Estimating Union – Non-union Wage Differential in Hungary

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Abstract

This paper estimates the wage impact of trade unions in Hungary. I use linked employer-employee panel data covering 1992 - 2005 and including information on 15,860 firms with more than 2,100 status switches of wage agreement. The data offer the opportunity to control for some forms of selection bias of firms into union status. I estimate numerous regression specifications varying the scope of the explanatory variables and the level of aggregation (firm-level vs. individual-level). In the firm-level regressions the raw wage gap of 26 percent falls to 8.9 percent after controlling for observable firm characteristics, and to 4.4 percent when including firm-level heterogeneity. The estimates on the individual-level database show a 26 percent raw wage gap, which decreases to 7 percent after controlling for individual and firm-level characteristics and to 2 percent when including firm-level unobservables.

JEL classifications: J31; J51; P30

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1. Introduction

This paper investigates the question whether wage differential between firms with and without collective contract is due to their contract status or it reflects only spurious correlation stemming from systematic differences of firms across contract status.

The impact of unions on wages is one of the most heavily studied topics in empirical labor economics. The estimated results of the union wage effects are diverse, ranging from 0.01 (Mincer (1983)) to 0.26 (Farber (2001)). A widely accepted standard result is that the average union – non-union wage gap was 15 percent in the US (Lewis, 1986).

The impact of unions on wage determination may be especially interesting in transitional countries where, after the communist regime, trade unions started to reorganize themselves and became voluntary associations. In Hungary, trade unions are decentralized, most of the bargaining takes place between the firm and its own trade union (Neumann, 2006). Unions are rather weak: cross section studies (Neumann, 2001, Kertesi-Köllő, 2003) show 5.5% union wage gain. Besides the few above papers, union wage impact has not been studied extensively in Hungary. The scant empirical evidence is probably due to the strong belief that labor unions do not play a significant role in wage determination. However, it is an interesting task to see what the availability of long time series data can add to our current knowledge about unions. Another source of motivation comes from the unresolved methodological issues centering on the unionization topic. There are still disputes over the method of estimation (OLS vs. FE), the treatment of measurement error, the level of aggregation (industry vs. firm vs. individual) and the regressors to be used. In this paper I will apply different methods to give an estimate for

the union wage gap. Comparing the different results may help us find out more about the processes influencing union status.

The paper is organized as follows. Section 2 provides an overview about Hungarian trade unions. Section 3 includes data issues, such as the description of the database and information on the cleaning of the agreement variables. Section 4 deals with the estimation method and results are shown in section 5. Finally, section 6 concludes.

2. Overview of Hungarian trade unions

2. 1. Institutional Setting

In Hungary, the wage bargaining process is characterized by the dominance of individual bargaining. Besides, firm-level collective bargaining is the most important channel of wage determination (Neumann, 2002). Collective agreements are negotiated between the management of the company and firm-level trade unions[1]. According to the Hungarian Labor Code, collective agreements are binding for all workers of the firm regardless of union membership[2]. Hence, in Hungary, similar to the continental European experience (e.g. Card and de la Rica, 2006; Hartog et al, 2002; Gürtzgen, 2006), collective bargaining coverage rather than individual membership matters in determining wages. Unions are necessary for collective bargaining, but the advantages agreed upon in

[1] Besides the small, firm-level, decentralized trade unions, there are six large trade union confederations in Hungary, which take part in the national tripartite social dialogue. However, these trade unions act only as a consultative body, forming opinions and recommendations.

[2] Wage advantages occasionally do not include the most highly paid employees. For example, the Rába joint-stock company's wage agreement in 2003 specified a wage growth of 6.5 percent (inflation was expected 5.2 percent for 2003), except for those employees whose base salary exceeds 400,000 HUF. On the other hand, the wage agreement in 2002 does not include such stipulation. Information on the Rába'a wage agreement is available at http://raba.axelero.hu/file/2003_evi_bermegallapodas.pdf and at http://raba.axelero.hu/file/2002_03.pdf.
However, the formal rules for exclusion are not clear in general and there is no reliable database on these practices.

the collective contracts apply to non-member employees as well. An obvious question is then „why do people join unions if they get the wage advantages even without being members of the union?". Visiting the websites of these local firm-level trade unions[3], one can see that they are offering extra services their members, e.g. administrative/consultative assistance, or the opportunity to use the unions' holiday houses. Other motives may be e.g. the social desire to be part of the „collective voice", the desire to improve the working conditions, or it is possible that the employer feels his job is more secure if regulated by collective agreement. According to Neumann (2002), in companies with collective agreements, on average, 40-60 percent of employees are union members.

A perhaps odd feature of Hungarian collective agreements is that in roughly 35-40 percent they do not include any regulations on wages (Neumann, 2002). A large portion of collective agreements defines rules only about the working conditions, e.g. work schedule, overtime or rest days. Moreover, collective agreements may also include a wide range of non-wage benefits, e.g. food and travel token, which we are unable to follow. However, we are able to follow the yearly number of those collective agreements, which include wage regulations (e.g. wage growth or minimum wage regulations). The subset of collective agreements including wage regulations is termed as wage agreements. Wage agreements are usually negotiated on a yearly basis[4]. It is an interesting empirical question if the wage impact of unions can be best captured by the collective agreement or

[3] E.g. http://www.molbanyasz.hu/alap.html

[4] The practice of yearly negotiations probably originates from the high-inflation years of the mid-1990's, when wages needed to be re-negotiated yearly (Neumann, 2002). Though inflation is less of a concern now, the practice of yearly negotiation is still in use today.

the wage agreement variable. In section 5, I will show wage gap estimates using both variables.

2.2. Empirical evidence about Hungarian trade unions

The Hungarian empirical evidence about the power of unions is scarce, and the existing empirical literature includes cross-sectional studies using data from 1998. Neumann (2001) investigates the wage impact using a linked database with individual and firm information. He estimates individual earning regressions with log earning as the dependent variable, includes different controls and a collective agreement dummy as independent variables. After including all possible controls, he finds a union wage impact of 5.6 percent. Kertesi-Köllő (2003) analyzes industrial wage differences. In Hungary, industrial wage differences have grown tremendously from 1986 to 1997. Firms in heavily concentrated industries managed to increase wages steadily, while firms in competitive environment encountered sizeable deterioration of wages (Kertesi-Köllő, 2003). Their conjecture is that high wages are the result of industrial rents in concentrated sectors, which are then grabbed by voluntarily organized unions in those sectors. Unionization is intensified by sizeable industry rents, and industrial wages are finally determined by concentration (determining the size of the cake) and unionization (determining the portion). Using data from 1998, the authors find evidence that the interaction of market concentration and unionization is the primary reason of the soaring industrial wages. Their estimates on the wage impact of collective agreements are similar to the one obtained by Neumann (2001).

Since by now we are equipped with a considerable long time series on collective agreement registries, it would be interesting to see how these results change. The long time series make it also possible to control for unobserved firm fixed-effects, hence, take care of some form of selection problem. Apart from these two studies, the bargaining strength of unions has not been studied in Hungary and the current study plans to contribute to filling this gap.

3. Data

3.1. Data description

Data on collective and wage agreements are recorded by the Ministry of Social Affairs and Labor. This database provides the best available data on collective contracting in Hungary, though it may suffer from union status misreporting.

Data collection about wage agreements started in 1992 under the heading of National Statistical Data Collection Program. In 1998, the Ministry of Labor extended the data collection to all collective contracts. Hence, compulsory registered collective agreements are available from 1998, though in many cases we have records for earlier years as well. The problem with both the wage and the collective agreement records is that though registration is compulsory, there is no sanctioning in case of unreported records.

