

# Impact of Changes in Wage Setting Policies on the Structure of Wages in Slovenia\*

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## Abstract

In this paper, we study the structure of wages and the importance of firm and person fixed effects in explaining the variance of log real hourly wages in Slovenia, using a longitudinal matched employer-employee database. Most significant changes in employment and wage setting policies occurred in 1991, but incomes policies still suppressed the growth of managerial wages until 1997. We find that this change brought about a change in the wage structure, with an increase in returns to education for the most educated workers. Our results also indicate that person fixed effects account for an overwhelming majority of variation in log real hourly wages, whereas firm fixed effects are not nearly as important.

**JEL Classification:** J31

**Keywords:** linked employer-employee data, person effects, firm effects, wage structure

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# 1 Introduction

It is a well established empirical fact that worker flows are large relative to job flows and that job flows underlie a big fraction of worker flows (see, e.g., Davis and Haltiwanger [1999]). However there are worker flows above and beyond those needed to accomodate job flows. Empirical evidence also shows that within-firm productivity growth accounts for the majority of aggregate productivity growth (see, e.g., Foster et al. [2001] and Bartelsman et al. [2005]). Putting these two empirical facts together, it is possible that within-firm productivity growth is driven by worker reallocation, which might reflect match quality turnover (i.e., workers leave firms because the jobs are not challenging enough for them or firms lay off workers because they cannot handle the job). Wage structure may induce workers to either stay with the firm or leave: if a match between a worker and the firm is bad, lower wage may induce the worker to leave.

Research on the structure of wages has a long history, but recent availability of comparable longitudinal micro-level datasets across countries has brought about a renaissance in both theoretical and empirical work on this subject (see, for example, Heckman et al. [2003]). Overviews of empirical work on differences in wages and changes in the wage structure can be found in Autor and Katz [1999] or, more recently, Autor et al. [2005]. In the 1940s and 1950s, empirical work on the wage structure focused on occupation and industry wage differentials. In the 1960s and 1970s, differences in wages by education and potential experience came to the forefront as a result of increased availability of micro-level datasets with information on earnings and worker characteristics. Mincer [1974] found that more educated workers have higher earnings and that wage-experience profiles are upward sloping and concave. Availability of longitudinal matched employer-employee data took this research further; Abowd and Kramarz [1999] have shown that it is important to use appropriate estimation techniques to eliminate biases resulting from omitting unobservable firm and person fixed effects from the specification.

Over the past decade or two, changes in the economic systems of transition countries provided an interesting “natural experiment” on the impact of institutional factors on the wage structure and its changes. Socialist governments constrained the labor supply mechanism: it was everyone’s duty to work and jobs were provided for everyone; firing was not allowed. Moreover, “economy-wide wage rates were assigned for all classes of jobs” (Orazem and Vodopivec [1994], p. 1). The collapse of the command economy and subsequent transition to the market economy brought about significant changes in the wage structure. Existing studies on the wage structure in transition economies rely on sample micro-level data (for example, Munich et al. [2005] and Flanagan [1995] for the Czech Republic, Jones and Ilayperuma Simon [2005] for Bulgaria, and Orazem and Vodopivec

[2000] for Estonia and Slovenia) and focus mostly on a year or two prior to and after the beginning of transition. The above mentioned studies find that market forces become more important in the wage determination process and consequently that the wage structure changes as transition progresses.

However, transition did not end in the early 1990s for most of these countries. Indeed, there were significant changes in employment protection legislation, unemployment benefits, collective bargaining systems and union density in the late 1990s in most transition countries (see, for example, Haltiwanger et al. [2003]) and all of these could potentially have an impact on the wage structure. None of these studies covers the late 1990s. The only exception is Vodopivec [2004] for Slovenia, who uses a matched employer-employee dataset, but only estimates a standard Mincer [1974] model. In this paper, we use the same dataset, covering the period from 1992 to 2000, and we extend the standard wage structure analysis by including firm and person fixed effects in the model. In addition, we exploit changes in the wage setting system in 1997 to compare the wage structure in 1992-1996 with the one in 1997-2000. We find that there were significant changes in the wage structure in the late 1990s, with the most educated groups gaining the most. We show that worker characteristics, either observable or unobservable, become more important in explaining the variance of real wages in the late 1990s, reflecting the change in the wage determination system.

The outline of this paper is as follows. In Section 2, we describe the institutional background of wage setting in Slovenia. Data used are described in Section 3. Estimation methods and results are discussed in Section 4. Section 5 concludes.

## 2 Institutional Background of Wage Setting<sup>1</sup>

The late 1980s and 1990s were a period of fundamental political and economic changes in Slovenia. These changes started in 1988, when Slovenia was still a part of Yugoslavia, with the Yugoslav *Law on Enterprises* that transferred decision-making rights from workers to equity owners, which resulted in significant changes in both employment and wage policies. Transition continued after Slovenia declared independence in 1991.

On the employment front, firms were given the right to lay off workers since 1988. However, large costs were associated with layoffs. One way for firms to reduce or eliminate these costs is the use of fixed-term contracts, which were introduced in the *Labor Code* of

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<sup>1</sup>This section draws heavily on Haltiwanger and Vodopivec [2003].

February 1991. These contracts were limited neither in the number of successive contracts nor in the maximum cumulated duration. The use of fixed-term contracts has increased over time. Another low- or no cost way to adjust labor is to induce workers to leave by giving them lower wages than they could get elsewhere. Despite allowing relatively liberal use of fixed-term contracts, Slovenian employment protection legislation has been among the most restrictive in Europe (see Haltiwanger et al. [2003], Riboud et al. [2002]).

Under self-management (pre-1988), the government set the firm's wage bill and the workers set individual wages within each firm. The objective was to even out differences in wage pay among firms, as well as within firms.<sup>2</sup> As a result, Yugoslav firms had extremely compressed wage scales. This system was replaced by a three-component system in Slovenia in 1991, consisting of the *Labor Code*, collective bargaining, and incomes policy (Haltiwanger and Vodopivec [2003], p. 258).

The *Labor Code* of 1991 let wages be determined by employers within the framework set by collective agreements. The first general bargaining collective agreement was ratified in August 1990, and it was followed by other general and industry collective bargaining agreements.<sup>3</sup> General collective bargaining agreements prescribe the components of the wage (basic wage, wage supplements, supplements for individual success and supplements based on firm success) and determine fringe benefits (duration of vacation, reimbursement of transportation to work, meals, etc.). Wages and fringe benefits of managerial workers are normally set in individual contracts, which are much more flexible.

The largest component of a worker's pay is the basic wage, which is usually determined as a multiple of the minimum basic wage, set by the collective agreements. This basic wage depends on the category to which a worker belongs on the basis of his/her highest attained educational level. There are nine categories total, and the basic wage for the highest category was set at three times that of the lowest category since 1991, although some industry collective bargaining agreements set higher ratios. Table 1 shows these ratios for the general collective bargaining agreement and select industry collective bargaining agreements in 1997 (there were very few changes in these ratios during the period of our analysis). Until 1997, firms in bad financial standing had the right to reduce basic wage levels.

