# Wage Structure and Labor Mobility in Norway 1980-1997

Arngrim Hunnes
(`arngrim.hunnes@nhh.no`)
Norwegian School of Economics and Business Administration

Jarle Møen
(`jarle.moen@nhh.no`)
Norwegian School of Economics and Business Administration

Kjell G. Salvanes
(`kjell.salvanes@nhh.no`)
Norwegian School of Economics and Business Administration, Statistics Norway and IZA

Norwegian School of Economics and Business Administraion
Helleveien 30, N-5045 Bergen, Norway

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# 1 Introduction

In the 1980s and 1990s most West European countries broke the trend of increasing the size of the welfare state and the use of solidaristic wage policies developed since the 1950s through the 1970s. Increased and persistent unemployment and budget deficits led many countries to question the size of the welfare state and egalitarian wage policies. Also Scandinavian countries–and most notably Sweden– were forced to reassess their welfare policies and centralized wage negotiations were abandoned.

Norway went in a different direction and stands out from the trend among developed countries in this period. Centralized bargaining was strengthened both by recentralization wage bargaining in 1986/87 from industry level bargaining in the early 1980s, and by introducing "solidarity alternative" wage policy in the early 1990s and strengthening the guaranteed negotiated minimum wage for the lowest paid (Wallerstein et al., 1996 ; Kahn, 1998: Freeman, 1996). Notable is also that the earnings distribution did not increase as in most other countries but stayed compressed until the mid 1990s (Aaberge et al., 1996).[1]

Although we know that generally the Norwegian economy is different from most with high wage compression and strong labour market institutions, we do not know very much about the details of the working of the labour market in Norway in this period such as the structure of wages, wage mobility, the structure of movement of workers within firms and between firms, the heterogeneity across worker segments and firm characteristics.[2]

In the present paper we utilize a unique matched employer-employee data set which is well suited for detailed analyses of worker and wage mobility within and between firms. The data set has the special feature of detailed information on occupation hierarchies and very detailed information on wage compensation both wage for normal hours, overtime, and different types of bonuses, plus very good information on hours worked. This data set is then matched to the main employer-employee data set used in several studies before in order to obtain detailed information on firm and worker characteristics.[3] We present results for a detailed analysis of wage and worker mobility within and between firms for the period 1980-97 both for white collar workers covering both the manufacturing and private service sector, and for both blue collar and white collar workers working in the same firm, but data restriction force us to focus for no on the manufacturing sector. In addition to comparing our results to other countries and most notably other Scandinavian countries that had a different development in terms of wage bargaining institutions in this period, we make a point of comparing results for blue collar and white collar workers since white collar workers within the private sector do not

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[1]See Kahn, 1998 and Hægeland, Klette and Salvanes, 1999 for different explanations for the increased wage compression.

[2]Some work on both the job and worker turnover and wage structure have been undertaken before, but very little on wage mobility within and between firms.

[3]See Møen, Salvanes, and Sørensen (2003) for a description of this data set.

bargain wages at the central level. For white collar workers in the private sector, only the rules for how to negotiate at the firm level are decided at centrally, wages are negotiated locally. White collar and blue collar workers differ of course also along other dimensions important for wage setting, but this is an interesting feature that we can exploit. In the addition, the period we are analysis was a volatile period in terms of business cycle development. Norway experienced the highest post war unemployment rate in this period and hence the business cycle pattern of wage and worker mobility are well suited to be studied in this period.

## 2 Macroeconomic conditions

For Table 1 we calculate the unemployment rate from the Norwegian Labor Force Survey (AKU). The numbers in the table are taken from different publications from Statistics Norway (1974, 1978, 1984, 1997 and 2003).

[Table 1 about here.]

The growth numbers are computed based on numbers from Statistics Norway (2003b). In the computation the GDP numbers are fixed at 2000 prices. The formula used is

$$growth_{GDP} = 100(\ln GDP_t - \ln GDP_{t-yr})/yr$$

where $t = 1971, \ldots, 2002$ and $yr \in \{1, 2, 5\}$. And finally, the numbers are multiplied with 100.

In addition to Table 1 we provide Figure 1 showing the business cycle for the Norwegian economy. From the figure we see that the macroeconomic conditions have not been stable in our data period from 1980 to 1997/98. The early 1980s had a mild downturn with a peak in the business cycle around 1985-87 with an unemployment rate at about 2 percent of the labour force. Then from 1988 onwards and peaking in 1993 the strongest downward period took place in Norway in the post-war period with an unemployment rate of about 6 percent. 1997 was again a peak year in a relatively stable period after the mid 1990s. From these pattern of the business cycle we also see the rationale for picking the years for 1981 and 1993 as the bad years of the business cycle and 1985/86 and 1997 at two good years.

[Figure 1 about here.]

In addition to the development of the macro economy in terms for development of GDP and the unemployment rate, the Government has also played an important part in coordinating the wage settlements which has important implications for wage determination in this period. For instance, wage negotiations in 1988 where undertaken with considerable concern for the Norwegian economy. In part due to the oil price fall in 1986, the Norwegian krone was

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devalued by 10 percent in May 1986. The predecessor of NHO, NAF, called a lock-out which failed, largely due to disagreement among the employers, leading the working time reduction and high wage increases in 1986. LO and NAF (NHO) reached a moderate agreement. To ensure that all groups followed suit, the Storting passed a law that wages and incomes could not increase by more than 5 percent, in line with the outcome of the wage settlements between LO and NHO. A similar law was passed in 1989. So basically there was a wage freeze policy at 5 percent nominal increase in these two years.

In 1990, the income regulation laws expired, yet LO and NHO agreed that wage increased should be moderate, owing to the high unemployment and weak competitive position of the traded sector. In 1992, the agreement among the labor market organizations on wage restraint was formalized in the Solidarity alternative. In 1994, the main revision was undertaken by industry, yet wage growth was moderate, following the lead from the metal industry. In contrast, in the main settlements in 1996 and 1998, proposed agreements in line with the Solidarity alternative were rejected in ballots, leading to strikes and subsequent agreements on higher wage growth.

# 3    Institutional setting

This section will cover both the wage setting institution in Norway for different worker groups and institutions for employment protection.

## 3.1    Wage setting

Most employees in Norway have their wage set in collective agreements. In the public sector (a bit less one third of all employees), this is the case for all employees, while in the private sector, bargaining coverage is about 53 percent (Stokke et al, 2003, page 105).[4] Union density, i.e. the share of employees who are member in a union, is somewhat lower, 43 percent in the private sector and 84 percent in the public sector (Stokke et al, 2003, page 40). These figures have been very stable in our data period (Wallerstein et al.). Bargaining coverage being higher than union density reflects that firms covered by a collective agreement follow the agreement for all employees. In contrast to many other European countries, extension mechanisms imposing the regulations from collective agreements on the unorganized sectors, are not used in Norway.

The largest employees' association is LO, where about half of all union members are organized. The traditional stronghold of LO is among blue-collar workers in the manufacturing industry, but LO is also large in some private service sectors, and for non-professionals and unskilled employees in the public sector. LO is organised in union branches, to a large degree

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[4]See Holden and Salvanes (2004) on more details of the wage setting process.

covering different industry sectors. Other employees' associations are YS, covering much of the same workers as LO; UHO, covering teachers, nurses, the police, etc; and Akademikerne, covering employees with long education. On the employer side, NHO is the dominating association in the private sector, being the main counterparty to LO. NHO has about 16 000 member companies, employing about 490 000 employees in Norway (Stokke et al, 2003), i.e. about one quarter of the total workforce of 2.3 million.

For employees covered by collective agreements, wage setting takes place at two levels, nationally or by industry (often referred to as centralized) and at firm level (wage drift). The central negotiations concern the collective agreements, which regulate wages, working hours, working conditions, pensions, sick payments, etc. Firm level negotiations determine possible local adjustments and additions to the collective agreements. These negotiations are generally conducted under a peace clause, preventing strikes and lock-outs within the contract period of the collective (i.e. central) agreements (Holden, 1998). The collective agreements usually last for two years. Since 1964, the main revisions of the collective agreements have been undertaken every second year, in even years (last time in 2004). The draft agreement in a main revision is subject to a ballot among the union members. Occasionally, draft agreements are rejected by the members, leading to a strike and subsequent negotiations during or after the strike. There are also central negotiations in intermediate years, but the scope for these negotiations are usually limited to wages only. Furthermore, negotiations in intermediate years are undertaken at the national level, without any ballot requirements, which usually ensures a more moderate wage outcome.

Broadly, we can distinguish three types of collective agreements:

- minimum wage agreements,

- normal wage agreements, and

- agreements without wage rates.

Most workers are covered by minimum wage agreements, which specify minimum wage rates, as well as other working conditions. For these workers there are local negotiations about additions to the central agreements. Importantly, as the local agreements specify additions to the central agreements, an increase in the centrally-specified minimum wage rates will raise the wage of all workers, even if they are paid more than the minimum rates. Workers covered by normal wage agreements are not supposed to have local wage negotiations, so their wages and working conditions are fully specified by the central agreements. At the opposite end there are also agreements without wage rates, which only specify procedures for the local wage setting. These agreements are only used for white collar workers. Hence, an important feature of the Norwegian wage setting is that white collar worker wages are mainly set at the firm level and thus reflecting conditions at the firm level. Noticeable is also that there is no

national, statutory minimum wage for all workers, so minimum wages only apply to workers covered by collective agreements.

Although blue collar workers' wages are negotiated centrally, tt varies quite a lot over sectors how many firms that have local bargaining, and how important the wage drift - the change in wages due to local negotiations - is for the total wage increases. Figure 2 shows the total wage change in the period 1970 to 1996 for blue collar workers. As is noticed from the figure quite a large proportion of the total wage gains is realised at the local level; see also Holden and Rødseth (1990). This means that the sector minimum wage will not be binding for several firms, since they have locally contracted higher wages. In our data a relatively small proportion of the workforce is paid at or near the minimum wage, and local bargaining could be one reason why this is so.

[Figure 2 about here.]

## 3.2 Employment protection[5]

Both rules regarding individual and collective dismissals, and the flexibility of plants with respect to temporary hiring and the use of subcontractors, are important aspects of employment protection and thus the costs of adjustment for plants. The different types of constraints regulating the hiring and firing of workers are not completely transparent, since, in addition to national laws, collective agreements between employer and workers organization also are very important in regulating the adjustment of the labor factor. These agreements may differ across industries and workers, depending upon age, tenure, etc.