The database on collective agreements includes records on the start and the end date of the collective contract. In many cases the duration of the collective contract is indefinite with no expiration date. In these cases, I assume that the collective contract has been in force since the start date. This is likely to be a good assumption, since the

ministry is continuously monitoring the validity of these indefinite contracts and modifies the agreement record if necessary. In spite of the careful monitoring it is possible that there are erroneous contract-years. Due to the fact that non-reporting is not sanctioned, misreporting is possible in the other direction as well: non-union status (i.e. no collective contract) is observed when the firm is actually a union (i.e. there is a collective contract). If we believe that the first type of misreporting (union is reported when actually non-union) is not frequent[5], then the major type of measurement error is due to nonreported collective contracts. Since compulsory registration started only in 1998, non-reporting is likely to be more frequent in the years before 1998.

In the wage agreement records, the same pieces of information are available as in the collective agreement records: identifier of the firm, start and end date of the wage contract. In many cases, the end date is not specified. Since wage agreements are usually yearly negotiated, my wage agreement dummy is specified as 1 only in the year of contracting in these cases. Hence, with the wage agreement dummy, only one type of measurement error is likely: firms that have wage agreements, but neglect reporting them.

It is unclear whether the power of unions can be best captured by the wage agreement or the collective agreement variable. Since wage agreements explicitly deal with wages, while collective agreements do not necessarily include regulations on wages, the obvious candidate to proxy the union power is the wage agreement variable. However, it is also possible that the mere presence of an organized union being able to conclude a collective contract is enough for securing higher wages than in similar non-

[5] There are several reasons to believe that "union reported when actually non-union" type misreporting is not frequent. First, never-union firms have no incentive to report, since reporting is an administrative burden requiring them to fill in official forms about the content of the agreement. Second, ever-union firms, whose collective agreement has expired and not renewed are removed from the database due to the careful monitoring of the Ministry.

contract firms. In section 5 it will be an interesting exercise to compare the wage gap estimates of both variables.

The empirical study about the wage impacts of the agreement variables can be done using a linked employer-employee dataset. The linked database consists of various information on the worker (e.g. wage, education, age, occupation) and also workplace characteristics. It includes theoretically all firms with double-entry bookkeeping with at least 20 employees. Within firms, employees are sampled: on average, 6.5 percent of production workers and 10 percent of non-production workers got into the sample[6]. The database follows firms over time, but individuals do not have a consistent identifier through the years. Due to the linked feature of the database, wage gap estimates can be obtained by using individual-level records with the individual wage as the dependent variable. Or, alternatively, firm-level estimates can be obtained by using firm-level wage costs or the mean of individual wages as dependent variable. Thus, both individual and firm-level regressions can be estimated, however, in both cases only firm fixed effects are included.

3.2. Descriptive statistics and cleaning issues

[6] The linked dataset was compiled from the Hungarian Wage Survey and firm-level data. The Wage Survey is conducted by the Hungarian Statistical Office and consists of various information on the worker (e.g. wage, education, age, occupation) and also a few workplace characteristics. The sampling procedure of the Wage Survey is as follows. Until 1995, all firms with double-entry bookkeeping with at least 20 employees were included. After 1995, the minimum number of employees to be included in the sample was reduced to 10 and smaller firms were also surveyed randomly. Within firms, all production workers born on the 5th or the 15th of any month were questioned, and non-production workers got into the sample if born on the 5th, 15th or 25th of any month. On average, 6.5 percent of production workers and 10 percent of non-production workers got into the sample within the firms, and all firms above 20 employees are theoretically included in the database for each year. Our firm data consists of the balance sheet and income statement information of every firm with double-entry bookkeeping. To construct the linked database, the Wage Survey and the firm data were statistically matched according to correspondence in the following variables: county, detailed industry, employment and sales.

The number of agreements from the original Ministry reports is shown in Table 1. Table 2 reports the number of firm-years with and without collective agreement in the linked employer-employee database. These numbers may be different from the official numbers reported by the Ministry, since some agreement records are dropped due to missing firm or worker information. In order to avoid spurious changes in contract status, I tried to detect the most obvious possibilities to clean the agreement variables.

First, I have found 276 firm-years (125 firms) when a wage agreement was reported, while a collective agreement was not reported. Since by definition, wage agreements are also collective agreements, I have corrected the collective agreement variable in those firm-years from zero to one.

For estimation purposes, one of the most important features of the database is the number of nonunion – union and union – nonunion status switches. Identifying the union impact based on these switches can remove possible endogeneity from the data. Fortunately, the database includes 1,011 nonunion – union and 276 union – nonunion switches when using the collective agreement dummy. The similar numbers for the wage agreement variable are 1,756 and 1,508, respectively. The number of firms with "never-union" status is 29,538 and the number of firms with "always-union" status is 333 with the collective agreement variable. The same numbers are 29,728 and 32, respectively, in case of the wage agreement variable. Contract status changes more frequently in case of the wage agreement variable, since the duration of the wage agreements is one year, unless the exact year is specified in the end date record. However, frequent status changes within firms are suspicious, as they may refer to negligent data reporting. 30 percent of

the firms experience multiple collective contract status switches, while the same number for the wage agreement variable is 52 percent.

To avoid spurious changes in contract status, I cleaned the wage agreement variable in certain cases. If the wage agreement dummy takes one, zero, one values in three consecutive years and the collective agreement dummy is one in the middle year, then the wage agreement dummy is cleaned from zero to one in the middle year. In this way, I have corrected 301 firm-years (this corresponds to 262 firms). The same cleaning procedure was applied to cases with two zero values of the wage agreement variable in the middle years. Hence, cases when the wage agreement variable takes one, zero, zero, one values in four consecutive years and the collective agreement dummy is one in the middle years, are also corrected. In this way, I have cleaned 135 firm-years (this corresponds to 130 firms).

Another important step before the estimation procedure is to construct the comparison group as precisely as possible. The comparison group is clearly huge: we have 9,846 firm-years with contract status and 109,892 firm-years without contract status[7]. Hence, it is useful to investigate the union coverage in different years and in various employment and industry categories to drop categories with very low coverage.

The fact that reporting is compulsory since 1998 can be clearly seen in Table 1, since agreement numbers in the pre-1998 years are smaller. The number of agreement records in the early years is especially low, hence I decided to drop the pre-1992 years from the database. This decision was also reinforced by the Ministry during a personal meeting: it was confirmed that the agreement records before 1990 are erroneous. Since

[7] These numbers are counted when union status is defined using the collective agreement dummy. The numbers are similar in case of the wage agreement variable as well. The number of firm-years with contract status is 4,804, while the number of non-contract firm-years is 114,934.

the coverage is very low in 1990 and 1991, I also dropped those years. Non-reported cases may also exist between 1992 and 1998, however, dropping those years would result in losing substantial information. Moreover, this type of measurement error (treating union cases as non-union) probably induces only a negative bias into the estimation results, since in this case the reference category includes a mixture of union and non-union firms, which – under the assumption the union effect is positive – represents a reference category with slightly higher wages. Comparing the wages of the union-firms to the wages of this mixed reference category may result in a smaller estimated wage gap.

After dropping the pre-1992 years, I checked the coverage in various employment-size categories. The numbers in Table 3 confirm that union coverage in small firms is very low. Hence, firms with less than 20 employees are dropped from the database. Dropping these firms also eliminates the sampling differences before and after 1995.