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<sup>2</sup>Haltiwanger and Vodopivec [2003] note that "the pay of the highest paid manager was 4.54 times that of the lowest paid worker" in a firm with more than one thousand workers.

<sup>3</sup>On December 31, 1996, there were 24 valid collective bargaining agreements (Pirš [1996]).

**Table 1:** Ratios for Basic Wage Scale in the General Collective Agreement and Select Industry Collective Agreements in 1997

Category	General	Paper	Coal	Electricity
1 Simple work (no training)	1.000	1.000	1.000	1.000
2 Less demanding work (short training, completed elementary education)	1.100	1.150	1.287	1.200
3 Medium demanding work (up to two year professional/vocational education)	1.230	1.300	1.406	1.320
4 Demanding work (up to two-and-a-half-year professional/vocational education)	1.370	1.450	1.582	1.550
5 More demanding work (3 years of professional/vocational education, with a foreman exam, or 4-5 years of such education)	1.550	1.700	1.771	1.750
6 Very demanding work (2 years of college level education)	1.850	2.200	2.154	2.120
7 Extremely demanding work (4-5 years of college level education)	2.100	2.600	2.170	2.740
8 Most demanding work (master degree)	2.500	3.300	3.650	3.950
9 Exceptionally important and most demanding work (doctorate)	3.000	3.800	4.347	4.500

**Source:** Pirš [2000].

Incomes policies continued to be an important component of the wage setting system until 1997. In 1991, the law tied the growth of the wage bill to the growth of the cost of living and limited managerial salary to fifteen times the minimum wage (Orazem and Vodopivec [1994]). After 1992, the growth of the wage bill was agreed upon in collective bargaining agreements. Since 1997, the only limitation on wage growth was the requirement that the annual growth of pay based on individual contracts should be matched by the growth of the payroll of the workers covered by collective agreements.

The wage-setting system in Slovenia is quite rigorous and complicated, but it does allow firm- and worker-specific deviations from the wage guidelines set in collective bargaining agreements, should the success of the firm and/or worker warrant them. Given that the wage-setting policies changed in 1997 in two respects (firms in bad financial standing no longer had the right to reduce basic wage levels and limitations on the wage growth were significantly reduced), an interesting question is whether this had any impact on the structure of wages and the importance of the person characteristics (both observed and unobserved) and firm fixed effects. This is precisely what we attempt to answer in this paper. But first, we describe the data used and its properties.

### 3 Data Description

We use a matched employer-employee dataset, compiled from three unusually rich administrative databases covering virtually all Slovenian workforce participants and all business subjects. The first is a database on workers, containing employee characteristics, employment history and earnings information. The second is a firm-level database, containing business registry information. The third is a firm-level database with data from balance sheets and income and loss statements. Common identifiers allow us to combine the records from these three datasets. The resulting dataset covers the period from 1992 until 2000.<sup>4</sup>

#### 3.1 Employee Dataset

Employee dataset is maintained by the Statistical Office of the Republic of Slovenia (SORS), as a part of the Statistical Register of Employment (SRDAP). It is based on the records from the Pension, Disability and Medical Insurance Register, augmented with: a) data from statistical surveys on the recipients of undergraduate and graduate degrees, b) data from

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<sup>4</sup>Data are also available for 2001, but the coverage is much worse than in previous years, so we exclude it from our analysis.

the Central Population Register (CRP) at the Ministry of the Interior, and c) data from the Business Register of Slovenia (PRS), now maintained by the Agency of the Republic of Slovenia for Public Legal Records and Related Services (AJPES). Data are collected by the Health Insurance Institute of Slovenia (ZZZS) from firms or self-employed persons. Records in SRDAP are updated monthly: all the changes need to be reported within 8 days of their occurrence. Data on the recipients of undergraduate and graduate degrees are obtained from the colleges and universities annually.

This dataset contains information on the start and end of employment (if applicable), employee and job characteristics (gender, birth year, level of education attained, level of professional training, type of shift, type of employment, vocation), start and end of the reference period of earnings, earnings, and hours worked in the reference period, including hours worked in overtime.

## 3.2 Employer Datasets

Business Register of Slovenia and firm-level accounting dataset are maintained by the Agency of the Republic of Slovenia for Public Legal Records and Related Services (AJPES) since July 15, 2002. Prior to that, they were maintained by SORS.

Firms are required to submit form PRS-1 at the time of their creation, change of their parameters, and their cessation, if applicable, by to Law on Enterprises. They are required by law to submit form PRS-2 at the time of the creation of an establishment within the firm, change in the establishment's parameters and its cessation, if applicable. According to the *Law on Enterprises*, all firms that are registered in any given year are supposed to provide balance sheets and income statements to the relevant government agency, regardless of whether they were in business the entire year or not.

Firm identification numbers are unique and are not recycled. However, they do not allow transparent tracking of mergers and acquisitions. This is possible with the additional information from the type of change.

Business register dataset includes information on the date of creation of the establishment, industry, municipality, ownership, origin of establishment's capital and date of the first entry to the registry. Date of creation was acquired from the current PRS online (<http://www.ajpes.si/prs>) for firms that are still active and were missing this information. Firm-level accounting dataset contains balance sheets and income statements for all businesses (excluding sole proprietors and the banking industry).

### 3.3 Sample Selection and Definition of Variables

The three datasets described above in principle cover all formal sector workers and firms in Slovenia, including sole proprietors,<sup>5</sup> which were excluded from the analysis, as were the workers employed by them. The reason for the exclusion is that sole proprietors in some cases appear to “adjust” reported earnings of their employees downward to reduce their old-age contributions.<sup>6</sup>

There were a number of workers that either held two jobs at the same time or switched employers during the year. When two jobs were held at the same time, we kept only their primary job, defined as the job in which they worked the most hours, either regular or overtime, and in which they were permanently employed. When a job switch occurred during the year, we calculated the employment spell at each job in that year and kept the observation with the highest earnings and the longest employment spell.

Our main question is whether the structure of wages changed during the period from 1992 to 2000. Since we have the information on hours worked during regular time and in overtime, we can calculate hourly wages. We define the nominal gross hourly wage of worker  $i$  in year  $t$ ,  $nw_{it}$ , as:

$$nw_{it} = \frac{earn_{it}}{h_{R,it} + 1.3 * h_{O,it}}$$

where  $earn_{it}$  is the sum of gross wage and salary income,<sup>7</sup>  $h_{R,it}$  denotes the number of hours worked during regular time and  $h_{O,it}$  denotes the number of hours worked in overtime. Since hours worked in overtime are paid 30 percent more than the hourly wage according to the general collective bargaining agreement, we use a factor of 1.3 to make the number of hours worked in overtime comparable to the number worked during regular time.<sup>8</sup>

Because monthly inflation rates were high especially during the first few years of our sample,<sup>9</sup> nominal earnings and prices in the first half of the year differed significantly from those in the last half of the year. We thus calculate average consumer price indices for the months in which earnings are observed, and then calculate real wages by deflating nominal wages with these indices.

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<sup>5</sup>We do not have accounting data for them, although they exist as well.