Two main laws govern the labor relations in Norway: The law on employment ("Sysselsettingsloven") and The law on labor relations ("Arbeidsmiljøloven"). The law on employment mainly regulates changes in labor during a period of restructuring and mass lay-offs by the firm. The latter was enacted in 1982 and it includes standards for general working conditions, overtime regulations and legal regulation for employment protection. According to the law on labor relations, dismissals for individual reasons are limited to cases of disloyalty, persistent absenteeism etc., while dismissals for economic reasons are automatically unfair. In general it is possible but very difficult to replace an individual worker in a given job with another worker. Hence, in general, there is a strong degree of employment protection in Norway. The law on employment states that the general rule for laying off a worker for *economic reasons* is that it layoffs can occur only when the job is "redundant" and the worker cannot be retained in another capacity. This regulation covers all workers independent of how long ago he/she has been hired. Requirements for collective dismissals in Norway basically follow the

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[5]A new law of employment protection and the use of time limited labor contracts has been suggested by the government and is going to be decided upon in the fall of 2004. The main suggestion are to allow more flexible use of fixed-term contracts and more flexible use of overtime work.

common minimum rules for EU-countries. It is important to notice is that a firm can dismiss workers not only when it is making losses but also when it has poor performance. There is not actually any rule on the selection of workers to be dismissed. However, the legal practice narrows down which workers can be dismissed. Conversations with lawyers in the employees organizations indicate that a lot if not most of the cases of dismissals are taken to court, which is costly for the firms.

When it comes to other costs of dismissal, according to the employment law, employment is terminable with one month's notice in Norway for workers with tenure less or equal to five years. This one-month notice is at the lower end of the spectrum compared to many countries. However, most workers have a three months' notice requirement for both parties of the contract. Although there is no generalized legal requirement of severance pay in Norway, agreements in the private sector require lump-sum payments to workers who have reached age 50-55. As an example, in the contract between LO (the largest blue collar workers organization) and NHO (the employers' association), a worker who is 50 and has been working for 10 consecutive years or 20 years in the firms is eligible for one to two months pay. Comparable agreements exist for the other unions. Some EU-countries actually have even stronger job protection rules, including also general compensation, a social plan for re-training or transfer to another plant within a firm for instance. Although not mandatory, some of these other requirements are also commonplace in Norway. For this set of dismissal restriction, Norway is ranked slightly below average among OECD countries. Note finally that while some costs of reducing the workforce (such as redundancy payments) are related to the size of the reduction, others (such as advance notice requirements, legal and other administrative costs, etc.) may have significant fixed components.

The work force flexibility of an economy can be enhanced by allowing fixed-term contracts in addition to standard contract, and the use of temporary work agencies. In many OECD countries there has been a strong trend in liberalizing the use of these two schemes. In Norway, the use of fixed term contracts is allowed only for limited situations, such as specific projects, seasonal work or the replacement of workers who are absent temporary. However, it may not necessarily be as restrictive as it appears since defining a specific project for a firm is partly open to discretion. Repeated temporary contracts are possible with some limitations, and there is no rule limiting the cumulated duration of successive contract. In general the use of temporary work agencies are prohibited, but wide exceptions exists for service sector occupations. Restrictions for the number of renewals exist also here, and two years is the maximum for cumulated contracts. Compared to other OECD countries, Norway is ranked a little bit above average for the strictness of the use of temporary employment (OECD, 1999).

Very few comparative studies of the overall degree of employment protection exist. A much-sited study by Emerson (1987), ranks Italy as having the strongest employment protection rules while the UK and partly Denmark are at the other end of the spectrum. Norway

is ranked together with Sweden, France and partly Germany (when all regulations are taken together) as an intermediate country with a fairly high degree of protection. Obviously inter-country comparisons are difficult. The most recent comparison was made by OECD in 1999, where Norway is ranked as number 12 out of 19 OECD countries for the late 1980s, and as number 19 out of 26 OECD countries for the late 1990s in the degree of restrictiveness (OECD, 1999). Evidence on the flexibility of the Norwegian economy from job and worker flows data suggests that it is about average for OECD countries, although worker flows are a bit below average (Salvanes, 1997 and Salvanes and Frre, 2003). The overall impression is that legislation, contracts, and common practice impose important additional costs in Norway when adjusting the labor force downward, and possibly upward as well. See Nilsen, Salvanes and Sciantarelli (2003) for and analyses of the effect of labor adjustment costs in Norway.

## 4  Data

Like other Scandinavian countries Norway has rich and high quality linked employer-employee data sets. The core of the Norwegian data are based on administrative files from Statistics Norway and plant level information from the annual census for manufacturing. Information on R&D and trade statistics have been added as well. See Salvanes and Førre (2003) for a general description of the Norwegian linked employer-employee data set.

In this paper we take advantage of two new data sets, one for white collar workers and one for blue collar workers. Both the data sets are from the main employers' association in Norway. It should be noted that the white collar data set is the main data set used in this paper. It's main advantage over data that has been available so far is that it contain information on hourly wages and occupations. Information from the administrative data set can be merged onto the new ones as they both use the same series of person identifiers.

### 4.1  White collar data

The white collar data consists of employment and wage data based on data from the main employers' association in Norway, the Confederation of Norwegian Business and Industry (NHO). NHO has about 16,000 member companies of which 73% have less than 20 man-labor year. The member companies employ about 450,000 workers covering mainly construction, services and manufacturing in Norway.[6] There is a bias towards manufacturing. Many of the member companies in NHO are operating within export and import competing industries. The total labor force in Norway is about 2 million workers all together where about half is employed in the public sector in year 2000, hence the NHO covers roughly 45% of private

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[6]http://www.nho.no/

sector employment. In terms of private sector GDP, the members of NHO produce about 40%.

The data is based on establishment records for all white collar workers employed by firms that are members of the NHO confederation. Norwegian law bounds all employers annually to report data on wages and employment to Statistics Norway. Until 1997 NHO collected data for their member plants under this law, and Statistics Norway collected data for the rest of the economy. From 1997 Statistics Norway collected data from all sectors. The data set is considered to be very precise since the wage data was a major input in the collective bargaining process in Norway between the NHO and the unions. See Holden and Salvanes (2003) for an assessment of the wage data from this data source as compared to other sources of earnings data from Norwegian registers.

Our data set covers on average 97,000 white collar workers per year in different industries during the period 1980-1997.[7] CEOs (and in large firms, vice CEOs) are not included. The average number of plants is 5,000 and the average number of firms is 2,700 per year.

We have merged the NHO data set with a larger administrative matched employer-employee database which we have established previously. This database contains a rich set of information on workers and plants for the period 1986-2000. For a further description of the administrative data set, see Møen, Salvanes, and Sørensen (2003). In principle, this merging allow us to identify CEOs and vice CEOs indirectly.[8] One of the reason for merging the NHO data set with the adminstrative register, besides obtaining more information, is that it is unclear whether the unit for establishment used in the NHO statistics is plant or firm or a combination of the two.[9] After establising the link between the workers and the plants we merged this again with the Norwegian register of establishment and firms which gives the link between the plants and the firms. On average we could match 97% of the workers with plants and 93% of the workers with firms.

### 4.1.1 Variables

In this section we briefly describe some of the most important variables in the white collar worker data set.

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[7]The year 1987 is missing. But all the years contains lagged values, hence we were able to recontrcuct 1987 by using lagged values in the 1988 file. This is course not a perfect reconstruction since we do not have information on workers who left the data in 1987 and was not in the 1988 file.

[8]Work on this has already started but it is to early to report any results.

[9]The register data covers the year 1986 and onwards and the merging between the NHO data set and the register data is painless. But we do not have register data for the years 1980-1985, so to get hold of the link between a worker and the plant he was attached to in this period we used different approaches. We started with the most reliable information and continued with less reliable information. Among the information used was the job start date in the 1986 register data and the 1980 census.

**Occupation** Each worker is assigned an occupational group and a level *within* the occupational group. The groups are labeled A-F: Group A is technical white collar workers; Group B is foremen; Group C is administration; Group D is shops and Group E is storage. Group F is a miscellaneous group consisting of workers that do not fit in any of the other categories. Hierarchical level is given by a number where zero represents the top level. The number of levels defined vary by group and ranges from 1 (F) to 7 (A). In total we have 22 different combinations of groups and levels. Table 2 shows the distribution of workers on the occupational groups. These codes are made by NHO for wage bargaining purposes, and as such they are similar across firms and industries. This information is one of the unique features of this data set, and it gives us a picture of how the hierarchical level looks like within a firm. We are e.g. able to study mobility within a firm and questions related to promotion.

[Table 2 about here.]

We define an occupation as a combination of group and level. That gives us 22 occupations. In the data set we also have a much richer set of 4 digits job codes. These are less consistently used across firms and perhaps also within firms across time. We have therefore not yet utilized this information.

To create a single hiearchy within a firm we aggregate the 22 different occupations into seven different levels. This gives a maximum of seven levels in a single firm.[10] To help in the aggregation we have carefully read the NHO's descriptions of the different occupational groups. But still, such a harmonization across occpational groups are of course not without problems. The most severe problem (probably) lies in the fact that some of the levelse are somewhat overlapping with respect to responsibility in the organization. For example, even though we aggregate occupational group A31 and A32 into the same level (see Table 3) we know that they differ in responsibility since A31 involves management of other workers while A32 does not (however, they both are ranked above the A4-level). Table 4 shows the distribtuion of workers on the seven levels.

[Table 3 about here.]

[Table 4 about here.]

**Wage** We use monthly salary (per September 1st) for white collar workers including the value of fringe benefits and exclusive of overtime and bonuses. Indirect costs to the firm such as employers' fee, pensions etc are not included. We transform nominal wages to real wages using the Consumer Price Index with base year 1990 (Statistics Norway 2004).

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[10]Note that not all firms will have workers on each of the seven levels.

**Hours**  The hours reported in the data set are average normal hours per week exclusive lunches and overtime.

**Bonuses**  This variable gives the montly average value during the last 12 months prior to September 1st of bonuses, commissions and production bonuses.

### 4.1.2  Restrictions on the sample

We put the following restrictions on the sample

1. The number of hours worked per week is 30 or above, i.e. we look at fulltime workers.

2. The number of full time employed workers (16 year of age or above) in each firm is at least 25 in year $t$.

3. The number of full time employed workers (16 year of age or above) in each firm is a least 25 in year $t - 1$.[11]

Since our data set only contains white collar workers, this means that we are looking at large firms by Norwegian standard. A firm with 25 full time employed white collar workers have in 1993 on average 60 blue collar workers. Table 5 shows the effect of the restrictions on the sample on number of workers and firms.

[Table 5 about here.]

## 4.2  Blue collar data[12]

The blue collar data set was obtained from Teknologibedriftenes Landsforening/the Federation of Norwegian Manufacturing Industries (TBL). TBL is by far the largest federation within NHO. As of December 2003, TBL has about 1,150 member companies which employ about 66,000 workers. The member companies operate in industrial sectors ranging from mechanical and electrical engineering to information technology, furnishing and textile industries.[13] The data set, which covers blue collar workers only, consists of quarterly observations covering the years 1986-1998, i.e. a span of 13 years.[14] Each quarter covers on average 34,000 workers. The information in the data covers e.g. remuneartion (fixed, piece and overtime), hours worked (regular hours, piece hours and overtime). Each worker is classified on basis

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[11]This restriction implies that we do not allow firms to enter the sample. This should be kept in mind when looking at the entry rates and rates of firm growth.

[12]Please note that since this will be an additional data set used in only a few of the analysis, the description of the data will be somewhat more brief than the description of the white collar data.