Next, I examined the coverage of firms in the different industry categories. In the case of the collective agreement variable, coverage ranges from 2 percent to 65 percent through the different ISIC-2 categories. The coverage when using the wage agreement variable runs from 1.1 percent to 44 percent. To get rid of categories with very low coverage, I decided to drop those 2-digit ISIC categories where the collective agreement coverage is smaller than 5 percent. Table 4 presents the number of firms in the union and non-union categories after the cleaning and the sample selecting procedure. Union coverage has improved substantially, since low – covered categories were dropped. For example, in 2005, 17 percent of firms were covered by collective agreement, which accounts for almost 46 percent of employees.

An important feature of the database is the number of status switches. Table 5 provides these numbers through the years 1992 – 2005, while Table 6 gives the yearly numbers of "always-union" and "never-union" firms. The numbers are promising: we have more than 1,100 switches in case of the collective agreement variable, and more than 2,100 switches of the wage agreement variable.

4. Estimation method

The presence of unions may impact on the wages of both union and non-union workers. While the standard assumption is that unions rise (or at least do not decrease) wages in the union sector, the earnings of non-union employees may change in both directions. One possibility is that after the increase of union sector wages, employment rearranges between the two sectors. Falling employment in the union sector induces higher employment in the non-union sector, which may reduce the wages of the non-union group. The impact may be opposite if employers want to avoid morale problems among non-union employees or they want to prevent unionization. In this case, employees are willing to pay comparable wages to the one received by the similar union group[8] (Pencavel, 1991).

Hence, when considering the union wage impact, ideally, we would measure the impact on union sector wages and the impact on non-union sector wages separately. Following Pencavel (1991), the effect on the non-union group is given by:

$$n_i = \frac{W_i^n - W_i^0}{W_i^0}$$

[8] This is usually called as the "threat-effect" of unionization.

where W_i^n is the wage of i^{th} observational unit in the non-union group and W_i^0 is the wage of the same observational unit without the organization of the trade union.

Similarly, the wage impact of unions on the union group is captured by:

$$u_i = \frac{W_i^u - W_i^0}{W_i^0}$$

where W_i^u is the wage of i^{th} observational unit in the union group.

The problem with computing these ratios is that we cannot give a good estimate of W_i^0. Hence, instead, the proportional difference between the wages of the union and non-union group is used in empirical research:

$$\Delta_i = \frac{W_i^u - W_i^n}{W_i^n}$$

where W_i^u is the wage of the i^{th} observational unit in the union group, and W_i^n is what the wage would be in the non-union sector of the i^{th} observational unit.

Using this ratio it is not possible to disentangle the above described two effects, instead, a composite effect is measured. This ratio is termed as the *union wage gap* (Pencavel, 1991) and will be also used in my paper. If the gap is sufficiently low, then it can be approximated by the difference in log wages. Unfortunately, for a given observational unit *i*, either status *u* or status *n* is observed, not both. There are several methods to compute the missing counterfactual.

If the observational units are randomly assigned to union and non-union status, then the wage gap can be computed as the difference in average wages between the two categories. However, this would rarely happen as Table 3 also confirms. For example, in

Hungary, firms with contract status are systematically larger and are concentrated in certain industries.

If we believe that sorting into union – non-union status is governed by observable characteristics, then conditioning on these characteristics, the union wage gap can be estimated via OLS. The most general form of the equation to be estimated includes both individual- and firm-level regressors:

$$\ln W_{ijt} = \alpha U_{jt} + \beta X_{it} + \gamma Z_{jt} + \varepsilon_{ijt} \qquad (1)$$

In the equation above *i* stands for the individual, *j* denotes the firm and *t* the time. Hence, W_{ijt} is the earning of individual *i* working at firm *j* at time *t*. U_{jt} is 1 if firm *j* has collective/wage agreement at time *t*, X_{it} summarizes individual-level observable variables (e.g. education, experience, gender, occupation), while Z_{jt} denotes firm-level observables (e.g. size, ownership, industry).

However, if selection into union – non-union status is governed by unobservable characteristics, then omitting the unobservables among the regressors will result in biased $\hat{\alpha}$, since the impact of unobserved variables being correlated with both union status and wages will be incorporated into the union variable. Positive correlation between the unobservable variables and the union dummy results in upward biased OLS estimates, while negative correlation causes the OLS estimates downward biased. Lewis (1986) argues about positive selection, which occurs since firms have incentive to hire employees with higher skills and quality due to higher union wages. Since the researcher is not likely to be able to control for these indicators of labor quality, the estimate of α will be upward biased reflecting also the better quality of the unionized employees. Another possibility for positive selection arises if workers are compensated for

disadvantageous working conditions[9]. In this case $\hat{\alpha}$ will also reflect the wage premium for the bad working conditions.

On the other hand, Robinson (1989) suggests an example for negative selection. He focuses on the supply side of the labor market emphasizing that workers with the lowest wage (and probably with the lowest skills) have the most incentive to move into the union sector. This implies that the estimate of α will also incorporate the wage impact of the low skills, which are rarely captured by control variables.

In the presence of selection bias due to unobservables, the wage gap estimated via OLS can be regarded only as the average difference in wages between firms with and without collective contract (Farber, 2001). It is widely believed in the literature (e.g. Robinson (1989) or Hildreth (1999)) that union status is not exogenous due to the above mentioned self-selection possibilities.

Longitudinal data offer the opportunity to control for selection bias. The panel structure of the Hungarian data makes it possible to estimate equation (2) via fixed effects (FE):

$$\ln W_{ijt} = \alpha U_{jt} + \beta X_{it} + \gamma Z_{jt} + \nu_j + \varepsilon_{ijt} \qquad (2)$$

FE is a within-firm estimator using the within-firm variation of contract status for identification. Units of observations are followed over time and their changes in union status are used for identification. In case of positive self-selection, the inclusion of fixed-effects (ν_j) would lower the coefficient of the union dummy compared to the OLS estimates, while negative self-selection increases the magnitude of the OLS estimate.

[9] For example, Duncan and Stafford (1980) finds that the observed differential between the wages of union and non-union workers is compensation for certain conditions of work.

The international literature on unions provides plenty of examples with various regression specifications. First studies using individual data included only human capital controls. On the other hand, DiNardo and Lee (2004) found no wage impact using establishment-level data. Their finding is in contrary to previous US individual-level estimates using only human capital controls and reinforces the role of firm-variables in union status determination. With the increasing availability of linked employer-employee datasets, it became possible to include both human capital and firm-level variables. According to Andrews et al (1998), who give a detailed review of union wage estimates by methodological differences, including firm size among the control variables roughly halves the union wage impact.

While cross-sectional datasets do not allow for controlling unobservables, linked panel databases yield opportunity to include time-invariant unobserved variables. Card and de la Rica (2006) used linked employer-employee data from a 1995 Spanish survey and found that firm-level contracting is associated with a 5-10 percent wage premium. Since their cross-sectional dataset did not allow for identifying wage impact from exogenous differences in contract status, they tried to control for unobserved individual- and firm-level heterogeneity in an alternative way. Firm-level unobservables were captured by the predicted probability that a firm has collective contract, while individual heterogeneity was marked by the coworkers' observable skills[10]. Kang (2003) used a panel of matched employer-employee data[11] including both individual- and firm-level time invariant heterogeneity. Starting with a pooled OLS specification including only human capital controls, the author found 15.1 percent union wage gap for the whole

[10] They argue that employees with higher unobserved abilities generally have colleagues with higher average skills.
[11] The matched data is constructed from NLYSY79 and Standard and Poors COMPUSTAT.

sample. Including unobservable individual time invariant heterogeneity halved the impact, while including both individual- and firm-level heterogeneity resulted in statistically insignificant estimates. Gürtzgen (2006) studied the wage impact of collective agreements on German linked panel data and she found a 2 percent wage premium after including both firm and individual unobserved heterogeneity.