<sup>6</sup>These concerns were also mentioned by Orazem and Vodopivec [1994] as a reason for excluding self-employed and workers in private enterprises.

<sup>7</sup>Sum of gross wage and salary income includes personal income tax (paid by employee), payroll tax (paid by employer) and social security contributions (paid by both employer and employee).

<sup>8</sup>This factor includes personal income tax (paid by employee), payroll tax (paid by employer) and social security contributions (paid by both employer and employee).

<sup>9</sup>In 1992, the annual inflation rate was 207 percent.



Education is measured as the highest attained level of education. Specifically, we form six groups: unfinished elementary school, finished elementary school, finished vocational school, finished high school, finished 2-year college and finished 4-year college, masters or doctorate. Potential experience ( $EXPER$ ) is measured on the basis of the average number of years it takes to attain each level of education:

$$EXPER_{it} = \begin{cases} AGE_{it} - 15 & \text{if unfinished elementary school} \\ AGE_{it} - 16 & \text{if finished elementary school} \\ AGE_{it} - 18 & \text{if finished vocational school} \\ AGE_{it} - 19 & \text{if finished high school} \\ AGE_{it} - 22.5 & \text{if finished 2-year college} \\ AGE_{it} - 24.7 & \text{if finished 4-year college or more} \end{cases}$$

where  $AGE_{it}$  is age of worker  $i$  in year  $t$ .

Tenure associated with a job at employer  $k$  is calculated as the difference between year  $t$  and the year in which the employment spell at employer  $k$  started. Workers in our dataset are either in permanent or fixed-term employment, and we define a dummy variable equal to one if they have a fixed-term appointment and zero otherwise.

We also observe type of shift at the person level. There are five shift types: a) one 8-hour shift, b) two 8-hour shifts, c) three 8-hour shifts, d) four persons work at one job in 24 hours, and e) “turns” of 12 hours or more, followed by more than 24 hour break.

We excluded observations with exceptionally low or exceptionally high hourly wages and observations with more than 50 years of potential experience from the sample. We also excluded observations for which data on earnings, type of employment, type of shift and level of education attained were not available. The excluded observations accounted for less than two percent of the entire sample.

Table 2 presents the official figures for employment from the Statistical Office of Slovenia from 1992-2000, and compares them to the number of people employed in our sample; columns (1) and (4) are relevant for this comparison. Our sample covers 74.41 percent of all persons in paid employment in firms in 1992, the coverage increases to 97.33 percent in 1996 and then falls again to 74.58 percent by 2000. The sample covers the entire economy, with the exception of the banking industry.

**Table 2:** Persons in Paid Employment in Enterprises and Other Organizations and by Private Employers

Year	Persons in Paid Employment			
	(1) In Firms	(2) By Sole Proprietors	(3) Total	(4) Sample
1992	658922	33157	692079	490312
1993	629016	36553	665568	506515
1994	605496	41840	647336	518377
1995	594394	47558	641952	531082
1996	581106	53545	634651	565618
1997	593086	58140	651226	564910
1998	591653	60827	652480	556836
1999	606928	64043	670971	545238
2000	615493	67549	683042	459035

**Source:** SORS and own calculations.

### 3.4 Summary Statistics

Some interesting facts emerge from the summary statistics in Table 3. Log real hourly wages have increased during the period from 1992 to 2000, but it seems that, contrary to expectations, their variation has not. On average, workers stayed in the same job for 3.4 years, but since the data is censored on December 31, 2000, tenure may be higher if we extended our analysis beyond this date. Overall, 84.1 percent of workers finished at most high school, with the number being higher in 1992-1996, and lower in 1997-2000. The share of workers with at least a 4-year college degree increased by 1.5 percentage points in 1997-2000 compared to 1992-1996. The shares of workers with unfinished or finished elementary school has decreased, indicating that the workforce was more educated at the end of 1990s than it was in the early 1990s.

It is also interesting to note two factors that could be interpreted as a result of adjusting to the strict labor market legislation: an increase in the share of workers who worked at least one hour in overtime<sup>10</sup> and an increase in the share of workers in fixed term appointments, rather than in permanent employment. In 1997-2000, the share of workers who worked at least one hour in overtime was 2.8 percentage points higher than in 1992-1996. More dramatically, the share of workers in fixed term appointments increased by 13.4 percentage points in 1997-2000, compared to 1992-1996.

<sup>10</sup>According to the general collective bargaining agreement, overtime work is limited to 20 hours per month and 180 hours per year.

**Table 3:** Summary Statistics

Variable	1992-2000		1992-1996		1997-2000	
	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
Log(Real Hourly Wage)	5.6856	0.5059	5.6325	0.5032	5.7507	0.5017
Experience	17.9856	9.9833	17.8629	9.9701	18.1363	9.9974
Tenure	3.3787	2.7264	2.7011	1.9009	4.2112	3.2968
Tenure Squared	18.8489	25.8727	10.9093	13.7285	28.6029	32.9794
Elementary School	0.1779	0.3824	0.1802	0.3843	0.1751	0.3801
Vocational School	0.3110	0.4629	0.3089	0.4621	0.3135	0.4639
High School	0.2629	0.4402	0.2546	0.4357	0.2731	0.4456
2-Year University	0.0757	0.2645	0.0753	0.2639	0.0761	0.2652
4-Year University or more	0.0836	0.2768	0.0768	0.2662	0.0920	0.2890
Two 8-Hour Shifts	0.2205	0.4146	0.2236	0.4167	0.2167	0.4120
Three 8-Hour Shifts	0.0447	0.2066	0.0441	0.2054	0.0453	0.2080
4 persons work at one job in 24 hours	0.0098	0.0987	0.0096	0.0974	0.0101	0.1002
Turns of 12 hours or more, followed by more than 24 hour break	0.0173	0.1304	0.0199	0.1396	0.0141	0.1179
Fixed Term Appointment	0.2334	0.4230	0.1734	0.3786	0.3071	0.4613
Overtime	0.2788	0.4484	0.2664	0.4421	0.2940	0.4556
Incomplete Year	0.1966	0.3974	0.2071	0.4052	0.1838	0.3873
Number of observations	4737923		2611904		2126019	

Source: Own calculations based on matched employer-employee database.

**Table 4:** Number of Years in the Sample and Number of Firms Worked At (Number and Percentage of Observations)

Years	Firms								Total	
	1	2	3	4	5	6	7	8		
1	100479									100479
	2.12									2.12
2	145454	34070								179524
	3.07	0.72								3.79
3	159900	72018	12612							244530
	3.37	1.52	0.27							5.16
4	239752	99540	30488	3852						373632
	5.06	2.10	0.64	0.08						7.89
5	345960	130150	45310	10125	1275					532820
	7.30	2.75	0.96	0.21	0.03					11.25
6	259356	151338	56670	16332	3150	312				487158
	5.47	3.19	1.20	0.34	0.07	0.01				10.28
7	301756	192689	74249	20860	4823	714	56			595147
	6.37	4.07	1.57	0.44	0.10	0.02	0.00			12.56
8	369848	271640	93296	24240	5320	1000	128	0		765472
	7.81	5.73	1.97	0.51	0.11	0.02	0.00	0.00		16.16
9	858699	441657	123048	29259	5328	963	171	36		1459161
	18.12	9.32	2.60	0.62	0.11	0.02	0.00	0.00		30.80
Total	2781204	1393102	435673	104668	19896	2989	355	36		4737923
	58.70	29.40	9.20	2.21	0.42	0.06	0.01	0.00		100.00

Source: Own calculations based on matched employer-employee database.