[13]http://www.tbl.no/

[14]The 4th quarter of 1987 is missing.

of a 3 digit code describing which working group the worker is a member of, i.e. we have information on what kind of job the worker is doing.

We have linked this data set as described in Section 4.1 above, that is, in the same way we have linked the white collar data set.

### 4.2.1 Blue and white collar data

The next logical step to take was to merge the blue and white collar data sets to get one sample giving information on the whole firm. This is possible since TBL is member of NHO. Since most of the workers in the TBL data are working within the sector 38 (Manufacture of fabricated metal products, machinery and equipment) we constrained the merging to this sector.[15]

In merging the two data sets we had to take into account the fact that some of the information in the two sets were not originally compatible. The TBL data e.g. reports quarterly wage while the NHO data reports monthly wage. In the process of merging the two sets we had to make some adjustment of the TBL data to make them compatible with the NHO data. Further, since the NHO data span the years 1980-1997 and the TBL data span 1986-1998 we are restricted to the years 1986-1997.

After cleaning up the merging process for outliers and firms with only blue collar workers or only white collar workers and putting the same restrictions on the sample as given i Section 4.1.2 we are left with 25,103 workers in 1987, 28,328 in 1993 and 25,641 in 1997. Numbers of firms are 134, 167 and 147. This implies that we are able to link approximately 25-30% of the NHO firms with TBL firms.[16] In other words the firms in the blue collar data set is a subsample of the firms in the white collar data set, which is natural since TBL is one of several federations within the NHO.

### 4.3 Defining plant and firm

In this subsection we explain briefly how we were able to construct plants and firms—a construction which is crucial. Both data sets contain an employer identification number which is the employer's member number in TBL (blue collar data) or NHO (white collar data).[17] Whether this employer identification is plant, firm or a combination of the two is ambiguous. It is also unclear how plant and firm restructuring is handled. To overcome these obstacles we took advantage the National Employer-Employee register which links employers

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[15]When talking about blue collar workers in this paper we mean blue collar workers in sector 38.

[16]This number is rather rough since we look at the number of firms after imposing the restrictions in Section 4.1.2.

[17]The member numbers in TBL and NHO are not compatible.

and employees for administrative purposes related to tax and social benefits.[18] The Employer-Employee register uses the same person identification number as our white and blue collar data sets. Hence we use the person identification number as the merging variable when adding in plant and firm information from the Employer-Employee register.[19] In fact, the person identification number is the key variable that allow us to merge the new data sets with other firm and worker information that we have access to.

# 5  Results

In this section we provide detailed descriptive measures of the wage structure and wage mobility in Norway for both blue and white collar workers for the years 1981, 1986/87, 1993 and 1997. These years comprise two peak years and two trough years in the business cycle as explained in Section 2. The white collar results consist of all white collar workers covered by NHO and includes both manufacturing and private services. When we assess both white and blue collar workers working in the same firms, we are restricted to one sector within manufacturing only (Manufacture of fabricated metal products, machinery and equipment). However, this sector comprises about half the labour force in the manufacturing sector and both high tech and low tech sectors, as explained in section 2. It is important to distinguish the wage structure between white collar and blue workers in Norway since the institutional setting in wage determination is quite different for white collar and blue collar workers in the private sector. White collar workers mainly have their wages set at the firm or plant level, while blue collar workers' wages are mainly set at central bargaining. Robustness tests will be presented where we use plant level results instead of firm level results.

## 5.1  Wage structure

In Table 6 we present different measures for the structure of the level of wages for white collar workers. The table represents white collar workers including both the manufacturing sector and private services over the time period 1980-1997. In Table 7 the same type of result are presented for white and blue collar workers for about half of the manufacturing sector (Manufacture of fabricated metal products, machinery and equipment). In Figures 3 and 4 we depict in more detail than in the table the development of average wage by presenting the average wage and for the 90, 75, 25 and 10 percentile from 1981 to 1997. When we consider

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[18]To be precise, we do not use the actual numbers from the Employer-Employee register, but plant and firm numbers used by Statistics Norway and added to the Employer-Employee register by them.

[19]The original person identification number both in the white and blue collar data sets and in all national administrative registers is the individual's social security number. When preparing the various data sets for research use, Statistics Norway recodes the social security numbers in order to preserve anonymity. The link file between the orignal series and the recoded personal identification numbers used in our data sets is maintained by Statistics Norway only.

white collar workers only we notice that overall the real wage increase has been about 20 percent in the period. A similar type of development is true for blue collar workers (and white collar workers within the manufacturing sector as shown in Figure 4). Noticeable in both cases is a slight increase in wages by 1985 and then the real wage drops in the late 1980s due to the wage freeze at 5 percent nominal raise in for 1988 and 1999. Then the wages starts to rise again in the 1990s. We basically also see that the different portions of the wage distribution follow the same pattern and wage dispersion did not increase in this period within the group of white collar workers nor for all workers taken together. The result of a quite stable wage distribution is also confirmed by the estimated kernel densities for different years for both white collar workers in manufacturing and private services presented in Figure 5, and for both white and blue collar workers in Figures 6, 7 and 8. These results confirm previous findings of no increased wage dispersion in Norway in this period.[20] These results are quite different from the development in other OECD countries in the period and most notably for other Scandinavian countries (see Edin et al., 2004, Oyer, 2004 for Sweden, and Uusitalo and Vartianen, 2004 for Finland).

[Table 6 about here.]

[Table 7 about here.]

[Figure 3 about here.]

[Figure 4 about here.]

[Figure 5 about here.]

[Figure 6 about here.]

[Figure 7 about here.]

[Figure 8 about here.]

Turning to different workers groups by age, we see from Table 6 that older white collar workers (age 45-50) have a higher wage level than young (age 25-35) as expected, but also higher wage dispersion than young workers implying that unobserved characteristics are correlated with the age of the workers. However, both groups seem to follow the overall patterns in wage increase, although the wage dispersion appears to be increasing for older workers over time.

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[20]There is some evidence that the wage dispersion increased in the late 1990s.

Next we assess the variation of wages at the firm level. The main question here is whether the modest and stable wage dispersion overall in Norway also accounts for all firms, or put differently whether differences across firms in wage structure is modest. From the institutional setting we would expect that centralized wage setting induce very similar wage structures across firms, however, we do know that wage drift are important in some years even for blue collar workers (see Figure 2), and that central bargaining is less important for white collar workers than for blue collar workers.

Looking at the entry in the tables for firm level wages, we notice that the wage increase is about 20 percent increase on average for white collar workers also in the period we are analyzing and that it is similar for different parts of the wage distribution of firms. Very similar results are obtained for blue and white collar workers within manufacturing. These results are also confirmed by a stable standard deviation over time. These findings imply that there has not been any increased wage dispersion across firms over time and that most of the wage dispersion in Norway is within plants.

Since this is an important result we decomposed the wage structure in within and between firms and present the results in Figure 9 for white collar workers only and in Figure 10 for blue and white together (the figures are given in Table 14 and 15 in the Appendix). As expected only about 15 and 20 percent of the wage variation for white collar workers are between plants. Important to notice, however, is that there is a slight increase in the importance of firm wage differences at the end of the period. Somehow the firms become more different over time. Turning to the results for both white and blue collar workers in the same firm reported in Figure 10, we notice that there is a big difference between white collar and blue collar workers and between sectors. First, the total variance is as expected much larger white collar workers within the same sector. Second, the total variance for white collar workers are also as expected lower within the manufacturing sector than when the private services are included as in Figure 9. Hence, because of less variance within the manufacturing sector and the blue collar workers are in majority here, the total variance for both groups taken together is lower than the results shown for only white collar workers in Figure 10. However, again we obtain the result that the within part is dominating the between firm part and that there is a slight increase in the between part at the end of the period. One slightly puzzling result however, is that when we compare the between part for blue and white collar workers separately within the manufacturing sector, the between part is by far much bigger for blue collar workers than for white collar workers (see the details in Table 15 in the Appendix). Since firm level negotiations are much more important for white collar workers than for blue collar workers, we would have expected the opposite. As we can see from Figure 2, the wage drift part is also very important for blue collar workers so this may partly answer this puzzle.

[Figure 9 about here.]

[Figure 10 about here.]

In order to test whether the increased between firm component for white collar workers is due to changes in the worker composition on observables, we show the decomposition of the residual wage distribution in Figure 11 after condition out type of education, gender and age in a Mincer wage equation estimated annually (the wage equation and figures behind the decomposition are given in Table 16 and Table 17 in the Appendix). Two important findings are noticeable. We basically get the same result in the first part of the period in the between firm wage dispersion accounts for about 17 percent of the dispersion. However, controlling for compositional changes, the increase in the wage dispersion across firms at the end of the period completely disappears. This is made even clearer in Figure 12 where we report the ratio of the between firm and total variation. The large increase in differences in wages due to changes in the work force composition started in the beginning of the large downturn of the Norwegian economy in the late 1980s. The finding of relatively strong compositional changes in Norwegian firms in this period is also supported by other studies by assess reallocation of jobs and workers (Salvanes and Førre, 2003). Salvanes and Førre find that the dominating part of reallocation of jobs is between firms within 5-digit sectors indicating that structural change has been important in explaining the change in the composition of workers in the firms. The change has been connected to increased technological change and increased international trade.

[Figure 11 about here.]

[Figure 12 about here.]

The results both for changes in the wage dispersion and the role of firms in determining the wage dispersion are interesting when comparing to the results to other countries with different wage setting institutions. Due to limited information at the moment from other countries, we compare with two other Scandinavian countries, Sweden and Finland. As for Norway, Sweden started out with centralized wage bargaining but in the early 1980s basically decentralized wage bargaining to the industry level and unlike Norway they did not recentralize. Finland had partly decentralized wage bargaining at the industry level since the early 1980 and plant level bargaining has been important as in Norway over the whole period. When we compare both the total wage dispersion and the importance of the firm level in determining wages, Norway is very similar to Sweden in the 1980s when the wage bargaining institutions was similar. The firm level part constituted about 20 percent until about 1990, and then it increased to about 30 percent in Sweden at about year 2000. For Norway it increased less at least until 1997. A similar pattern is found when controlling for sorting to explain the increased importance of firms in determining wages; sorting is important also in Sweden but

unlike in Norway also real firm effects exists. Finland is very different from both Norway and Sweden in that the total wage dispersion is much smaller than in Norway and Sweden; but constant in the whole period. Furthermore, Finland is vastly different when it comes to the importance of firm effects; the firm effect is neglible in the beginning and explains the complete wage dispersion from the late 1990.

### 5.1.1 Firm size

There is strong empirical evidence that larger employers pay higher wages than smaller employers. (Davis and Haltiwanger 1996). Figure 13 shows the average of log monthly wage for white collar workers distributed by firm size. As can be seen, the wage increases by firm size. Furthermore, the level of the wage increases over time, which reflects the increase in real wages, while the slopes of the curves are almost the same over time. That is, it looks like the wage differences between classes of firm sizes are unchanged over time.

[Figure 13 about here.]

[Figure 14 about here.]