Another issue of potential interest is the level of aggregation. The comparison of individual- vs. firm-level estimates is a neglected field of an otherwise well-studied topic. With the increasing availability of individual-level micro databases, researchers tend to use individual data, however, there is no strong consensus as for the proper level of aggregation (Pencavel, 1991). Despite the increasing number of empirical papers using worker data, the ideal unit of observation is not necessarily the individual worker. As Pencavel (1991) argues bargained wages usually do not differ by all sorts of worker characteristics, they are rather base salaries, perhaps adjusted by skill and experience categories. This reasoning lends support to using firm-level data, especially if collective contracts are signed at firm level including stipulations on all employees of the firm.

In the current study, I plan to contribute to adding empirical evidence to the aggregation issue: I am running regressions on linked individual-level data and on its corresponding firm-level panel. The firm-level regressions include basically the same controls as the individual-level equations, but in the form of proportions (e.g. proportion female or the proportion of employees with university degree). Since collective agreements are contracted at firm level, the union variable is a firm-dummy in both specifications. In individual-level regressions, the dependent variable is the gross monthly earnings in May plus one-twelfth of previous year's bonuses. On the other hand,

firm-level regressions offer two candidates as dependent variable. One choice is the mean of the individual wages, while the other one is the average wage in the company computed as wage costs divided by the number of employees. One possible advantage of using average wage as the dependent variable is that averages are less sensitive to false reporting and to sampling problems than individual wages. Since the primary goal of this study is to examine if contract status has an impact on *average wages*, the aggregated firm-level regressions are also suitable for the purpose. However, distributional impacts could be inferred only from the individual regressions, but this question is left for future research.

The existing empirical literature provides numerous studies using different levels of aggregation. Industry-level data is used by Geroski and Stewart (1986), who show that estimates are very sensitive to the model specification and they conclude that the appropriate way to assess the wage impact of unions is to use individual-level data. Lewis (1986) also concludes that estimates using aggregated data yield unreliable estimates. Lewis (1986) uses US individual level data and gets cross-section estimates of 12 percent in 1967, rising to 20 percent in 1976 and falling to 14 percent in 1979. Ashenfelter (1978), using individual data, estimates a union wage gap of 12 percent in 1967, 16 percent in 1973 and 18 percent in 1975 in the US. Additionally, he finds that wage gap is inversely related to skill, laborers with highest and craftsmen with lowest wage premium. Stewart (1983) is the first to use individual-level data to study union – non-union wage differentials in the UK. He uses a sample of 5,352 full-time manual male employees surveyed in 1975. He finds a raw differential of 20.08 percent, and an average union – non-union wage differential of 7.7 percent after controlling for individual and job

characteristics. The wage premium is positively related to skill among blue-collar workers, skilled man can appropriate higher wages than unskilled man. This is in contrast to Ashenfelter's (1978) finding in the US. Most recently, the increasing availability of matched employer-employee data (e.g. Card and de la Rica, 2005; Kang, 2003; Gürtzgen, 2006) emphasizes the use of worker level databases.

5. Results

Before running the regressions, it is useful to take a careful look at the characteristics of firms with and without contract status. This information is summarized by Table 7. The "union group" has slightly "better" characteristics: the educational composition and the average experience is better, and, interestingly, the ratio of female employees is also somewhat higher. As the last row of the table shows, wages in the "union - group" are higher. However, without further empirical investigation it is not clear if higher wages reflect the more advantageous composition of the union group or the power of firm-level unions.

5.1. Individual-level results

The empirical investigation starts with estimating equation (2):

$$\ln W_{ijt} = \alpha U_{jt} + \beta X_{it} + \gamma Z_{jt} + \nu_j + \varepsilon_{ijt}$$

In the equation above U_{jt} is the collective/wage agreement dummy taking the value 1 if firm j has contract at time t. X_{it} summarizes the following individual-level control variables: education, experience, gender, occupation, Z_{jt} denotes firm- and industry-level variables: size, ownership, industry; and the variable ν_j stands for time-invariant

unobservable firm characteristics. Firm size is measured by the logarithm of average employment; the ownership control is the lagged private dummy, which is one if the firm was majority private in the previous year. Industry controls are 19 industry dummies composed of ISIC-2 categories. Besides, year dummies are added to each specification. Regressors are gradually included in the equation. First, raw wage gap is estimated including only the agreement dummy and year effects, and the final specification covers all available individual- and firm-level variables.

Regression results with the collective agreement variable are presented in Table 8. Raw wage gap is 26 percent, which falls to 20 percent when accounting for education, experience and gender controls. Including occupational controls leaves the wage differential almost unchanged. Firm controls are responsible for a large drop in the wage gap estimates: in the final specification $\hat{\alpha}$ is 3 percent and statistically significant at 5 percent level. There is a slight negative selection of firms into collective contract status along firm-level time invariant unobservables, and most of the selection occurs along observable firm variables (ownership, size, industry).

The same results when using the wage agreement variable are shown in Table 9. The raw wage gap is 26 percent, which drops to 7 percent after including all observable individual- and firm-level controls and further reduces to 2 percent when taking into account firm-level unobservables. Comparing OLS and FE estimates, we can conclude that firms are positively selected into contract status also along unobservables and most of the selection occurs along firm level observable variables.

Besides investigating the effect of the collective and wage agreement variable separately, it would be interesting to see what their joint impact is. Do wage agreements

matter once the union was able to conclude a collective agreement or simply the fact that the firm has an organized union, which is able to conclude a collective agreement, is enough to secure higher wages? The joint impact of both agreement variables are presented in Table 10. The OLS specification with the largest number of explanatory variables (4) indicates that only the presence of wage agreement has significant positive impact on wages, the impact of collective agreement becomes zero after including industry variables. However, controlling for time invariant firm heterogeneity, the impact of wage agreements also drops to zero implying that the positive impact of wage agreements in specification (4) is probably due to omitted variables being positively correlated with the union dummies. Though there is no careful documentation whether the top-wage layer of employees is excluded from the wage agreements, case studies show[12] that it may be possibly the case. Hence, the previous regressions were re-estimated on a subsample of individuals excluding managers and professionals. Results are qualitatively the same, estimated coefficients do not change almost at all.

5.2. Firm-level estimation results

Wage regressions were estimated using firm-level data as well. Firm-level data was constructed from the linked employer-employee database keeping only firm information and constructing within-firm proportions from the individual-level variables. Equation (2) reduces to the following form:

$$\ln W_{jt} = \alpha U_{jt} + \beta \overline{X}_{jt} + \gamma Z_{jt} + \nu_j + \varepsilon_{jt}$$

[12] E.g. Rába's wage agreement, see footnote 2.

W_{jt} is the average wage at firm *j* at year *t* computed as wage costs divided by the number of employees or as the mean of employees' gross monthly wages. $\overline{X}_{jt}$ consists of the mean of employees' characteristics at firm *j* at year *t* (proportion female, average experience, proportion of employees with different level of education, proportion of employees in the different occupational categories), Z_{jt} includes the same firm-level variables as equation (2) and v_j denotes time-invariant unobservable firm variables. Similarly to the individual regressions, year dummies are added. I will briefly review the results starting with the mean of individual wages as the dependent variable, which will be followed by discussing the same specifications using wage cost per employee as the dependent variable.