Table 4 tabulates the observations by the number of years a worker is in the sample and the number of firms he or she works at while in the sample. 30.80 percent of workers were in the sample during the entire period from 1992-2000, and 58.70 percent of workers never switched their employers. However, the remaining 41.30 percent of workers have worked for at least 2 or more employers during 1992-2000.

## 4 Empirical Analysis

### 4.1 The Estimation Model

To assess how the wage structure in Slovenia changed in the late 1990s compared to the early 1990s, we first estimate the standard Mincer [1974] model, with observable worker

characteristics and controls only, which we will refer to as our baseline specification:

$$\ln w_{it} = \mathbf{X}_{it}\boldsymbol{\beta} + \mathbf{Z}_{it}\boldsymbol{\gamma} + \epsilon_{it} \quad (1)$$

where  $\ln w_{it}$  is the natural logarithm of the real hourly wage of worker  $i$  at time  $t$ .  $\mathbf{X}_{it}$  denotes a vector of observable individual characteristics, including an intercept, a set of dummy variables indicating different levels of formal education, years of potential work experience (and its square, triple and quadruple) and years of tenure (and its square).  $\mathbf{Z}_{it}$  denotes a vector of controls, including a dummy variable indicating if the individual is in a permanent or a fixed-term contract position, a set of dummy variables for the type of shift, a dummy indicating whether the individual worked overtime, a dummy variable indicating if the individual worked less than a full year, and a set of annual dummy variables. These job-related circumstances could have an impact on the amount of workers' remuneration: for example, firms might be willing to offer a lower wage to workers employed on the basis of fixed-term contracts than to workers in permanent employment, even though both types of workers work in the same jobs and have comparable person characteristics.

However, specification in model (1) does not take into account firm-specific or industry-specific deviations from the wage guidelines. In order to control for these, we include either 2-digit industry or firm fixed effects in the model:

$$\ln w_{it} = \varphi_{J(i,t)} + \mathbf{X}_{it}\boldsymbol{\beta} + \mathbf{Z}_{it}\boldsymbol{\gamma} + \epsilon_{it} \quad (2)$$

where  $\varphi_{J(i,t)}$  denotes either a 2-digit industry fixed effect or a firm fixed effect. We cannot include both industry and firm fixed effects in the model at once, because we defined 2-digit industry for each firm as the mode of 2-digit industry over 1992-2000. Note that in this model,  $\mathbf{X}_{it}$  does not include an intercept, as it is absorbed in the industry or firm fixed effects.

Abowd et al. [2002] specify a statistical model that takes into account not only firm fixed effects (heterogeneity), but also person fixed effects:

$$\ln w_{it} = \theta_i + \varphi_{J(i,t)} + \mathbf{X}_{it}\boldsymbol{\beta} + \mathbf{Z}_{it}\boldsymbol{\gamma} + \epsilon_{it} \quad (3)$$

where  $\theta_i$  denotes person fixed effects and  $\mathbf{X}_{it}$  contains time-varying individual and/or firm characteristics. This vector does not include the level of education attained, which is now part of  $\theta_i$ , and it does not include an intercept. Estimation of this model requires algorithms based on iterative conjugative gradient method to deal with the high dimensionality of the problem. Identification of person and firm fixed effects requires that some of the individuals

in the sample switch employers, as it uses graph theory to determine groups of connected individuals and firms (Abowd et al. [2002], p. 3). As Table 4 illustrates, our sample fulfills this requirement.

We estimate models (1), (2) and (3) using the data from 1992-2000, and for the two sub-periods, 1992-1996 and 1997-2000. We also ask how much variation in log real hourly wages can be explained by the respective components in these three models: industry and firm fixed effects, person fixed effects (both observable and unobservable), time-varying person characteristics and controls (as applicable).

## 4.2 The Baseline Specification - Observable Worker Characteristics

We start with a baseline specification, the standard Mincer [1974] model of log real hourly wages. We estimate the model using the entire sample, and then we split the sample into two subsamples, 1992-1996 and 1997-2000. We also estimate the model using the entire sample, allowing all the coefficients to vary in the two subperiods. Table 5 presents the results for this specification.

As expected, returns to potential experience are positive, in accordance with the findings from other studies (for example, Orazem and Vodopivec [2000]). On average, one year of additional experience brought about a 4.2 percent increase in real earnings in 1992-1996 and a 6.0 percent increase in 1997-2000. This result could indicate that firms valued work experience more in the later period, since the general collective bargaining agreement prescribed the minimum rate of return to seniority of only 0.5 percent for every year of work experience. These returns are higher than the ones Orazem and Vodopivec [2000] find for 1992.

The wage - potential experience profile is concave, and it became even more concave in 1997-2000 compared to 1992-1996, especially for those with less than 25 years of potential experience. For those with more than 25 years of potential experience but less than 35 years of potential experience, the marginal returns are almost the same in both sub-periods, while returns decreased in 1997-2000 for those with more than 47 years of potential experience. This indicates that marginal returns to a year of potential experience rise for the least experienced but fall for the most experienced. Panel A of Figure 1 shows precisely this pattern.

Firm tenure also had a positive impact on wages - an additional year of “service” at the

**Table 5:** Wage Model - Observable Worker Characteristics

	1992-2000	1992-1996	1997-2001	Change
Intercept	4.8551*** [0.0014]	4.8485*** [0.0018]	4.9121*** [0.0020]	
Experience	0.0470*** [0.0003]	0.0409*** [0.0004]	0.0583*** [0.0004]	0.0174*** [0.0006]
Experience <sup>2</sup> /100	-0.2846*** [0.0028]	-0.2306*** [0.0038]	-0.3834*** [0.0040]	-0.1526*** [0.0056]
Experience <sup>3</sup> /1000	0.0860*** [0.0010]	0.0711*** [0.0014]	0.1151*** [0.0014]	0.0441*** [0.0020]
Experience <sup>4</sup> /10000	-0.0090*** [0.0001]	-0.0077*** [0.0002]	-0.0119*** [0.0002]	-0.0041*** [0.0002]
Tenure	0.0305*** [0.0002]	0.0329*** [0.0003]	0.0217*** [0.0003]	-0.0111*** [0.0004]
Tenure <sup>2</sup> /100	0.1272*** [0.0020]	-0.0341*** [0.0040]	-0.0602*** [0.0025]	-0.0260*** [0.0047]
Elementary	0.0814*** [0.0007]	0.0899*** [0.0009]	0.0784*** [0.0011]	-0.0115*** [0.0015]
Vocational	0.2494*** [0.0007]	0.2554*** [0.0009]	0.2511*** [0.0011]	-0.0042*** [0.0014]
High school	0.5125*** [0.0007]	0.5152*** [0.0009]	0.5176*** [0.0011]	0.0024 [0.0015]
University (2 years)	0.8315*** [0.0009]	0.8225*** [0.0012]	0.8519*** [0.0013]	0.0294*** [0.0018]
University (4 years)	1.1618*** [0.0009]	1.1390*** [0.0012]	1.1933*** [0.0013]	0.0543*** [0.0018]
Fixed Term Appointment	-0.0546*** [0.0005]	-0.0299*** [0.0008]	-0.0726*** [0.0006]	-0.0428*** [0.0010]
Overtime	0.0961*** [0.0004]	0.1015*** [0.0005]	0.0910*** [0.0005]	-0.0105*** [0.0008]
Incomplete year	-0.0925*** [0.0005]	-0.0964*** [0.0007]	-0.0871*** [0.0007]	0.0093*** [0.0010]
Shift effects	YES	YES	YES	
Year effects	YES	YES	YES	
Industry effects	NO	NO	NO	
Firm effects	NO	NO	NO	
Observations	4737923	2611904	2126019	
R-squared	0.4695	0.4282	0.5090	