To get a picture of the wage dispersion we look at the Coefficient of variation between and within firms.[21] Figure 14 shows that the Coefficient of variation *between* firms decline with firm size while the Coefficient of variation *within* firms tends to increase with firm size, i.e. the they go in opposite directions. In other words, the wage dispersion within firms tends to increase with firm size, while the wage dispersion between firms tends to descrease with firm size.[22]

## 5.2 Wage dynamics

Turning to Tables 8 and 9 the wage changes in the period are presented for white collar only and for both blue and white collar workers. Focusing first on white collar workers, we notice that the wage changes differ strongly over the business cycle for this group of workers. The wage increase is much higher for the two peak periods 1985 to 1986 and 1996 to 1997, than the two years at low point years with a real decline in wages from 1980 to 1981. Actually this pro-cyclical pattern is strong and characterizes all segments of the wage change distribution. Notice also that there is a trend in wage changes in that the standard deviation of wages for white collar workers is increasing over time. The pro-cyclical pattern is found for both

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[21]We have no controls, i.e. we look at the raw wage data.

[22]Davis and Haltiwanger (1996) write "The negative realtionship of establishment size to wage dispersion [...] entirely reflects the behavior of the between-plant component of wage dispersion. [...] In contrast, the within-plant coefficient of wage variation tends to rise with establishment size." Our findings seem to be in line with this.

the 25th and the 75th percentile, and the wage increases are much stronger for the 75th percentile. When comparing the group of worker moving between firms to the stayers, the results indicate that most of these movers are voluntary movers since they have a much higher wage increase than the stayers. This result is especially strong for the 75th percentile. Again the cyclical patterns is strong pointing to voluntary movers. As we would expect, workers with low tenure have much higher wage increases than worker which have stayed with the firm for a while. And again the cyclical pattern is strong.

[Table 8 about here.]

[Table 9 about here.]

Turning the sample of both blue collar and white collar workers, the pro-cyclical pattern is present but much less pronounced. This indicates that white collar workers are under a more flexible regime in terms of wage setting whether it has to do with firm level negotiations or other factors determining their wages setting. Differences across stayers and movers, short and long tenured workers hold also for this group of workers.

## 5.3   Mobility

Tables 10, 11 and 12 provides information on hires and separations for white collar workers only, while Table 13 is for blue and white collar for the manufacturing sector. For white collar workers information is both given for the total samples and for different segments of the workers. Table 10 provides information for all workers, while Tables 11 and 12 provide information for the upper and lower segments of the workers. The segments are split by wage. We will focus mostly on the results for white collar workers.

[Table 10 about here.]

[Table 11 about here.]

[Table 12 about here.]

[Table 13 about here.]

The restriction for all the analyses in this paper is that the firm has to be 25 or more employees both in year t and t-1, and the mobility results are for all of these firms and for large firms (100+ employees). We see that the firm level has been increasing over time from 121 in 1980/81 to 139 in 1996/97, and for the largest firms the size has risen from 287 to 345 employees. Occupation is defined as a combination of groups (A-F) and up to seven levels within each group. There are 22 combinations in the data defining occupations. The average

number of occupations within firms has been stable in the period and is 13 and 16 for all firms and for large firms, respectively. The number of levels has also been stable in the period and is about 6 for all firms and about 6.8 for the 100+ firms. The number of levels appears to be larger for Norwegian firms than for Swedish firms (Oyer, 2004). We also notice that there was a negative growth rate for all firms taken together but a positive growth rate for large firms indicating that the distribution of firm size is changing in Norway in this period.

In order to illustrate the pattern of worker mobility we present in Figure 15 the exit and entry rates by year, firm size, and for the lower and upper segments. The exit rate or worker separability rate for all white collar workers taken together is about 15 percent annually for all firms and about 10 percent for large firms. The entry rate or hiring rate is between 13 and 19 percent for all firms and between 9 and 12 percent for large firms. Hence, one observation is that the turnover rates are high even for white collar workers and is decreases with form size as expected. These results are but quite similar for previous work using other data sets and splitting the worker turnover rates by education level and taking into consideration that we are using a different part of the firm size distribution (Salvanes and Forre, 2003). Considering different segments of the work force, we notice that low level jobs within the white collar segment have much higher levels of both entry and exit rates. Thus lower level jobs are more volatile than high level jobs. In Figure 16 we split the entry and exit rates also by the top and bottom wage quartile at the firm level, and we see much of the same pattern that workers in high wage firms have lower turnover rates.

[Figure 15 about here.]

[Figure 16 about here.]

The cyclical pattern is quite interesting for worker flows. The exit rates or worker separation rates are quite stable over the cycle whereas the job destruction rates  which comprise one part of the worker separation rate - are for many countries found to be counter-cyclical (for the US see, Davis and Haltiwanger, 1995; and for Norway see Salvanes, 1997). This pattern appears to be true for all segments of the firms. It is the entry rates that vary over the cycle in a pro-cyclical fashion. Looking at job creation rates only, standard results is that they are stable over the cycle. This pattern appears to be true for all segments of the work force but more pronounced for the lower level jobs.

We also report in Tables 10, 11 and 12 the percentage of workers switching jobs internally and it is about 10 percent. It is similar across firm size, but notably much higher for high level jobs as we would expect. We also report the number of new job filled internally which is about 50 percent considering all white collar workers. Also as we would expect, this number of internally filled jobs are much lower at the lower end of the job level distribution since

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we would expect that those jobs are filled externally since the ports of entry jobs are at the bottom.

We also report the result for both blue and white collar workers taken together in Table 13. The blue collar workers comprise the bulk of the jobs here since this data is from the manufacturing sector. The external turnover rates are much the same as for white collar workers. The internal rates are quite different in that the percentage of internal switchers are half the size of the number for white collar workers only. Also the percentage of jobs filled internally are much lower since we expect that these jobs are filled primarily externally.

## 6  Summary and conclusions

Summary and conclusions....

## A  Tables.....

[Table 14 about here.]

[Table 15 about here.]

[Table 16 about here.]

[Table 17 about here.]

### A.1  Plant versus firm

[Table 18 about here.]

[Table 19 about here.]

[Table 20 about here.]

[Figure 17 about here.]

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Figure 1: Unemployment rate and 1-year growth rate GDP.

Figure 2: Total wage change in Norway decomposed by central and local bargained wage.
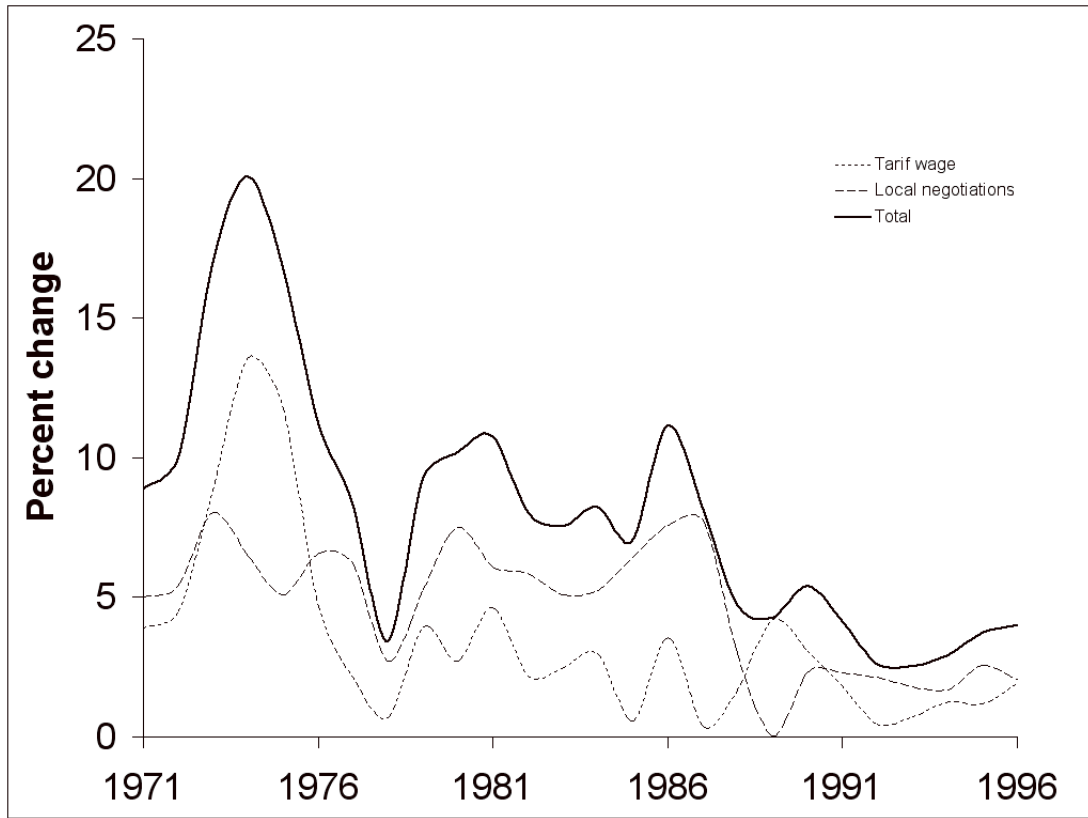
Figure 3: log monthly wage for white collar workers.
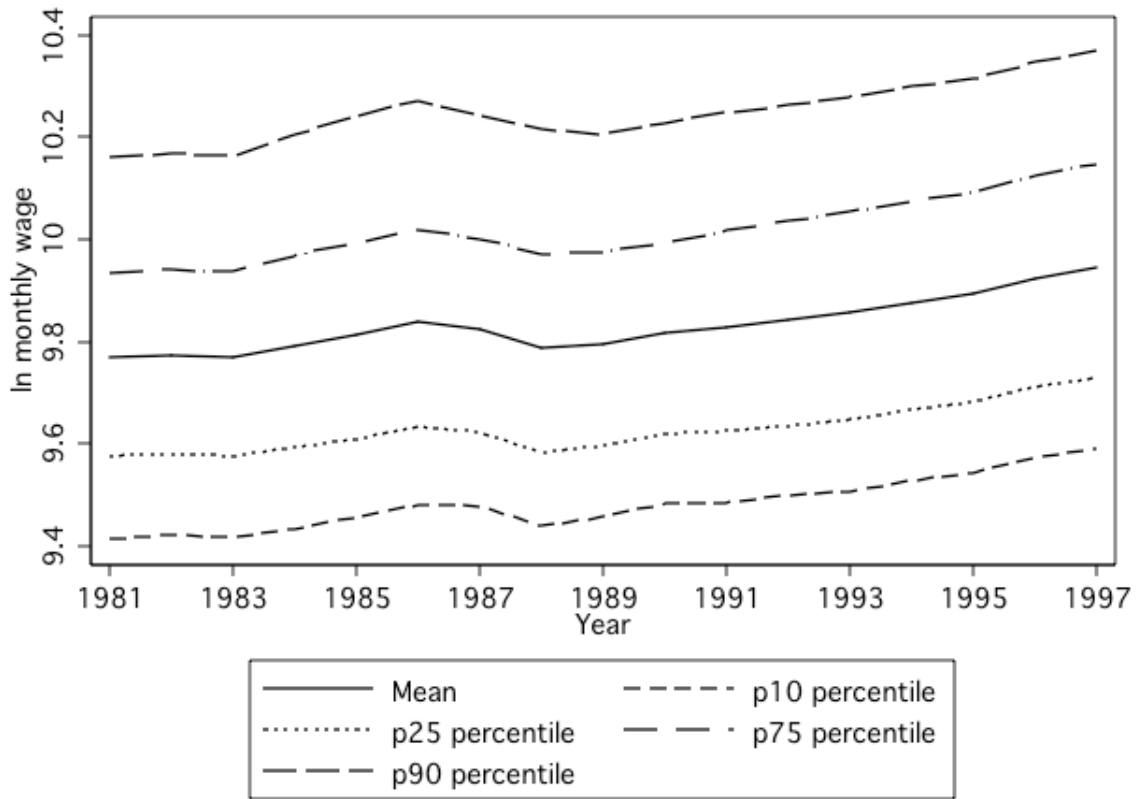
Figure 4: log monthly wage for blue and white collar workers.
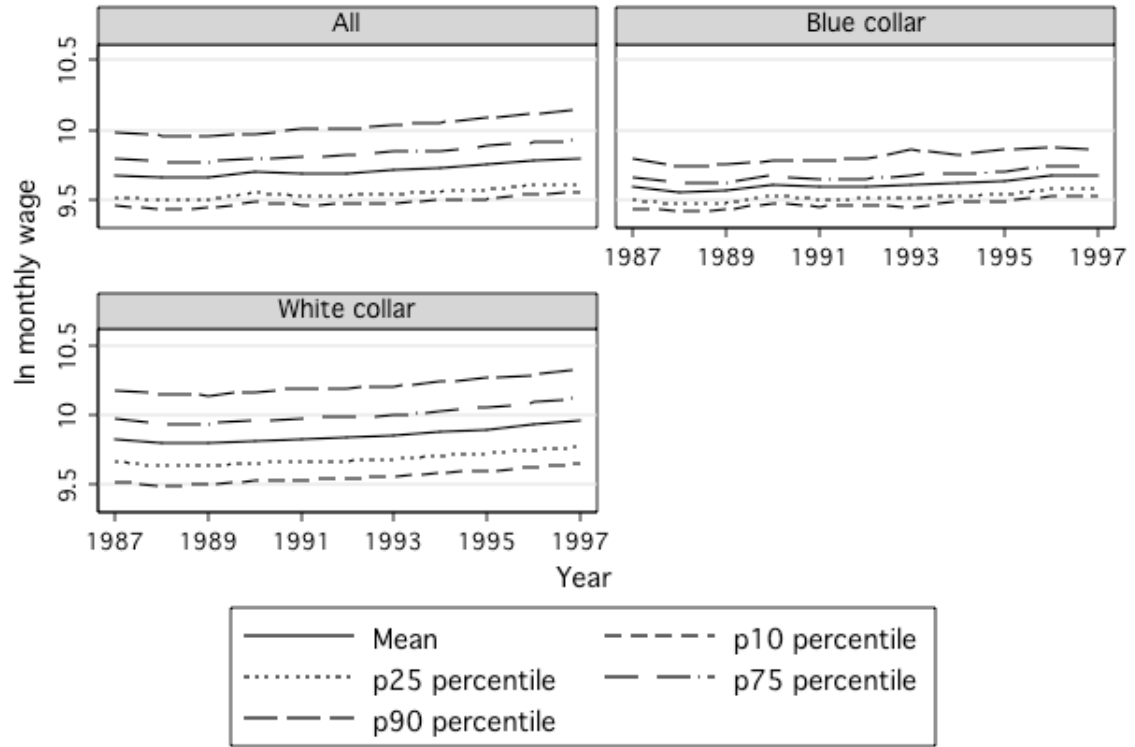
Figure 5: Kernel density for white collar workers.