Tables 11 and 12 summarize the results when the union dummy is defined by the collective agreement variable. The raw wage gap is 20 percent, which reduces to 4 percent after including all possible control variables. Comparing OLS and FE estimates one can see a slight negative selection of firms into contract status along firm-level unobservables. Similar results were detected using the worker-level database as well. Tables 13 and 14 display the results when union dummy is defined by the wage agreement variable. The unconditional wage gap is 22 percent, which drops to 2.5 percent after including all control variables. Most of the selection into contract status occurs along observable firm variables, but unobservables also play a role. The wage gap is higher than the one obtained in the individual regressions in each case and is significant at 1 percent level.

The joint impact of the agreement variables are summarized by Tables 15 and 16. OLS results show that both collective and wage agreements matter. According to the final

(5) specification, unionized firms with collective agreement have 2 percent higher wages, while firms with wage agreement (by definition, wage agreements are also collective agreements) offer 5 percent higher wages than firms without collective agreement. FE results indicate similar pattern, though the magnitude of the coefficients is different. In the final specification (5) with all explanatory variables, FE results are larger than OLS estimates in case of the collective agreement dummy, while the impact of wage agreements collapses to zero. This is in line with the pattern experienced in previous specifications.

As Tables 17-22 illustrate, the same specifications with average wage (computed as wage costs per employee) show larger wage gap. The raw wage gap in case of the collective agreement variable is 23 percent, which reduces to 7 percent after including all possible controls. The pattern is similar than experienced previously: firm-level observables play the largest role in selection. In case of the wage agreement variable the raw wage gap of 26 percent drops to 4.4 percent after taking into account all controls. Selection occurs along firm-level observable and unobservable variables: large and systematically "better" firms are selected into contract status. When studying the impact of both variables jointly, the familiar pattern can be seen: firm-level observables play a large role, moreover, firms are negatively selected into collective contract status and positively selected into wage agreement status. The wage impact of collective agreements alone is 6.4 percent, while firms having also wage agreement have a wage gap of 7.6 percent.

Comparing the results with the two types of dependent variables, it is interesting to see that firm-level wage costs yield higher estimates. Firm-level wage costs are

possibly less sensitive to sampling issues and may be a better measure of firm-level average costs. In case only firm-level variables U_{jt} and Z_{jt} are included and the dependent variable is the mean of individual wages, estimates using equation (1) and weighting equation (2) with the number of employees sampled within firms are the same. However, including individual-level variables (X_{it} and $\overline{X}_{jt}$) complicates the relationship between the estimated wage impacts and is the topic of future research.

6. Conclusion

In Hungary the conventional wisdom about unions is that they are the heritage of centralized communist unions with small or no influence on wages. This paper aims to examine this statement using the best available database. Our union variable is a firm-level collective agreement dummy. Since collective agreements do not always include stipulation about wages, those collective agreements, which also include wage regulations receive special attention: the firm-level wage agreement dummy summarizes this information. The impact of firm-level collective/wage agreements are studied both on firm- and individual level databases. Our individual-level database is especially suitable to this purpose: besides providing information about the individual worker's age, gender, education, occupation, etc., it also includes information about the firm. Hence, it is possible to control for numerous individual and firm characteristics the union status may be correlated with. Since firms are followed over time in the database, besides using pooled OLS, we can check if the inclusion of unobserved time invariant firm heterogeneity changes the results.

Though most recent research tends to use individual data if available, it is not obvious if union wage gap should be estimated at firm or individual level. The fact that agreements are concluded at firm level and agreements include universal wage regulations for the whole firm (e.g. universal wage growth) justifies studying the wage impact at firm level. However, variations in wages and in individual control variables can be better exploited in the linked employer-employee database. Individual-level regressions show a smaller wage impact. After controlling for selectivity into union status along unobservable firm characteristics, the wage premium of collective and wage agreements is 2.8 and 1.8 percent, respectively. However, when estimating their impacts jointly, both coefficients become insignificant. It seems that wage agreements basically do not imply positive wage advantages compared to firms with only collective agreement, and firms with only collective agreement have an insignificant 2.3 percent wage advantage to firms without collective agreement.

Firm-level results show a statistically significant positive wage differential in each specification. After controlling for selectivity into union status along unobservable firm characteristics, the wage premium of firms with collective and wage agreement is 7 percent and 4.4 percent, respectively. However, the higher gap of firms with collective agreement may partly reflect the effect of wage agreements. A more precise estimation can be obtained if the two agreement variables are estimated jointly. In this case firms with only collective agreement have 6.4 percent higher wages, while firms having wage agreement offer on average 7.6 percent higher wages.

Summing up all the results from the different specifications, we can conclude that we were able to detect positive wage premium in firms with collective agreement, though

the result is weaker when using the individual-level database. It is the topic of future research to find out the relationship between individual- and firm-level estimates and to decide about the most proper specification.

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Table 1: Number of registered agreements in the Ministry's database

	collective agreements	wage agreements
1986	4	3
1987	4	-
1988	4	-
1989	7	2
1990	16	6
1991	32	16
1992	112	69
1993	279	138
1994	418	162
1995	525	132
1996	705	204
1997	979	324
1998	1,222	566
1999	1,264	561
2000	1,294	589
2001	1,249	537
2002	1,205	515
2003	1,173	529
2004	1,156	581
2005	1,121	400
2006	1,075	191
2007	1,032	46

Table 2: Number of firms with and without agreement in the database (before cleaning and selecting the sample)

	collective agreement		wage agreement	
	firms with contract	firms without contract	firms with contract	firms without contract
1986	2	3,241	1	3,242
1989	2	4,042		4,044
1992	44	5,415	21	5,438
1993	170	6,143	92	6,221
1994	335	7,330	113	7,552
1995	426	7,352	100	7,678
1996	564	7,274	149	7,689
1997	797	7,162	261	7,698
1998	1,016	6,902	464	7,454
1999	1,013	7,541	474	8,080
2000	1,016	9,573	475	10,114
2001	952	10,305	446	10,811
2002	846	7,015	388	7,473
2003	816	7,046	396	7,466
2004	803	7,890	431	8,262
2005	768	5,937	301	6,404

Table 3: Union coverage in the different employment-size categories in 2000

# of employees	percentage of firms with	
	collective agreement	wage agreement
<20	1.6	0.8
20-40	3.1	1.4
40-50	6.7	2.4
50-100	12.6	5.7
100-200	27.5	14.7
200-300	51.8	30.1
300-500	61.1	47.8
500-1000	76.1	48.7
>1000	81.7	61.0

Table 4: Coverage of the agreement variables (after cleaning and selecting the sample)

	collective agreement			wage agreement		
	# agreements	companies covered (%)	employees covered (%)	# agreements	companies covered (%)	employees covered (%)
1992	35	0.8	1.4	17	0.4	0.7
1993	150	3.1	7.0	77	1.6	2.7
1994	309	5.8	19.3	106	2.0	6.5
1995	394	6.8	21.6	92	1.6	3.3
1996	526	9.3	28.2	143	2.5	6.3
1997	759	13.2	46.8	275	4.8	14.5
1998	962	16.9	52.3	537	9.4	30.6
1999	965	16.0	52.4	538	8.9	39.1
2000	976	14.1	48.5	547	7.9	30.0
2001	914	13.1	46.9	509	7.3	24.7
2002	838	17.8	49.4	466	9.9	25.9
2003	813	17.6	50.4	468	10.1	32.0
2004	805	16.0	45.8	454	9.0	34.4
2005	773	17.0	45.6	298	6.6	20.1
Total (1992-2005)	9,219	12.0	35.9	4,527	5.9	18.6