Standard errors in brackets. \*significant at 10%, \*\*significant at 5%, \*\*\*significant at 1%. Omitted group of education are workers with unfinished elementary school. The model also includes controls for the type of shift and year fixed effects.

Source: Own calculations based on matched employer-employee database.

same firm brought about a 3.1 percent increase in earnings during 1992-2000, 3.3 percent during 1992-1996 and 2.2 percent during 1997-2000. These results indicate that seniority in the firm became less valued (while perhaps individual skills became more important) in the late 1990s. The wage - tenure profile is concave as well, meaning that marginal returns to a year of tenure rise less than proportionately with the length of tenure.

Average returns to education rose more for the most educated groups relative to the least educated groups. Consistent with findings from Orazem and Vodopivec [1994], we find that those with four years of university education or more gained the most in relative earnings, followed by those with two years of university education. Returns to education increased by 5.6 percent for the first group and by 1.0 percent for the second relative to those who did not finish elementary school. Those with finished elementary school or vocational school actually lost 1.1 and 0.4 percent relative to those who did not finish elementary school. These results indicate that the wage scale was not as compressed in the late 1990s as it was at the beginning of transition.

### 4.3 Industry and Firm Fixed Effects

The next step in our analysis is to look at the impact of industry and firm fixed effects using model (2). Firms are allowed to deviate from the prescribed minimum basic wage and the basic wage differs by industry, since there are a number of industry collective bargaining agreements in force. We again estimate the model for the entire period, and for the two sub-periods.

Table 6 contains the results for the Mincer [1974] model with 2-digit industry fixed effects. Compared to the model without industry fixed effects, the returns to potential work experience are larger in 1992-1996, about 4.6 percent for each additional year of potential experience, but slightly smaller in 1997-2000. The wage - potential experience profile is still concave, as Panel B of Figure 1 illustrates, and only workers with 25 to 35 years of potential experience do worse in 1997-2000 than in 1992-1996. Tenure with the firm has a positive impact on log real wage in both sub-periods, and the wage - tenure profile is concave.

Average returns to education still follow the same general pattern as in Table 5, but they are lower. One possible explanation is that some industries attract more educated workers or have on average a better educated workforce than others, and the omission of industry fixed effects causes the coefficients on education to pick up some of this correlation.

On the other hand, it is also plausible that there are differences not only between



**Table 6:** Wage Model - Observable Worker Characteristics and Industry Fixed Effects

	1992-2000	1992-1996	1997-2001	Change
Experience	0.0487*** [0.0003]	0.0445*** [0.0004]	0.0578*** [0.0004]	0.0156*** [0.0006]
Experience <sup>2</sup> /100	-0.2962*** [0.0026]	-0.2618*** [0.0036]	-0.3753*** [0.0038]	-0.1262*** [0.0053]
Experience <sup>3</sup> /1000	0.0899*** [0.0009]	0.0819*** [0.0013]	0.1121*** [0.0013]	0.0334*** [0.0019]
Experience <sup>4</sup> /10000	-0.0096*** [0.0001]	-0.0091*** [0.0002]	-0.0116*** [0.0002]	-0.0028*** [0.0002]
Tenure	0.0325*** [0.0002]	0.0395*** [0.0003]	0.0222*** [0.0003]	-0.0177 [0.0004]
Tenure <sup>2</sup> /100	-0.1523*** [0.0019]	-0.1211*** [0.0038]	-0.0668*** [0.0024]	0.0630*** [0.0045]
Elementary	0.0765*** [0.0007]	0.0818*** [0.0009]	0.0753*** [0.0011]	-0.0094*** [0.0014]
Vocational	0.2329*** [0.0007]	0.2359*** [0.0008]	0.2368*** [0.0010]	-0.0056*** [0.0013]
High school	0.4544*** [0.0007]	0.4560*** [0.0009]	0.4599*** [0.0011]	-0.0050*** [0.0014]
University (2 years)	0.7793*** [0.0009]	0.7742*** [0.0012]	0.7940*** [0.0013]	0.0189*** [0.0017]
University (4 years)	1.0937*** [0.0009]	1.0716*** [0.0012]	1.1221*** [0.0013]	0.0479*** [0.0017]
Fixed Term Appointment	-0.0458*** [0.0005]	-0.0179*** [0.0007]	-0.0681*** [0.0006]	-0.0394*** [0.0009]
Overtime	0.0939*** [0.0004]	0.1004*** [0.0005]	0.0856*** [0.0005]	-0.0105*** [0.0007]
Incomplete year	-0.0753*** [0.0005]	-0.0777*** [0.0007]	-0.0691*** [0.0007]	0.0123*** [0.0010]
Year effects	YES	YES	YES	
Industry effects	YES	YES	YES	
Firm effects	NO	NO	NO	
Observations	4737923	2611904	2126019	
R-squared	0.5260	0.4919	0.5630	

Standard errors in brackets. \*significant at 10%, \*\*significant at 5%, \*\*\*significant at 1%. Omitted group of education are workers with unfinished elementary school. The model also includes controls for the type of shift and year fixed effects.

Source: Own calculations based on matched employer-employee database.

industries but also between firms in the types of workers they are able to attract. Table 7 presents the results of Mincer [1974] model estimation with firm fixed effects. The returns to potential experience are even larger than in the model with industry fixed effects, overall and in both sub-periods, but the difference between the two subperiods is now only 1.1 percentage points.

It is interesting to note, however, that the returns to education for all groups relative to the least educated group are lower than in the baseline model and the model with industry fixed effects. In addition, all groups gain relative to those with the least education in 1997-2000 compared to 1992-1996, with the most educated workers gaining the most, 5.6 percentage points. Figure 2 shows the change in returns to education by the highest educational level attained in 1997-2000 compared to 1992-1996, for models (1) and (2).

These findings suggest that there indeed is a firm fixed effect present in the wage structure, but person fixed effects are likely to be important as well, for which an Abowd et al. [2002] model estimation is necessary. This is what we do next.