Figure 6: Kernel density for all workers.

Figure 7: Kernel density for blue and white collar workers.
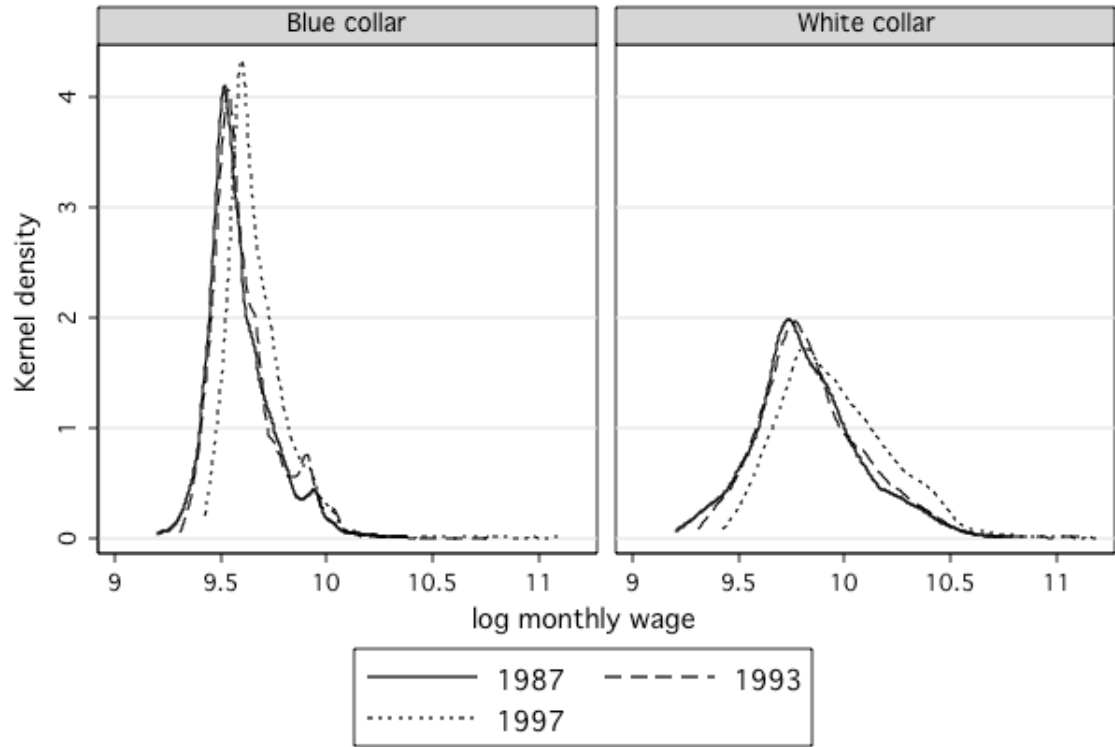
Figure 8: Kernel density for blue and white collar workers by year.
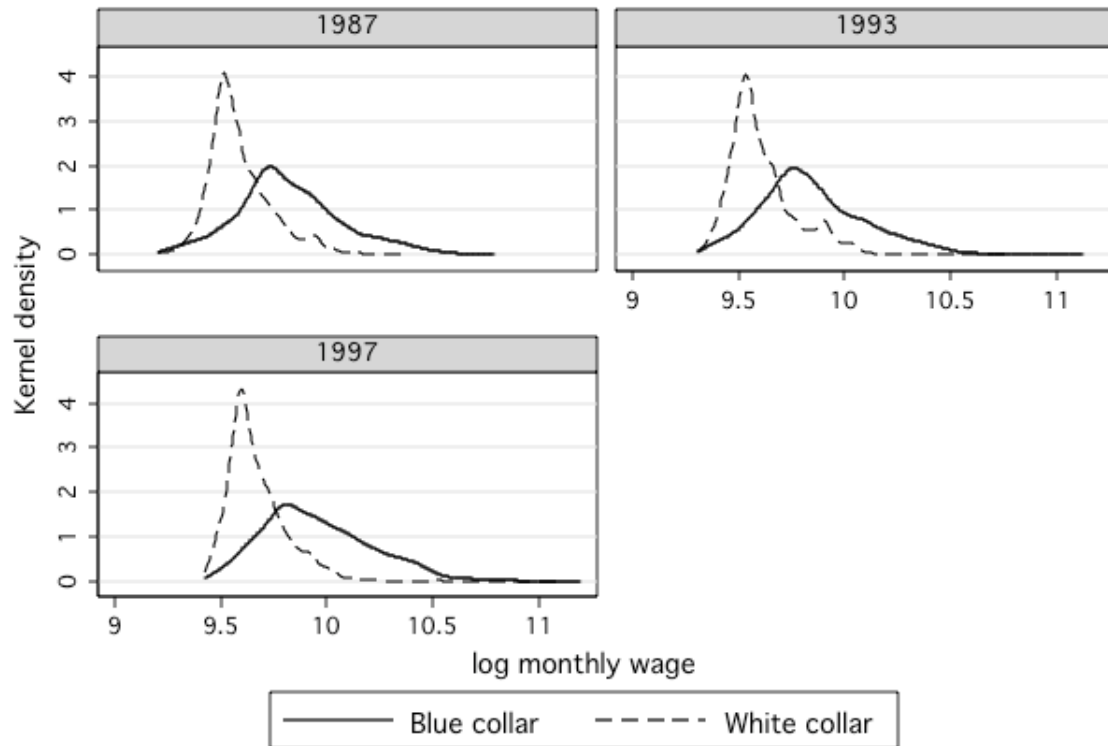
Figure 9: The log of wages decomposed.
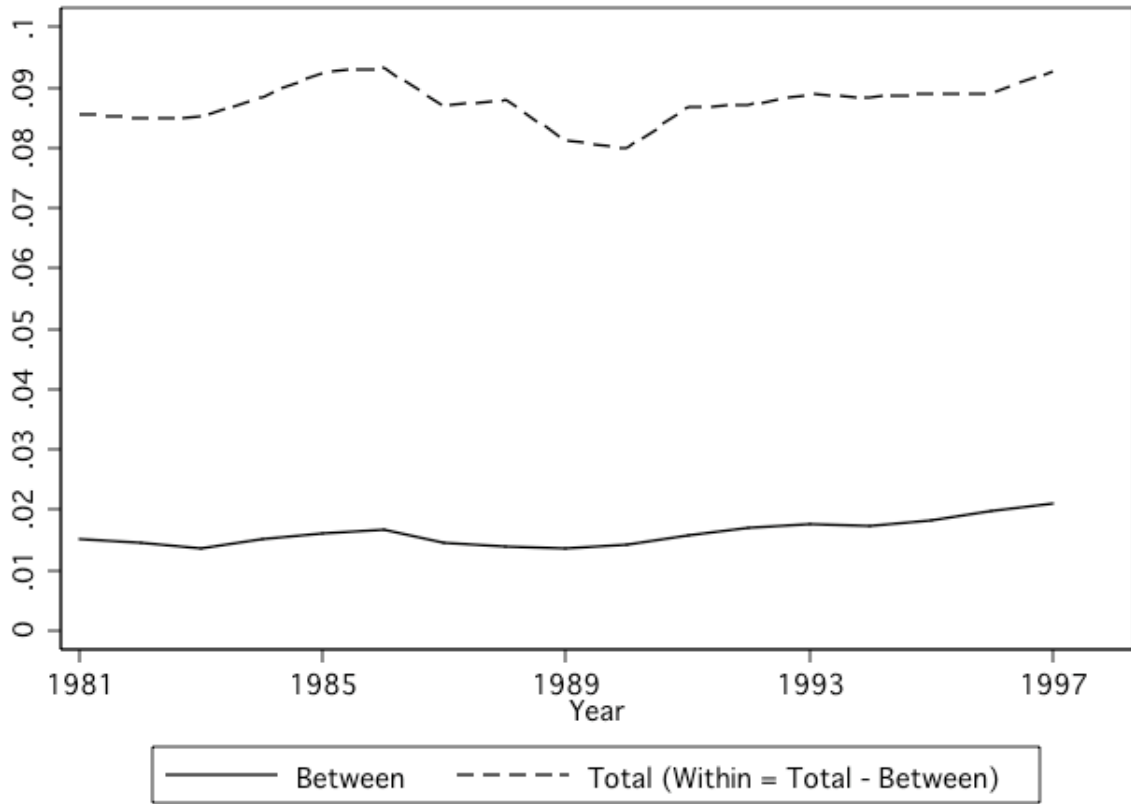
Figure 10: Decomposition of log monthly wage.