Table 5: **Number of status switches in the final firm-level database**

	contract status switches			
	collective agreement variable		wage agreement variable	
	0 - 1 status switches	1 - 0 status switches	0 - 1 status switches	1 - 0 status switches
1992/1993	67	1	52	15
1993/1994	73	6	55	62
1994/1995	65	9	56	76
1995/1996	113	5	90	51
1996/1997	208	4	164	56
1997/1998	182	8	305	68
1998/1999	58	21	123	102
1999/2000	46	20	85	70
2000/2001	20	28	53	75
2001/2002	25	17	51	64
2002/2003	26	19	68	54
2003/2004	37	18	73	75
2004/2005	17	21	33	171
Total	937	177	1,208	939

Table 6: Number of firm-years without status change

	collective agreement		wage agreement	
	# of always-contract firms	# of never-contract firms	# of always-contract firms	# of never-contract firms
1992	33	3771	0	3804
1993	73	4217	1	4267
1994	147	4411	2	4479
1995	171	4748	3	4834
1996	188	4570	6	4661
1997	202	4621	13	4711
1998	224	4546	15	4649
1999	224	4922	16	5026
2000	240	5786	19	5898
2001	233	5918	25	6025
2002	229	3734	28	3830
2003	228	3689	29	3776
2004	224	4129	32	4215
2005	209	3,661	27	3,747
Total	2,625	62,723	216	63,922

Table 7: **Descriptive statistics of union and non-union firms in 2000**

mean of the variable	union status defined by			
	collective agreement variable		wage agreement variable	
	non-union	union	non-union	union
proportion of employees with primary school	0.199	0.184	0.198	0.184
proportion of employees with vocational school	0.370	0.347	0.369	0.351
proportion of employees with high school	0.317	0.348	0.319	0.342
proportion of employees with university degree	0.114	0.120	0.114	0.123
average experience of employees	22.093	24.306	22.242	24.297
proportion female	0.383	0.418	0.387	0.404
proportion blue-collar worker	0.637	0.584	0.632	0.597
proportion white-collar worker	0.363	0.416	0.368	0.403
real average wage (million HUF, in 2005 prices)	1.962	2.413	1.982	2.528

Table 8: Estimation results of individual-level regressions

Explanatory variables		OLS				FE	
		1	2	3	4	5	6
collective agreement variable		0.258**	0.206**	0.198**	0.025	0.029*	0.028*
		0.031	0.021	0.021	0.014	0.012	0.012
highest educational level	vocational school		0.121**	0.060**	0.067**	0.086**	0.086**
			0.007	0.006	0.006	0.004	0.005
	high school		0.442**	0.246**	0.218**	0.166**	0.168**
			0.011	0.011	0.007	0.006	0.006
	university		1.105**	0.719**	0.680**	0.523**	0.530**
			0.018	0.015	0.012	0.01	0.011
experience			0.023**	0.018**	0.019**	0.021**	0.021**
			0.001	0.001	0.001	0.001	0.001
experience square			-0.000**	-0.000**	-0.000**	-0.000**	-0.000**
			0	0	0	0	0
female			-0.180**	-0.173**	-0.178**	-0.156**	-0.160**
			0.007	0.007	0.008	0.003	0.003
occupational category	unskilled			-0.691**	-0.700**	-0.711**	-0.726**
				0.014	0.019	0.014	0.016
	skilled manual			-0.451**	-0.469**	-0.528**	-0.533**
				0.017	0.023	0.021	0.023
	service			-0.620**	-0.641**	-0.601**	-0.612**
				0.029	0.038	0.026	0.03
	skilled non-manual			-0.410**	-0.438**	-0.497**	-0.504**
				0.018	0.024	0.02	0.023
	associate professionals			-0.277**	-0.344**	-0.399**	-0.404**
				0.024	0.034	0.023	0.025
	professionals			-0.174**	-0.197**	-0.301**	-0.301**
				0.016	0.02	0.017	0.019
ownership (private=1)					0.099**		0.033
					0.022		0.019
employment					0.058**		0.009
					0.007		0.007
Constant		11.358**	10.843**	11.427**	11.252**	11.750**	12.199**
		0.013	0.016	0.024	0.049	0.031	0.111
Industry-year interactions		No	No	No	Yes	No	Yes
Firm-specific intercepts		No	No	No	No	Yes	Yes
Observations		1,364,398	1,364,014	1,364,014	1,203,615	1,364,014	1,203,615
R-squared		0.05	0.37	0.42	0.5	0.46	0.47

Note: The dependent variable in all specifications is gross monthly earnings in May plus one-twelfth of previous year's bonuses. The reference category for the educational level is elementary school, and the reference occupational category is managers.

Table 9: Estimation results of individual-level regressions

Explanatory variables		OLS				FE	
		1	2	3	4	5	6
wage agreement variable		0.264**	0.209**	0.203**	0.069**	0.018**	0.018**
		0.027	0.019	0.021	0.014	0.005	0.005
highest educational level	vocational school		0.120**	0.056**	0.067**	0.086**	0.086**
			0.007	0.007	0.006	0.004	0.005
	high school		0.450**	0.247**	0.217**	0.167**	0.168**
			0.012	0.012	0.007	0.006	0.006
	university		1.110**	0.715**	0.679**	0.523**	0.530**
			0.019	0.015	0.012	0.01	0.011
experience			0.023**	0.018**	0.018**	0.021**	0.021**
			0.001	0.001	0.001	0.001	0.001
experience square			-0.000**	-0.000**	-0.000**	-0.000**	-0.000**
			0	0	0	0	0
female			-0.176**	-0.171**	-0.177**	-0.156**	-0.160**
			0.007	0.008	0.008	0.003	0.003
occupational category	unskilled			-0.701**	-0.699**	-0.711**	-0.726**
				0.014	0.018	0.014	0.016
	skilled manual			-0.457**	-0.469**	-0.528**	-0.533**
				0.017	0.023	0.021	0.023
	service			-0.616**	-0.640**	-0.601**	-0.612**
				0.029	0.038	0.026	0.03
	skilled non-manual			-0.413**	-0.438**	-0.497**	-0.504**
				0.017	0.024	0.02	0.023
	associate professionals			-0.267**	-0.343**	-0.399**	-0.404**
				0.019	0.033	0.023	0.025
	professionals			-0.172**	-0.197**	-0.301**	-0.301**
				0.016	0.02	0.017	0.019
ownership (private=1)					0.102**		0.035
					0.022		0.019
employment					0.058**		0.009
					0.007		0.007
Constant		11.436**	10.894**	11.482**	11.256**	11.662**	12.202**
		0.018	0.016	0.019	0.048	0.027	0.111
Industry-year interactions		No	No	No	Yes	No	Yes
Firm-specific intercepts		No	No	No	No	Yes	Yes
Observations		1,364,398	1,364,014	1,364,014	1,203,615	1,364,014	1,203,615
R-squared		0.04	0.36	0.42	0.5	0.46	0.47

Note: The dependent variable in all specifications is gross monthly earnings in May plus one-twelfth of previous year's bonuses. The reference category for the educational level is elementary school, and the reference occupational category is managers.