#### 4.4 Firm and Person Fixed Effects

Firms are also allowed to make worker-specific deviations from the wage guidelines set in collective bargaining agreements if they want to reward the worker for his/her success. Hence, it is necessary to include not only observable worker heterogeneity (for example, level of education attained), but also unobservable worker heterogeneity in the model. The approach pioneered by Abowd et al. [2002] allows us to estimate both firm and person fixed effects, and our sample fulfills the requirement needed for such estimation to be possible (some workers switch employers), as we have shown in Table 4.

As mentioned above, the Abowd et al. [2002] approach uses graph theory to determine mutually exclusive groups of connected individuals and firms. Table 8 shows the result of applying this algorithm to our data. The largest group contains 97 percent of the sample in 1992-2000, 96 percent of the sample in 1992-1996 and 92 percent of the sample in 1997-2000. This measure can be interpreted as a measure of worker mobility. Abowd et al. [2002] find this measure to be around 88 percent for France and 99 percent for the State of Washington. Mobility is higher than we expected for Slovenia, but this can be explained by the fact that a lot of churning occurred especially in the early 1990s when there was a lot of entry of small firms, but also later on, as large firms were either downsizing or closing down.

Panel D of Figure 1 shows that the wage - potential experience profile is still concave,

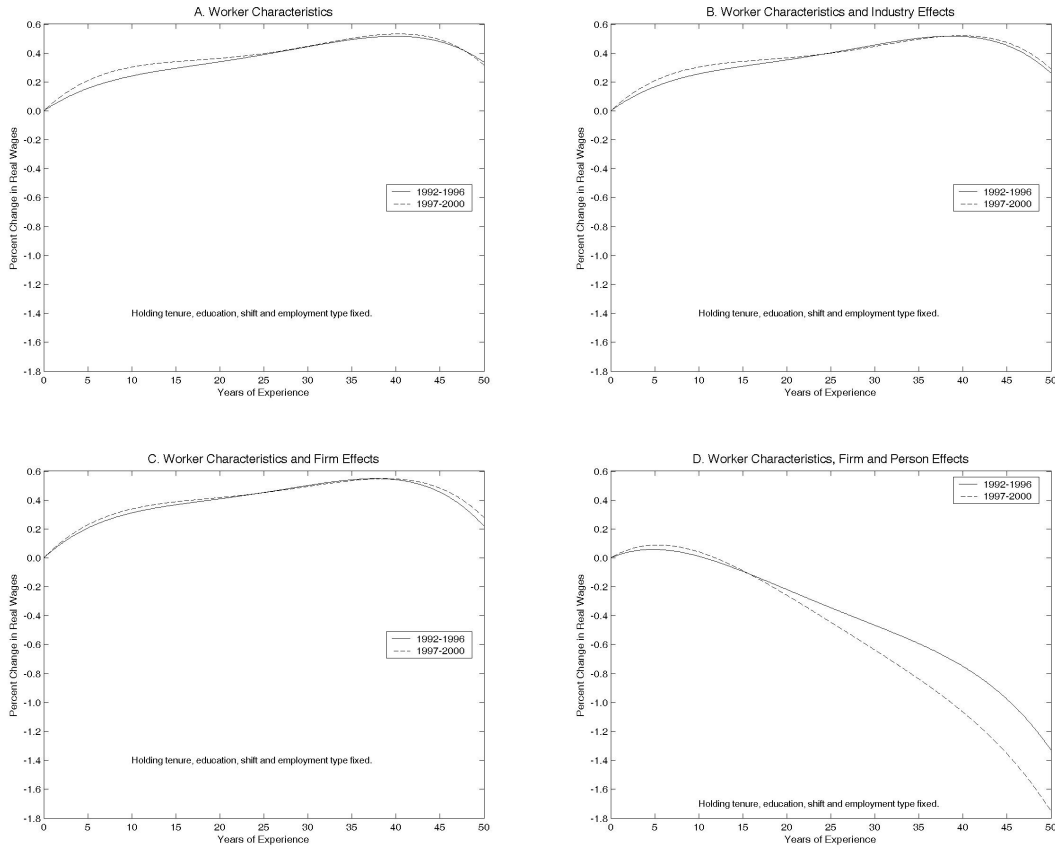
**Table 7:** Wage Model - Observable Worker Characteristics and Firm Fixed Effects

	1992-2000	1992-1996	1997-2001	Change
Experience	0.0557*** [0.0002]	0.0553*** [0.0003]	0.0621*** [0.0003]	0.0108*** [0.0005]
Experience <sup>2</sup> /100	-0.3318*** [0.0021]	-0.3313*** [0.0028]	-0.3834*** [0.0032]	-0.0743*** [0.0043]
Experience <sup>3</sup> /1000	0.0979*** [0.0008]	0.1000*** [0.0010]	0.1115*** [0.0011]	0.0162*** [0.0015]
Experience <sup>4</sup> /10000	-0.0104*** [0.0001]	-0.0108*** [0.0001]	-0.0115*** [0.0001]	-0.0010 [0.0002]
Tenure	0.0212*** [0.0002]	0.0095*** [0.0003]	0.0222*** [0.0002]	0.0013*** [0.0003]
Tenure <sup>2</sup> /100	-0.1423*** [0.0016]	-0.0325*** [0.0033]	-0.1178*** [0.0022]	-0.0589*** [0.0037]
Elementary	0.0721*** [0.0006]	0.0742*** [0.0007]	0.0712*** [0.0009]	0.0033*** [0.0011]
Vocational	0.2310*** [0.0005]	0.2345*** [0.0007]	0.2299*** [0.0009]	0.0093*** [0.0011]
High school	0.4406*** [0.0006]	0.4470*** [0.0007]	0.4397*** [0.0009]	0.0045*** [0.0011]
University (2 years)	0.7729*** [0.0007]	0.7754*** [0.0009]	0.7804*** [0.0011]	0.0260*** [0.0014]
University (4 years)	1.0519*** [0.0008]	1.035*** [0.0010]	1.0803*** [0.0011]	0.0543*** [0.0014]
Fixed Term Appointment	-0.0783*** [0.0004]	-0.0748*** [0.0006]	-0.0852*** [0.0006]	-0.0239*** [0.0008]
Overtime	0.0324*** [0.0004]	0.0345*** [0.0005]	0.0271*** [0.0005]	-0.0303*** [0.0006]
Incomplete year	-0.0470*** [0.0004]	-0.0591*** [0.0005]	-0.0360*** [0.0006]	0.0201*** [0.0008]
Year effects	YES	YES	YES	
Industry effects	NO	NO	NO	
Firm effects	YES	YES	YES	
Observations	4737923	2611904	2126019	
R-squared	0.7053	0.7161	0.7298	

Standard errors in brackets. \*significant at 10%, \*\*significant at 5%, \*\*\*significant at 1%. Omitted group of education are workers with unfinished elementary school. The model also includes controls for the type of shift and year fixed effects.

Source: Own calculations based on matched employer-employee database.