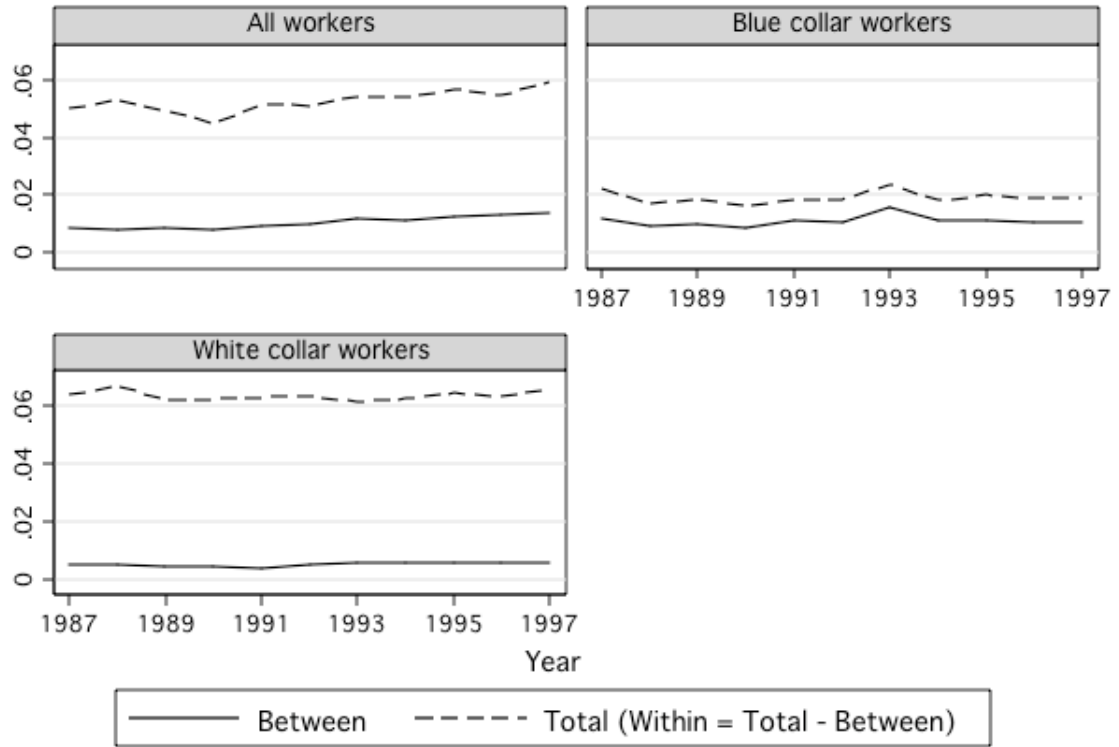
Figure 11: The residuals from the Mincer-equation decomposed.
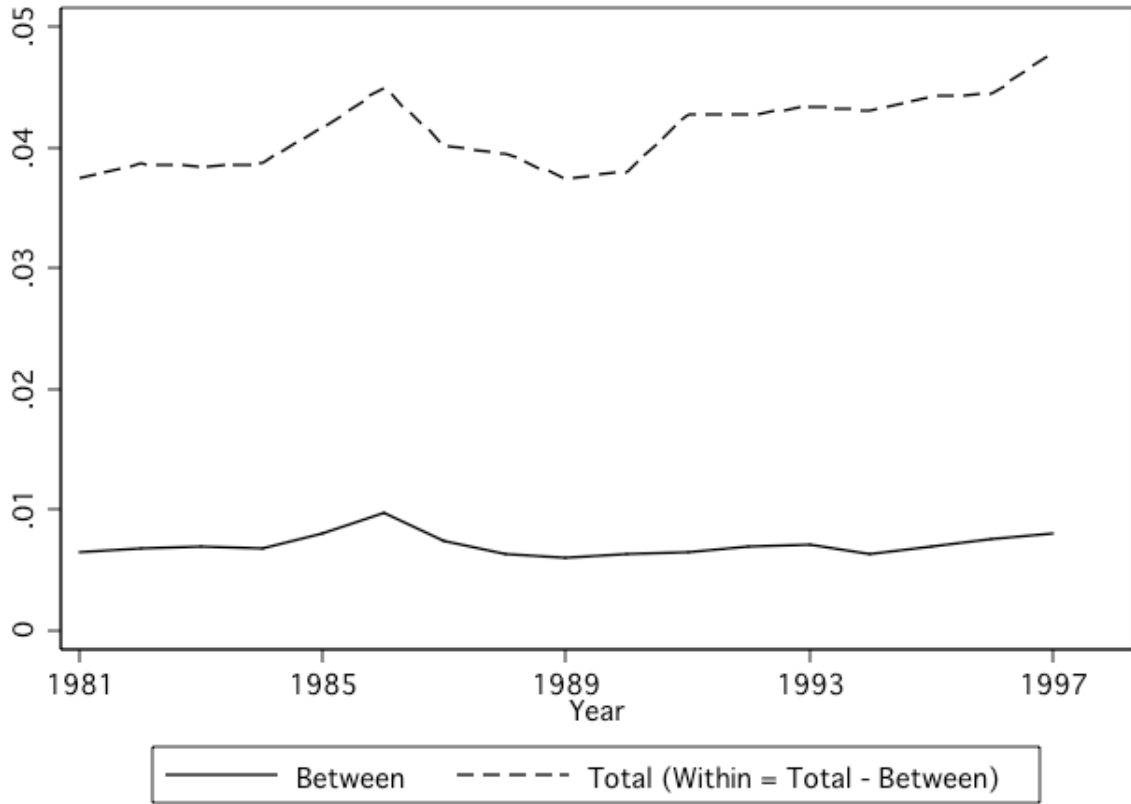
Figure 12: Fraction of total variance explained by between effects.
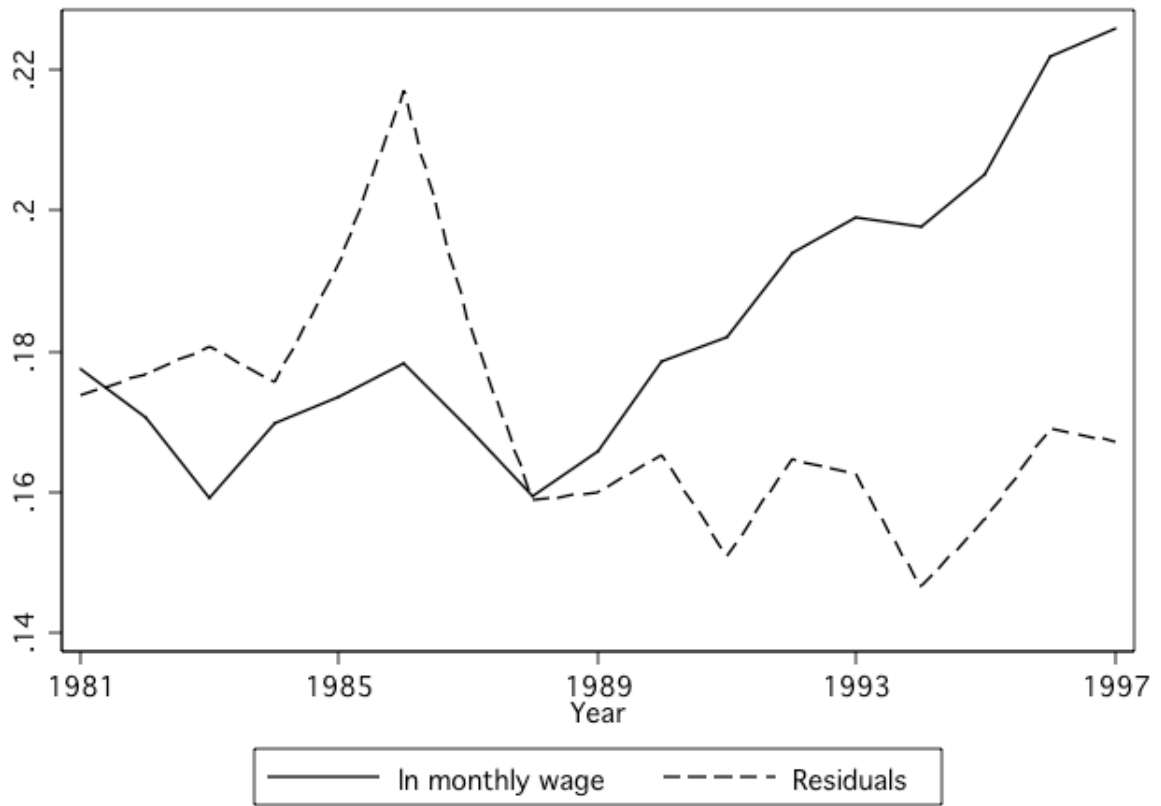
Figure 13: Mean of firm mean ln monthly wage by firm size. White collar workers.
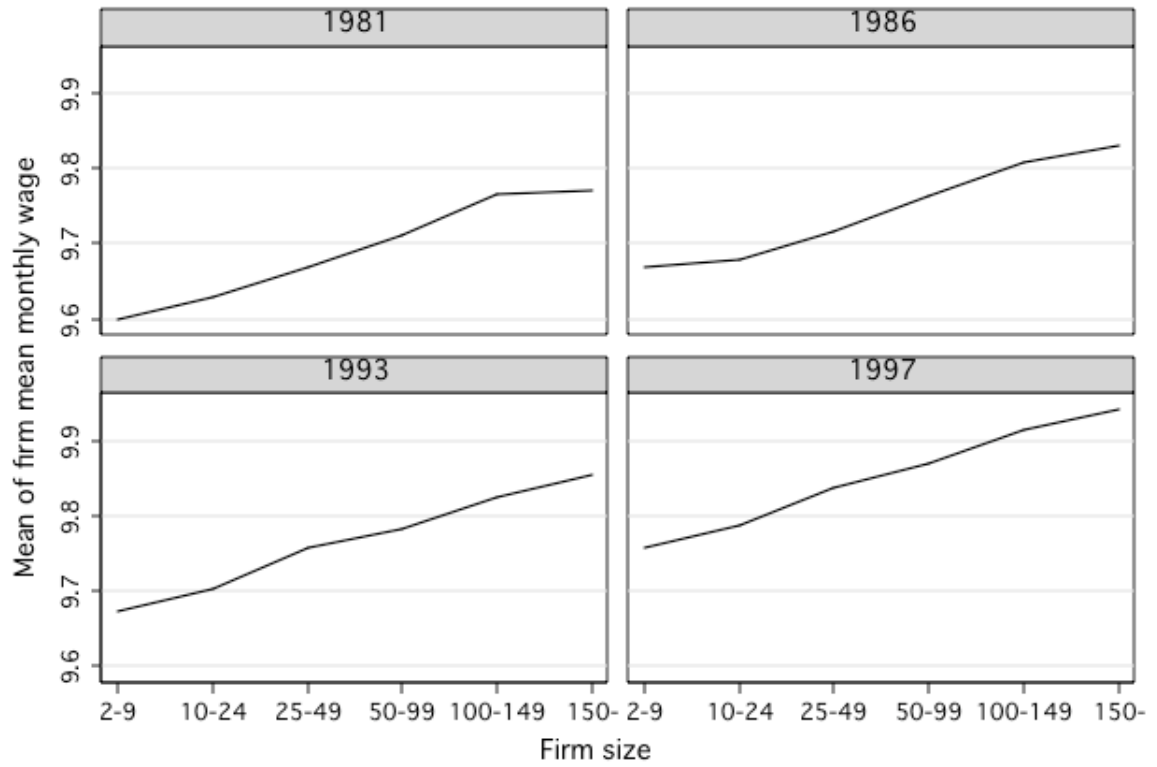