Table 10: Estimation results of individual-level regressions

Explanatory variables		OLS				FE	
		1	2	3	4	5	6
collective agreement variable		0.210**	0.167**	0.159**	-0.013	0.024	0.023
		0.038	0.026	0.024	0.019	0.015	0.015
wage agreement variable		0.096**	0.076**	0.078**	0.077**	0.008	0.008
		0.032	0.022	0.022	0.019	0.008	0.008
highest educational level	vocational school		0.121**	0.059**	0.068**	0.086**	0.086**
			0.007	0.006	0.006	0.004	0.005
	high school		0.442**	0.246**	0.217**	0.166**	0.168**
			0.011	0.011	0.007	0.006	0.006
	university		1.105**	0.718**	0.679**	0.523**	0.530**
			0.018	0.015	0.012	0.01	0.011
experience			0.023**	0.018**	0.019**	0.021**	0.021**
			0.001	0.001	0.001	0.001	0.001
experience square			-0.000**	-0.000**	-0.000**	-0.000**	-0.000**
			0	0	0	0	0
female			-0.179**	-0.172**	-0.177**	-0.156**	-0.160**
			0.007	0.007	0.008	0.003	0.003
occupational category	unskilled			-0.691**	-0.700**	-0.711**	-0.726**
				0.014	0.019	0.014	0.016
	skilled manual			-0.452**	-0.470**	-0.528**	-0.533**
				0.017	0.023	0.021	0.023
	service			-0.620**	-0.640**	-0.601**	-0.612**
				0.029	0.038	0.026	0.03
	skilled non-manual			-0.411**	-0.438**	-0.497**	-0.504**
				0.018	0.024	0.02	0.023
	associate professionals			-0.275**	-0.343**	-0.399**	-0.404**
				0.023	0.033	0.023	0.025
	professionals			-0.174**	-0.197**	-0.301**	-0.301**
				0.016	0.02	0.017	0.019
ownership (private=1)					0.101**		0.033
					0.022		0.019
employment					0.059**		0.009
					0.007		0.007
Constant		11.416**	10.851**	11.435**	11.256**	11.664**	12.198**
		0.011	0.017	0.023	0.048	0.028	0.112
Industry-year interactions		No	No	No	Yes	No	Yes
Firm-specific intercepts		No	No	No	No	Yes	Yes
Observations		1,364,398	1,364,014	1,364,014	1,203,615	1,364,014	1,203,615
R-squared		0.05	0.37	0.43	0.5	0.46	0.47

Note: The dependent variable in all specifications is gross monthly earnings in May plus one-twelfth of previous year's bonuses. The reference category for the educational level is elementary school, and the reference occupational category is managers.

Table 11: Estimation results of firm-level regressions with dependent variable the mean of individual wages

Explanatory variables	OLS results				
	Eq 1	Eq 2	Eq 3	Eq 4	Eq 5
collective agreement variable	0.200**	0.149**	0.045**	0.046**	0.035**
	0.012	0.011	0.011	0.011	0.009
employment			0.088**	0.089**	0.092**
			0.004	0.004	0.003
ownership (private=1)				0.017	0.024**
				0.011	0.008
proportion of employees with vocational school (highest level of education)					0.083**
					0.01
proportion of employees with high school (highest level of education)					0.493**
					0.013
proportion of employees with university degree (highest level of education)					1.327**
					0.023
proportion female					-0.182**
					0.011
average experience					0.007**
					0
Constant	11.410**	12.081**	11.604**	11.597**	10.974**
	0.006	0.115	0.114	0.114	0.114
Industry-year interactions	No	Yes	Yes	Yes	Yes
Firm-specific intercepts	No	No	No	No	No
Observations	76,299	76,299	76,299	76,299	76,299
R-squared	0.08	0.19	0.22	0.22	0.45

Table 12: Estimation results of firm-level regressions with dependent variable the mean of individual wages

Explanatory variables	FE results			
	Eq 2	Eq 3	Eq 4	Eq 5
collective agreement variable	0.043** 0.007	0.043** 0.007	0.043** 0.007	0.042** 0.006
employment		-0.003 0.005	-0.004 0.006	0.024** 0.005
ownership (private=1)			-0.007 0.009	-0.006 0.008
proportion of employees with vocational school (highest level of education)				0.130** 0.008
proportion of employees with high school (highest level of education)				0.341** 0.01
proportion of employees with university degree (highest level of education)				0.793** 0.019
proportion female				-0.159** 0.01
average experience				0.006** 0
Constant	11.150** 0.113	11.168** 0.116	11.175** 0.116	10.801** 0.098
Industry-year interactions	Yes	Yes	Yes	Yes
Firm-specific intercepts	Yes	Yes	Yes	Yes
Observations	76,299	76,299	76,299	76,299
R-squared	0.21	0.21	0.21	0.32

Table 13: Estimation results of firm-level regressions with dependent variable the mean of individual wages

Explanatory variables	OLS results				
	Eq 1	**Eq 2**	**Eq 3**	**Eq 4**	**Eq 5**
wage agreement variable	0.224**	0.171**	0.061**	0.062**	0.047**
	0.013	0.012	0.012	0.011	0.009
employment			0.089**	0.090**	0.093**
			0.004	0.004	0.003
ownership (private=1)				0.016	0.023**
				0.011	0.008
proportion of employees with vocational school (highest level of education)					0.084**
					0.01
proportion of employees with high school (highest level of education)					0.494**
					0.013
proportion of employees with university degree (highest level of education)					1.327**
					0.023
proportion female					-0.181**
					0.011
average experience					0.007**
					0
Constant	11.410**	12.081**	11.597**	11.590**	10.967**
	0.006	0.115	0.114	0.114	0.114
Industry-year interactions	No	Yes	Yes	Yes	Yes
Firm-specific intercepts	No	No	No	No	No
Observations	76,299	76,299	76,299	76,299	76,299
R-squared	0.07	0.19	0.22	0.22	0.45

Table 14: Estimation results of firm-level regressions with dependent variable the mean of individual wages

Explanatory variables	FE results			
	Eq 2	Eq 3	Eq 4	Eq 5
wage agreement variable	0.026**	0.026**	0.027**	0.025**
	0.005	0.005	0.005	0.005
employment		-0.004	-0.004	0.023**
		0.005	0.006	0.005
ownership (private=1)			-0.005	-0.003
			0.009	0.008
ratio of employees with vocational school (highest level of education)				0.131**
				0.008
ratio of employees with high school (highest level of education)				0.341**
				0.01
ratio of employees with university degree (highest level of education)				0.794**
				0.019
ratio of female employees				-0.159**
				0.01
average experience				0.006**
				0
Constant	11.144**	11.166**	11.171**	10.797**
	0.113	0.116	0.116	0.098
Industry-specific intercepts	Yes	Yes	Yes	Yes
Firm-specific intercepts	Yes	Yes	Yes	Yes
Observations	76,299	76,299	76,299	76,299
R-squared	0.21	0.21	0.21	0.32

Table 15: Estimation results of firm-level regressions with dependent variable the mean of individual wages

Explanatory variables	OLS results				
	Eq 1	Eq 2	Eq 3	Eq 4	Eq 5
collective agreement variable	0.166**	0.117**	0.026	0.027*	0.021*
	0.014	0.013	0.014	0.014	0.01
wage agreement variable	0.072**	0.066**	0.040**	0.040**	0.030**
	0.015	0.013	0.013	0.013	0.01
employment			0.088**	0.088**	0.091**
			0.004	0.004	0.003
ownership (private=1)				0.017	0.024**
				0.011	0.008
proportion of employees with vocational school (highest level of education)					0.083**
					0.01
proportion of employees with high school (highest level of education)					0.493**
					0.013
proportion of employees with university degree (highest level of education)					1.326**
					0.023
proportion female					-0.182**
					0.011
average experience					0.007**
					0
Constant	11.410**	12.081**	11.607**	11.599**	10.976**
	0.006	0.115	0.114	0.114	0.114
Industry-year interactions	No	Yes	Yes	Yes	Yes
Firm-specific intercepts	No	No	No	No	No
Observations	76,299	76,299	76,299	76,299	76,299
R-squared	0.08	0.19	0.22	0.22	0.45

Table 16: Estimation results of firm-level regressions with dependent variable the mean of individual wages