**Figure 1: Returns to Potential Experience, 1992-1996 and 1997-2000**



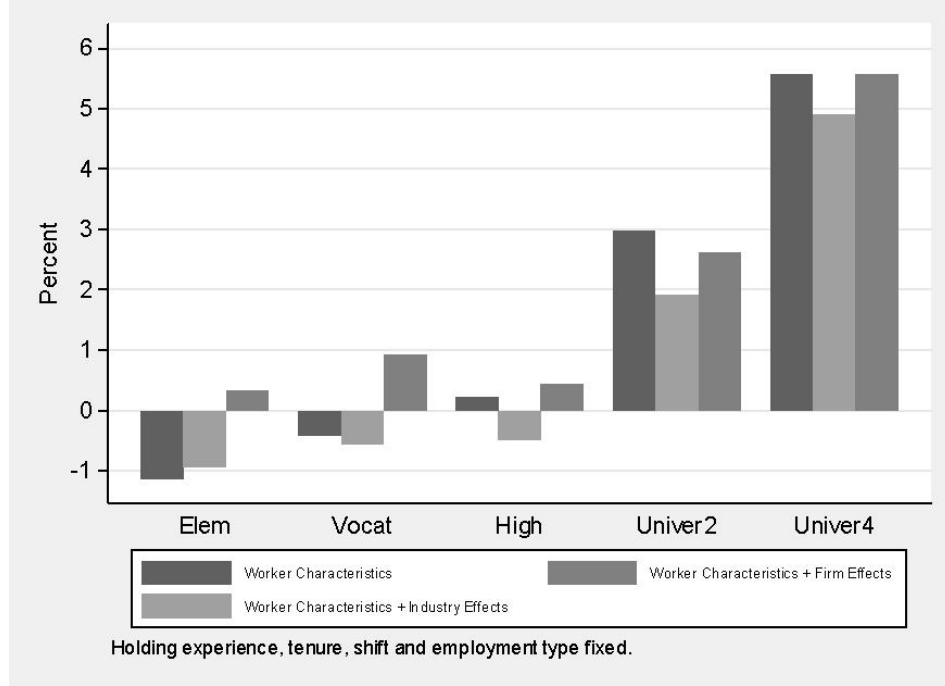
Source: Own calculations based on matched employer-employee database.

as in the previous models, but the shape of this profile differs a lot from previous estimations. Returns to potential experience are slightly positive and increasing until about 5-10 years of potential experience, and then turn downwards and become negative at around 13 years of potential experience. This downward slope is steeper in 1997-2000. It appears that the estimated coefficients from previous models picked up something else besides potential experience, related to unobservable person fixed effects (such as ability of workers), which we are now able to estimate separately.

## 4.5 Analysis of Variance

In the previous sections, we have shown that the wage structure changed in the late 1990s compared to the early 1990s. The big winners of the transition appear to be the most educated workers. However, it is also interesting to analyze the variance structure of log

**Figure 2:** Change in Returns to Education (Relative to Those with Unfinished Elementary School), 1992-1996 to 1997-2000



Source: Own calculations based on matched employer-employee database.

real hourly wages and explore whether there has been a change in the explanatory power of observable and unobservable worker characteristics, industry and firm fixed effects in the late 1990s compared to the early 1990s. As we explained in section 2, there are differences among industries both in the level of the basic wage and the wage scale, the wage-setting mechanism allows firm- and person-specific deviations, and there was a change in the wage determination process in 1997, which could have had an impact on the explanatory power of these characteristics.

The variance of log real hourly wages from model (1) can be decomposed in the following way:

$$\begin{aligned} Var(\ln w_{it}) = & Var(\mathbf{X}_{it}\boldsymbol{\beta}) + Var(\mathbf{Z}_{it}\boldsymbol{\gamma}) + Var(\epsilon_{it}) \\ & + 2Cov(\mathbf{X}_{it}\boldsymbol{\beta}, \mathbf{Z}_{it}\boldsymbol{\gamma}) + 2Cov(\mathbf{X}_{it}\boldsymbol{\beta}, \epsilon_{it}) + 2Cov(\mathbf{Z}_{it}\boldsymbol{\gamma}, \epsilon_{it}) \end{aligned} \quad (4)$$

Similar decompositions of the variance of log real hourly wages follow from models (2) and (3).

As a first step, we look at how much of the variation in log real wage can be explained

**Table 8:** Results of the Grouping Algorithm

	Largest group	Second largest group	Average of all other groups	Total of all groups
<b>1992-2000</b>				
Observations	4615460	38	5.4	4737923
Persons	865091	38	1.3	895750
Firms	62929	1	1.0	86739
Groups	1	1	22785	22787
Estimable effects	928019	38		959702
<b>1992-1996</b>				
Observations	2517404	60	3.4	2611904
Persons	719027	60	1.5	759506
Firms	38040	1	1.0	66502
Groups	1	1	27597	27599
Estimable effects	757066	60		798409
<b>1997-2000</b>				
Observations	1959527	1152	4.3	2126019
Persons	651454	303	1.7	716417
Firms	34657	1	1.0	75181
Groups	1	1	38610	38612
Estimable effects	686110	303		752986

Source: Own calculations based on matched employer-employee database.

by industry or firm fixed effects only. As Table 9 shows, 2-digit industry effects accounted for 17.20 percent and firm fixed effects for 46.56 percent of variation in log real wage in 1992-1996. The importance of 2-digit industry fixed effects increased by 3.75 percentage points and that of firm fixed effects by 0.71 percentage points in 1997-2000.

**Table 9:** Analysis of Variance

R-squared	1992-1996	1997-2001
Industry effects	0.1720	0.2095
Firm effects	0.4656	0.4727

Source: Own calculations based on matched employer-employee database.

**Table 10:** Variances of Wage Components and Share of Variance of Log Real Hourly Wages Due to Wage Components Using Models (1), (2) and (3)

	Worker Characteristics		Worker Characteristics and Industry Effects		Worker Characteristics and Firm Effects		Firm and Person Effects	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	1992-1996	1997-2000	1992-1996	1997-2000	1992-1996	1997-2000	1992-1996	1997-2000
R-squared	0.4282	0.5090	0.4919	0.5630	0.7161	0.7298	0.8448	0.8400
Variances								
$\text{Var}(\ln w_{it})$	0.2532	0.2517	0.2532	0.2517	0.2532	0.2517	0.2532	0.2517
$\text{Var}(\mathbf{X}_{it}\boldsymbol{\beta})$	0.0215	0.0177	0.0222	0.0175	0.0158	0.0174	0.0493	0.0990
$\text{Var}(\mathbf{Z}_{it}\boldsymbol{\gamma})$	0.0065	0.0072	0.0052	0.0052	0.0038	0.0032	0.0101	0.0056
$\text{Var}(\varphi_{J(it,industry)})$			0.0170	0.0146				
$\text{Var}(\varphi_{J(it,firm)})$					0.0773	0.0591	0.0544	0.0373
$\text{Var}(\theta_i)$							0.2329	0.3085
$\text{Var}(\theta_{i,observable})$	0.0986	0.1134	0.0861	0.0983	0.0825	0.0919	0.0516	0.0565
$\text{Var}(\theta_{i,unobservable})$							0.1813	0.2519
$\text{Var}(\epsilon_{it})$	0.1448	0.1236	0.1286	0.1100	0.0719	0.0680	0.0393	0.0403
Share of variance in $\ln w_{it}$ accounted for by the variance of								
$\mathbf{X}_{it}\boldsymbol{\beta}$	0.0848	0.0702	0.0875	0.0693	0.0625	0.0691	0.1948	0.3932
$\mathbf{Z}_{it}\boldsymbol{\gamma}$	0.0255	0.0285	0.0207	0.0207	0.0150	0.0128	0.0398	0.0223
$\varphi_{J(it,industry)}$			0.0671	0.0582				
$\varphi_{J(it,firm)}$					0.3052	0.2348	0.2146	0.1481
$\theta_i$							0.9197	1.2258
$\theta_{i,observable}$	0.3895	0.4507	0.3400	0.3904	0.3257	0.3651	0.2037	0.2247
$\theta_{i,unobservable}$							0.7160	1.0011

Source: Own calculations based on matched employer-employee database.