Graphs by Year

Figure 14: Coefficient of Variaton within and between firms. White collar workers
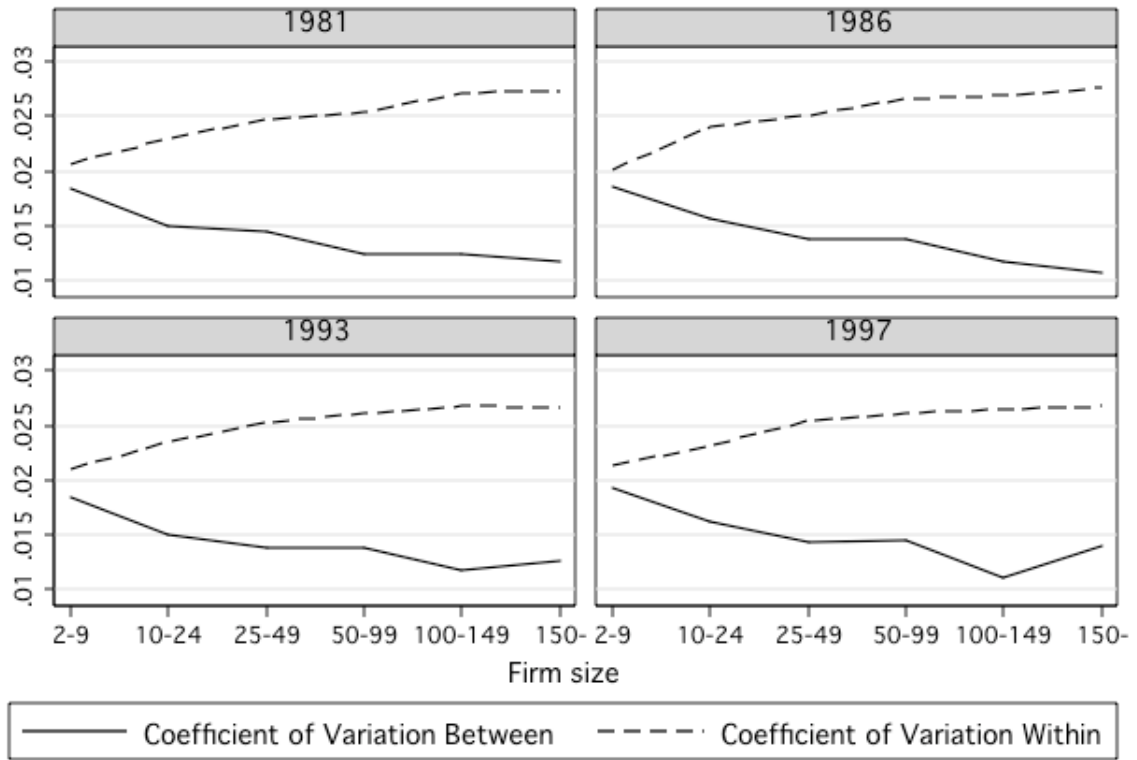


Graphs by Year

Figure 15: Exit and entry rates: firm level.
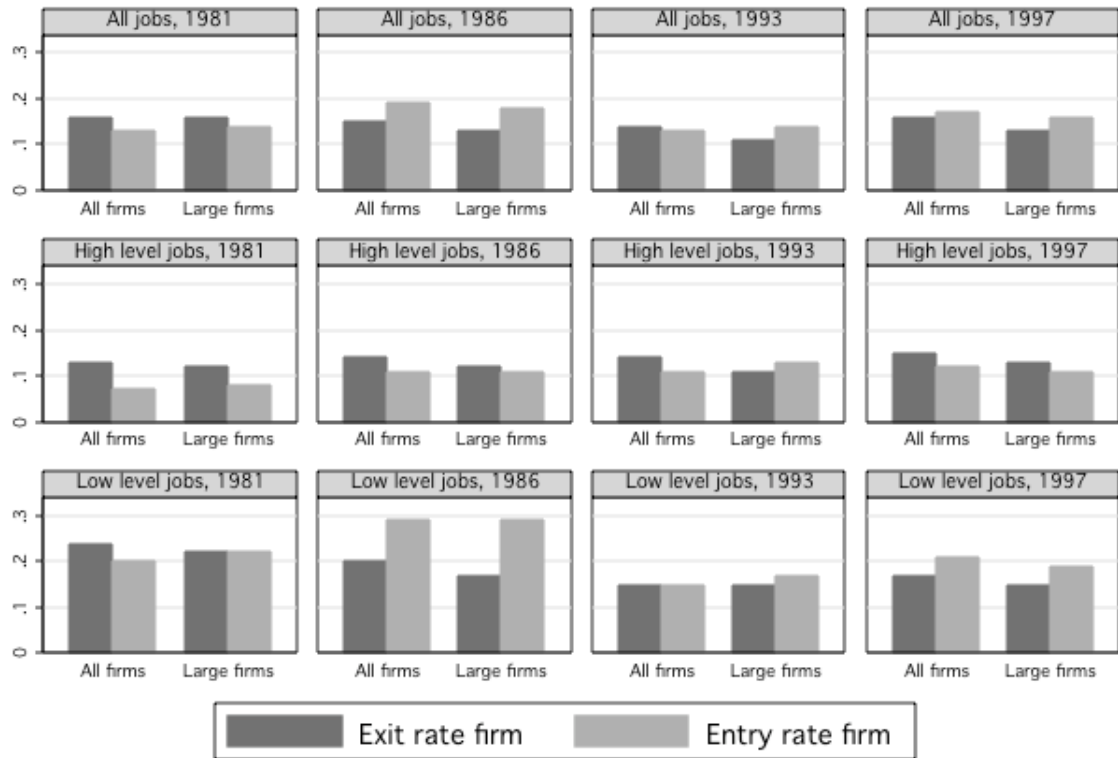


Graphs by Jobs and Year

Figure 16: Exit and entry rates split by all/high/low level jobs and top/bottom quartile of firm wages
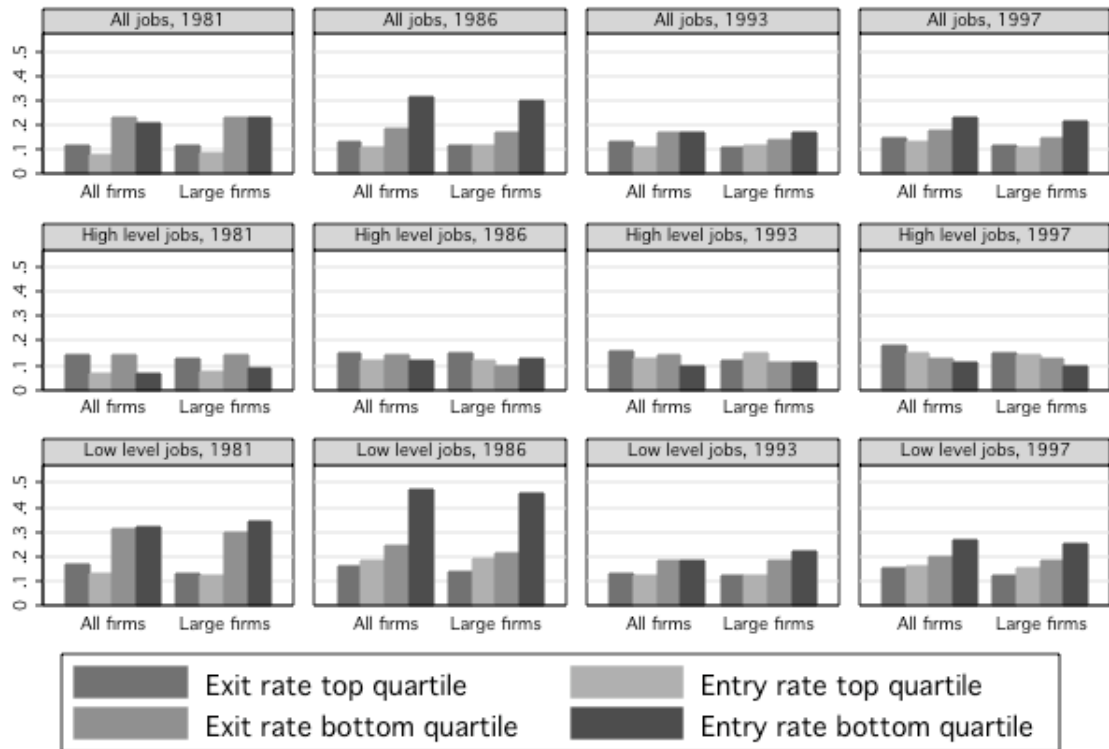


