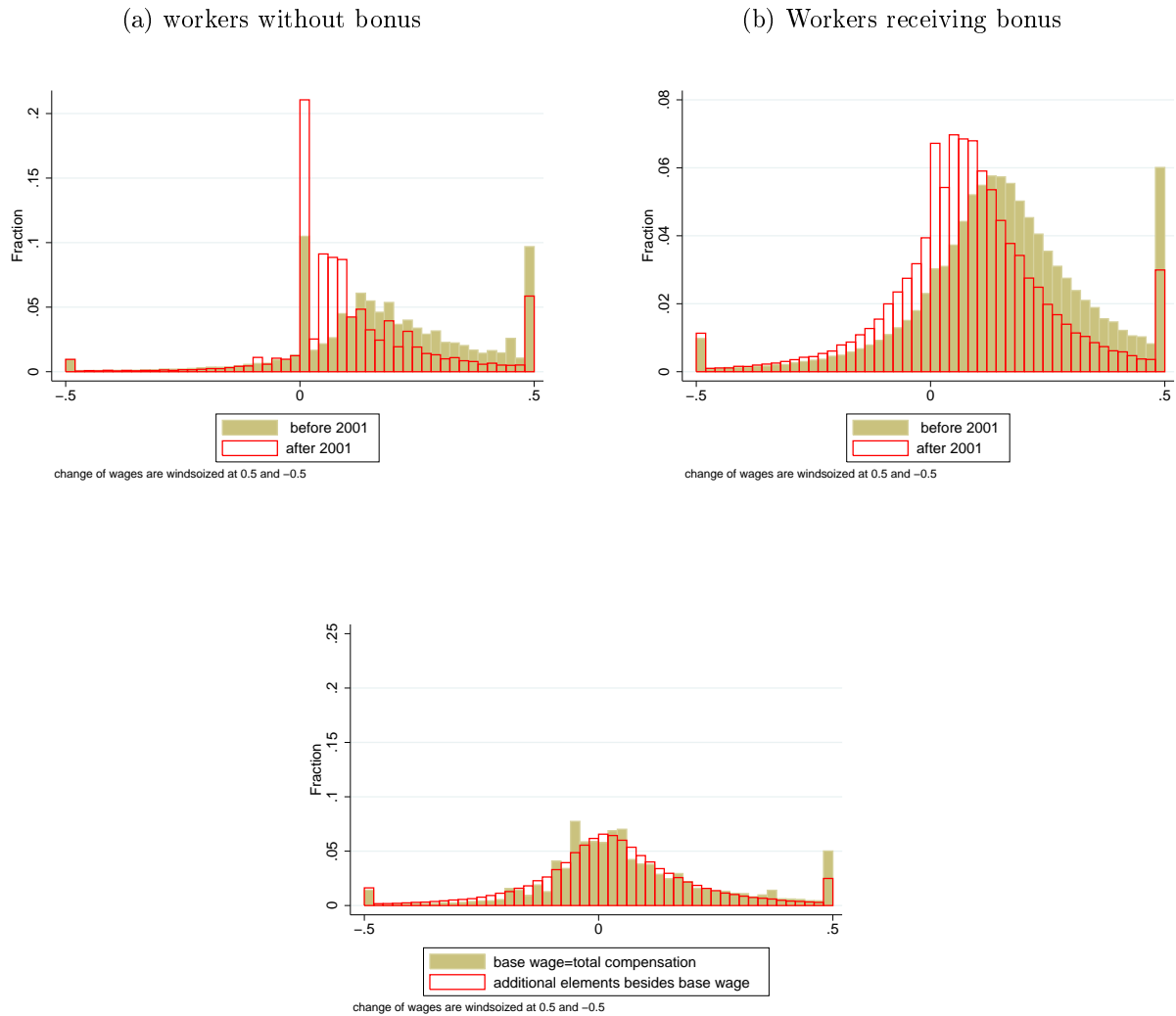
(c) The change of real wages

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 percent are included and Panel (b) shows the changes of wages after 2001 when the inflation was below 8 percent. 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: Probability of job separation
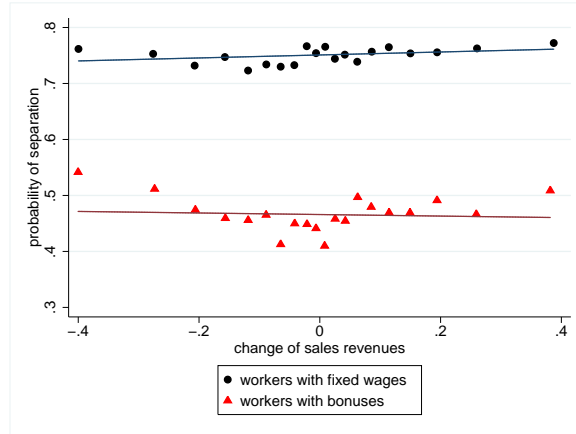
Note: Workers are grouped into equally-sized bins based on the change of the sales revenue of the firm employing them. The graph shows the conditional probability of remaining at the firm. Contrary to Figure 2, I consider a job to be separated if the firm does not participate in the Structure of Earnings Survey in the next year. The control variables are sex, experience, square of experience, years of education, capital and sales revenue per worker, 2-digit occupation codes (ISCO 98), 2-digit industry codes (NACE) and year dummies. The graph shows that the probability of job survival is not correlated with the change in sales revenueand the probability of job survival is larger if the worker received a bonus. .