Table 10 shows the variance decomposition of log real wage, using models (1), (2) and (3).<sup>11</sup>  $\mathbf{X}_{it}$  contains experience and tenure and their squares, triples and quadruples (last two for experience only), and intercept in model (1).  $\mathbf{Z}_{it}$  contains dummy variables for type of shift, type of employment, incomplete year, overtime work, and year effects. Person fixed effect,  $\theta_i$  is decomposed into observable and unobservable person fixed effect. Observable person fixed effect refers to the educational level attained.

Columns (1) and (2) refer to model (1), which includes only observable worker characteristics and controls. In this model, the share of variance of log real hourly wage due to the variance in observable worker characteristics decreases by 1.5 percentage points in the late 1990s compared to the early 1990s. This pattern is still present in columns (3) and (4), which refer to model (2) with industry fixed effects, but not to the models with firm and/or person fixed effects (columns (5)-(8)). In fact, in the model with person and firm fixed effects, the share of variance of log real hourly wage due to the variance in observable worker characteristics increases by almost 20 percentage points. Firm fixed effects also account for a significant amount of variation in log real hourly wage, but their share drops by 7 percentage points in the late 1990s compared to the early 1990s.

Which component accounts for the most variation in log real hourly wage? Person fixed effects in both sub-periods. Models (1) and (2) only include observable person fixed effect, the level of education attained, whereas model (3) allows us to estimate total person fixed effect, observable and unobservable. The share of variance of log real hourly wage due to observable person fixed effect increases in 1997-2000 compared to 1992-1996 in all model specifications, with increase being the highest when using model (1). An overwhelming share of the variation in log real hourly wage comes from the unobservable person fixed effect, especially so in 1997-2000.

Given that unobservable person fixed effects explain almost all of the variation in log real hourly wage, it is interesting to look at the correlation coefficients among the wage components. The correlation between the person fixed effects and firm fixed effects is of particular interest, since it indicates whether good workers are employed by good firms. As Table 11 shows, this coefficient is positive and significant<sup>12</sup> in both sub-periods, but it is also very small in magnitude (0.03 in 1992-1996 and 0.02 in 1997-2000).

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<sup>11</sup>Covariance terms are omitted from the table, but are available upon request from the authors.

<sup>12</sup>All of the correlation coefficients in Table 11 are significant.



**Table 11:** Correlation Coefficients among Wage Components in a Model with Person and Firm Fixed Effects

	$\ln w_{it}$	$\mathbf{X}_{it}\boldsymbol{\beta}$	$\mathbf{Z}_{it}\boldsymbol{\gamma}$	$\varphi_{J(it,firm)}$	$\theta_i$	$\theta_{i,observable}$	$\theta_{i,unobservable}$	$\epsilon_{it}$
<b>1992-1996</b>								
$\ln w_{it}$	1.0000							
$\mathbf{X}_{it}\boldsymbol{\beta}$	-0.1305	1.0000						
$\mathbf{Z}_{it}\boldsymbol{\gamma}$	0.1156	-0.1102	1.0000					
$\varphi_{J(it,firm)}$	0.4844	-0.0250	0.0027	1.0000				
$\theta_i$	0.7110	-0.5463	-0.0233	0.0341	1.0000			
$\theta_{i,observable}$	0.5324	0.1067	-0.0047	0.0535	0.4707	1.0000		
$\theta_{i,unobservable}$	0.5219	-0.6761	-0.0240	0.0102	0.8823	0.0000	1.0000	
$\epsilon_{it}$	0.3255	-0.0364	-0.0360	-0.0029	-0.0458	0.0255	-0.0655	1.0000
<b>1997-2000</b>								
$\ln w_{it}$	1.0000							
$\mathbf{X}_{it}\boldsymbol{\beta}$	-0.0991	1.0000						
$\mathbf{Z}_{it}\boldsymbol{\gamma}$	0.1607	-0.1566	1.0000					
$\varphi_{J(it,firm)}$	0.3912	-0.0232	0.0602	1.0000				
$\theta_i$	0.7186	-0.5928	0.0741	0.0220	1.0000			
$\theta_{i,observable}$	0.5838	0.0958	0.0157	0.0803	0.4281	1.0000		
$\theta_{i,unobservable}$	0.5185	-0.7014	0.0746	-0.0137	0.9037	-0.0000	1.0000	
$\epsilon_{it}$	0.2301	-0.0939	0.0108	-0.0312	-0.0909	0.0412	-0.1202	1.0000

Source: Own calculations based on matched employer-employee database.

These results indicate that although firm effects are important, worker characteristics, especially unobserved person fixed effects, became more important in the late 1990s. Given the nature of the change in wage determination system in 1997, this is not surprising, especially in conjunction with the increase in returns to the most educated group of workers. Those workers are namely most likely to have individual contracts, and these were not limited as much in the late 1990s as in the early 1990s.

## 5 Conclusion

This paper exploits a rich matched employer-employee dataset for Slovenia, covering almost the entire universe of workers in the 1990s. Transition in Slovenia started in 1988, and continued throughout the 1990s. Most significant changes in the labor market occurred in the early 1990s, but we find that additional small “deregulations” in the form of significantly reduced limitations on the wage growth in 1997 also had a significant impact on the wage structure. Most notably, there was an increase in returns to experience and in returns to the most educated workers. Returns to experience increased more than in the early years of transition, whereas returns to education increased less compared to 1987-1991 (see Orazem and Vodopivec [1994] for the latter).

The magnitude of the returns and the changes in the wage structure depends on the model of log real hourly wages. Specifically, variance in person fixed effects accounted for more than 90 percent of variation in log real hourly wages, and their explanatory power increased in the late 1990s. Firm fixed effects are important as well, but not nearly as much as person fixed and time-variant effects. In fact, their importance decreases in the late 1990s, and the correlation between person and firm fixed effects, although positive, is very small. To caricature, it matters where you work, but it matters much more how good you are at what you do.

In future work, we plan to use the estimated firm and person fixed effects to examine the impact of worker matching on productivity growth. When a match is made between a worker and a firm, its productivity will depend on both the firm effect, the worker effect and the quality of the match. Firms learn about the latter through experience, and separating bad matches will have a positive impact on their productivity.

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