Explanatory variables	FE results			
	Eq 2	Eq 3	Eq 4	Eq 5
collective agreement variable	0.039**	0.039**	0.039**	0.039**
	0.008	0.008	0.008	0.007
wage agreement variable	0.007	0.007	0.007	0.006
	0.006	0.006	0.006	0.005
employment		-0.003	-0.004	0.024**
		0.005	0.006	0.005
ownership (private=1)			-0.008	-0.006
			0.009	0.008
proportion of employees with vocational school (highest level of education)				0.130**
				0.008
proportion of employees with high school (highest level of education)				0.341**
				0.01
proportion of employees with university degree (highest level of education)				0.793**
				0.019
proportion female				-0.159**
				0.01
average experience				0.006**
				0
Constant	11.150**	11.168**	11.175**	10.801**
	0.113	0.116	0.116	0.098
Industry-year interactions	Yes	Yes	Yes	Yes
Firm-specific intercepts	Yes	Yes	Yes	Yes
Observations	76,299	76,299	76,299	76,299
R-squared	0.21	0.21	0.21	0.32

Table 17: Estimation results of firm-level regressions with dependent variable the wage costs per employee

Explanatory variables	OLS results				
	Eq 1	**Eq 2**	**Eq 3**	**Eq 4**	**Eq 5**
collective agreement variable	0.227** 0.013	0.169** 0.012	0.074** 0.013	0.076** 0.013	0.076** 0.011
employment			0.081** 0.005	0.082** 0.005	0.081** 0.004
ownership (private=1)				0.027* 0.013	0.024* 0.011
proportion of employees with vocational school (highest level of education)					0.017 0.012
proportion of employees with high school (highest level of education)					0.382** 0.015
proportion of employees with university degree (highest level of education)					1.078** 0.028
proportion female					-0.102** 0.013
average experience					0.001 0
Constant	0.779** 0.008	1.546** 0.12	1.108** 0.126	1.096** 0.127	0.673** 0.125
Industry-year interactions	No	Yes	Yes	Yes	Yes
Firm-specific intercepts	No	No	No	No	No
Observations	76,296	76,296	76,296	76,296	76,296
R-squared	0.06	0.21	0.23	0.23	0.36

Table 18: Estimation results of firm-level regressions with dependent variable the wage costs per employee

Explanatory variables	FE results			
	Eq 2	Eq 3	Eq 4	Eq 5
collective agreement variable	0.078** 0.007	0.071** 0.007	0.071** 0.007	0.071** 0.007
employment		-0.086** 0.007	-0.085** 0.007	-0.084** 0.007
ownership (private=1)			0.002 0.009	0.002 0.009
proportion of employees with vocational school (highest level of education)				0.009 0.007
proportion of employees with high school (highest level of education)				0.035** 0.008
proportion of employees with university degree (highest level of education)				0.072** 0.017
proportion female				-0.008 0.007
average experience				-0.001** 0
Constant	0.724** 0.156	1.119** 0.149	1.117** 0.149	1.113** 0.147
Industry-year interactions	Yes	Yes	Yes	Yes
Firm-specific intercepts	Yes	Yes	Yes	Yes
Observations	76,296	76,296	76,296	76,296
R-squared	0.21	0.22	0.22	0.23

Table 19: Estimation results of firm-level regressions with dependent variable the wage costs per employee

Explanatory variables	OLS results				
	Eq 1	Eq 2	Eq 3	Eq 4	Eq 5
wage agreement variable	0.255**	0.196**	0.093**	0.094**	0.089**
	0.015	0.014	0.014	0.013	0.011
employment			0.083**	0.085**	0.084**
			0.004	0.005	0.004
ownership (private=1)				0.024	0.021*
				0.013	0.011
proportion of employees with vocational school (highest level of education)					0.018
					0.012
proportion of employees with high school (highest level of education)					0.383**
					0.015
proportion of employees with university degree (highest level of education)					1.079**
					0.028
proportion female					-0.100**
					0.013
average experience					0.001
					0
Constant	0.598**	1.546**	1.093**	1.082**	0.651**
	0.007	0.12	0.126	0.127	0.126
Industry-year interactions	No	Yes	Yes	Yes	Yes
Firm-specific intercepts	No	No	No	No	No
Observations	76,296	76,296	76,296	76,296	76,296
R-squared	0.05	0.2	0.23	0.23	0.36

Table 20: Estimation results of firm-level regressions with dependent variable the wage costs per employee

Explanatory variables	FE results			
	Eq 2	Eq 3	Eq 4	Eq 5
wage agreement variable	0.047** 0.005	0.044** 0.005	0.044** 0.005	0.044** 0.005
employment		-0.087** 0.007	-0.086** 0.007	-0.085** 0.007
ownership (private=1)			0.006 0.009	0.006 0.009
proportion of employees with vocational school (highest level of education)				0.01 0.007
proportion of employees with high school (highest level of education)				0.035** 0.008
proportion of employees with university degree (highest level of education)				0.073** 0.017
proportion female				-0.008 0.007
average experience				-0.001** 0
Constant	0.718** 0.156	1.118** 0.148	1.114** 0.149	1.110** 0.147
Industry-year interactions	Yes	Yes	Yes	Yes
Firm-specific intercepts	Yes	Yes	Yes	Yes
Observations	76,296	76,296	76,296	76,296
R-squared	0.21	0.22	0.22	0.22

Table 21: Estimation results of firm-level regressions with dependent variable the wage costs per employee

Explanatory variables	OLS results				
	Eq 1	Eq 2	Eq 3	Eq 4	Eq 5
collective agreement variable	0.186** 0.016	0.132** 0.014	0.049** 0.015	0.051** 0.015	0.055** 0.012
wage agreement variable	0.083** 0.016	0.076** 0.015	0.052** 0.014	0.052** 0.014	0.044** 0.012
employment			0.080** 0.005	0.082** 0.005	0.080** 0.004
ownership (private=1)				0.027* 0.013	0.024* 0.011
proportion of employees with vocational school (highest level of education)					0.017 0.012
proportion of employees with high school (highest level of education)					0.382** 0.015
proportion of employees with university degree (highest level of education)					1.077** 0.028
proportion female					-0.101** 0.013
average experience					0.001 0
Constant	0.781** 0.008	1.546** 0.12	1.111** 0.126	1.100** 0.127	0.676** 0.125
Industry-year interactions	No	Yes	Yes	Yes	Yes
Firm-specific intercepts	No	No	No	No	No
Observations	76,296	76,296	76,296	76,296	76,296
R-squared	0.06	0.21	0.23	0.23	0.36

Table 22: Estimation results of firm-level regressions with dependent variable the wage costs per employee

Explanatory variables	FE results			
	Eq 2	Eq 3	Eq 4	Eq 5
collective agreement variable	0.071** 0.008	0.065** 0.008	0.064** 0.008	0.064** 0.008
wage agreement variable	0.012* 0.006	0.012* 0.005	0.012* 0.005	0.012* 0.005
employment		-0.086** 0.007	-0.085** 0.007	-0.084** 0.007
ownership (private=1)			0.002 0.009	0.002 0.009
proportion of employees with vocational school (highest level of education)				0.009 0.007
proportion of employees with high school (highest level of education)				0.035** 0.008
proportion of employees with university degree (highest level of education)				0.072** 0.017
proportion female				-0.008 0.007
average experience				-0.001** 0
Constant	0.724** 0.156	1.118** 0.149	1.117** 0.149	1.112** 0.147
Industry-year interactions	Yes	Yes	Yes	Yes
Firm-specific intercepts	Yes	Yes	Yes	Yes
Observations	76,296	76,296	76,296	76,296
R-squared	0.21	0.22	0.22	0.23