Graphs by Jobs and Year

Figure 17: Exit and entry rates split by firm and plant.
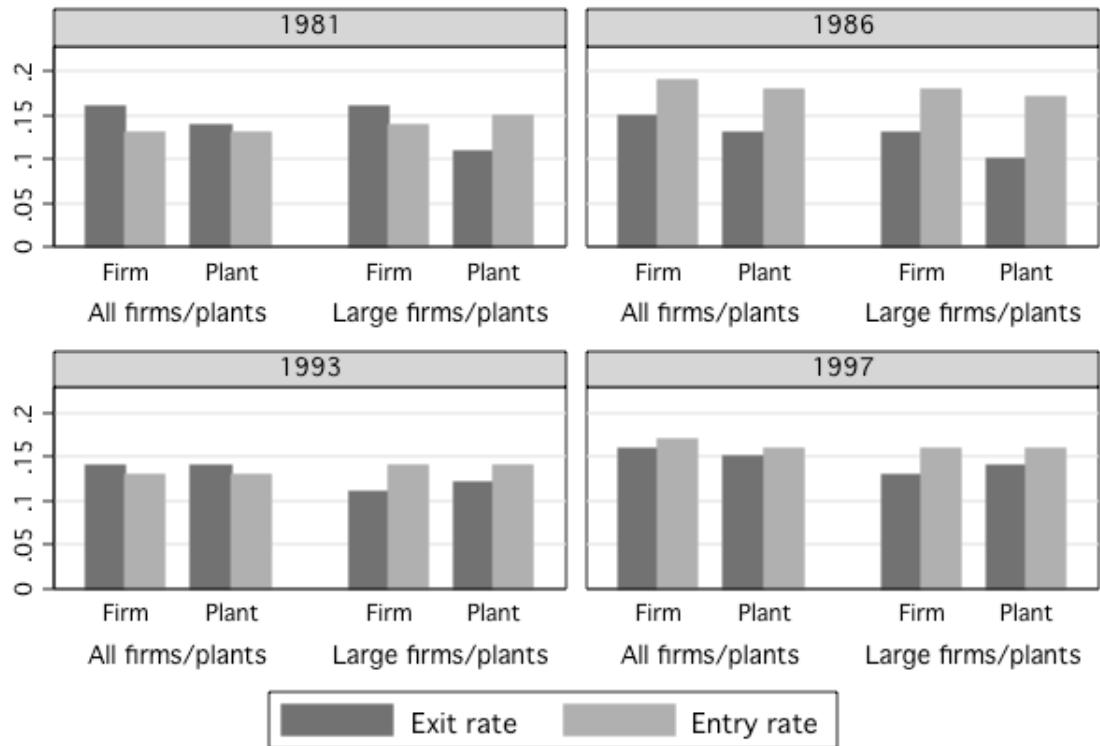


Graphs by Year

Table 1: Macroeconomic conditions.

| Year | Unemployment rate[a] | Economic growth (% change in GDP)[b] | | |
|------|------|------|------|------|
| | | 1 year | 2 year | 5 year |
| 1971 | . | 5.00 | . | . |
| 1972 | 1.7 | 4.97 | 4.99 | . |
| 1973 | 1.5 | 4.32 | 4.64 | . |
| 1974 | 1.5 | 4.11 | 4.21 | . |
| 1975 | 2.3 | 5.10 | 4.60 | 4.70 |
| 1976 | 2.0 | 5.70 | 5.40 | 4.84 |
| 1977 | 1.0 | 4.18 | 4.94 | 4.68 |
| 1978 | 1.8 | 3.43 | 3.80 | 4.50 |
| 1979 | 2.0 | 4.38 | 3.91 | 4.56 |
| 1980 | 1.7 | 4.83 | 4.61 | 4.50 |
| **1981** | **2.0** | **0.96** | **2.90** | **3.56** |
| 1982 | 2.6 | 0.21 | 0.58 | 2.76 |
| 1983 | 3.4 | 3.52 | 1.86 | 2.78 |
| 1984 | 3.2 | 5.74 | 4.63 | 3.05 |
| 1985 | 2.6 | 5.07 | 5.40 | 3.10 |
| **1986** | **2.0** | **3.54** | **4.30** | **3.61** |
| 1987 | 2.1 | 2.03 | 2.79 | 3.98 |
| 1988 | 3.2 | -0.04 | 1.00 | 3.27 |
| 1989 | 4.9 | 0.95 | 0.45 | 2.31 |
| 1990 | 5.2 | 2.06 | 1.51 | 1.71 |
| 1991 | 5.5 | 3.55 | 2.81 | 1.71 |
| 1992 | 5.9 | 3.25 | 3.40 | 1.95 |
| **1993** | **6.0** | **2.69** | **2.97** | **2.50** |
| 1994 | 5.4 | 5.12 | 3.91 | 3.33 |
| 1995 | 4.9 | 4.27 | 4.69 | 3.78 |
| 1996 | 4.8 | 5.12 | 4.69 | 4.09 |
| **1997** | **4.0** | **5.06** | **5.09** | **4.45** |
| 1998 | 3.2 | 2.60 | 3.83 | 4.43 |
| 1999 | 3.2 | 2.11 | 2.35 | 3.83 |
| 2000 | 3.4 | 2.80 | 2.45 | 3.54 |
| 2001 | 3.6 | 1.91 | 2.35 | 2.89 |
| 2002 | 3.9 | 0.95 | 1.43 | 2.07 |

[a]The unemployment rate is taken from the Norwegian Labour Force Survey (AKU) published by Statistics Norway (1974, 1978, 1984, 1997 and 2003).

[b]The growth numbers are computed based on numbers from Statistics Norway (2003b). In the computation the GDP numbers are fixed at 2000 prices. The formula used is $growth_{GDP} = 100(\ln GDP_t - \ln GDP_{t-yr})/yr$ where $t = 1971, \ldots, 2002$ and $yr \in \{1, 2, 5\}$

Table 2: Distribution of the workers on the occupational groups.

| Occupational group | Year | | | |
|---|---|---|---|---|
| | 1981 | 1986 | 1993 | 1997 |
| A0 | 0.41 | 0.5 | 0.51 | 0.55 |
| A1 | 2.18 | 2.58 | 3.68 | 4.12 |
| A2 | 4.8 | 6.5 | 6.9 | 6.88 |
| A31 | 4.43 | 5.22 | 4.34 | 4.63 |
| A32 | 5.65 | 6.64 | 8.74 | 8.33 |
| A41 | 1.45 | 1.63 | 1.36 | 1.19 |
| A42 | 7.29 | 7.33 | 7.33 | 8.42 |
| A5 | 4.82 | 4.8 | 4.09 | 4.61 |
| A6 | 1.79 | 1.68 | 1.61 | 1.34 |
| B1 | 0.59 | 0.54 | 0.68 | 0.76 |
| B2 | 2.25 | 1.93 | 1.98 | 1.92 |
| B3 | 11.96 | 9.16 | 7.26 | 6.34 |
| C0 | 0.92 | 1.02 | 1.07 | 1.11 |
| C1 | 5.55 | 5.5 | 6.6 | 6.41 |
| C2 | 8.83 | 9.79 | 10.32 | 10.6 |
| C3 | 13.34 | 14.08 | 14.6 | 13.9 |
| C4 | 9.88 | 7.92 | 6.29 | 5.81 |
| D1 | 0.33 | 0.27 | 0.36 | 0.29 |
| D2 | 0.96 | 0.68 | 0.92 | 0.86 |
| E1 | 1.44 | 1.2 | 0.93 | 0.79 |
| E2 | 3.04 | 2.92 | 1.81 | 1.91 |
| F | 8.08 | 8.11 | 8.63 | 9.23 |
| Total | 100 | 100 | 100 | 100 |

Table 3: Harmonization of the levels.

| Level | Occupational groups |
| --- | --- |
| 7 (top) | A0, C0 |
| 6 | A1, B1, C1 |
| 5 | A2 |
| 4 | A31, A32, B2, C2 |
| 3 | A41, A42, B2, C3, D1, E1 |
| 2 | A5, F, D2, E2 |
| 1 (bottom) | A6, C4 |

Table 4: Distribution of the workers on the harmonized levels.

| Level | Year | | | |
|---|---|---|---|---|
| | 1981 | 1986 | 1993 | 1997 |
| 7 (top) | 1.32 | 1.52 | 1.58 | 1.65 |
| 6 | 8.33 | 8.62 | 10.96 | 11.29 |
| 5 | 4.8 | 6.5 | 6.9 | 6.88 |
| 4 | 21.16 | 23.57 | 25.39 | 25.49 |
| 3 | 35.81 | 33.68 | 31.84 | 30.93 |
| 2 | 16.9 | 16.5 | 15.44 | 16.6 |
| 1 (bottom) | 11.67 | 9.6 | 7.89 | 7.16 |
| Total | 100 | 100 | 100 | 100 |

Table 5: The effect of the restrictions on the numbers of workers (top panel) and firms in the sample.

|  | 1981 | 1986 | 1993 | 1997 |
|---|---|---|---|---|
| No restrictions | 74,075 | 91,911 | 100,087 | 111,336 |
| Hours per week $\geq 30$ | 73,777 | 91,710 | 94,446 | 104,986 |
| Firmsize $\geq 25$ in year $t$ | 60,657 | 78,614 | 80,875 | 87,587 |
| Firmsize $\geq 25$ in year $t-1$ | 56,924 | 73,654 | 76,737 | 79,472 |

|  | 1981 | 1986 | 1993 | 1997 |
|---|---|---|---|---|
| No restrictions | 2,348 | 2,622 | 2,682 | 3,838 |
| Hours per week $\geq 30$ | 2,327 | 2,614 | 2,510 | 3,525 |
| Firmsize $\geq 25$ in year $t$ | 532 | 592 | 587 | 679 |
| Firmsize $\geq 25$ in year $t-1$ | 470 | 508 | 531 | 571 |

Table 6: Structure of wages within and between firms.

| | Monthly wages | | | | Log monthly wages | | | |
|---|---|---|---|---|---|---|---|---|
| | 1981 | 1986 | 1993 | 1997 | 1981 | 1986 | 1993 | 1997 |
| Average wage | 18,258 | 19,690 | 19,991 | 21,838 | 9.8 | 9.8 | 9.9 | 9.9 |
| sd | 5,808 | 6,561 | 6,456 | 7,084 | .29 | .31 | .3 | .3 |
| 75%-ile | 20,642 | 22,463 | 23,251 | 25,544 | 9.9 | 10 | 10 | 10 |
| 25%-ile | 14,411 | 15,256 | 15,465 | 16,788 | 9.6 | 9.6 | 9.6 | 9.7 |
| N-workers | 56,924 | 73,654 | 76,737 | 79,472 | 56,924 | 73,654 | 76,737 | 79,472 |
| Average of firm average wage | 17,230 | 18,187 | 18,669 | 20,371 | 9.7 | 9.8 | 9.8 | 9.9 |
| sd | 2,345 | 2,416 | 2,653 | 2,976 | .14 | .13 | .13 | .14 |
| 75%-ile | 18,802 | 19,801 | 20,126 | 22,293 | 9.8 | 9.9 | 9.9 | 10 |
| 25%-ile | 15,529 | 16,364 | 16,892 | 18,374 | 9.6 | 9.7 | 9.7 | 9.8 |
| N-firms | 470 | 508 | 531 | 571 | 470 | 508 | 531 | 571 |
| Average of sd of wage | 4,568 | 5,003 | 5,113 | 5,584 | .25 | .26 | .25 | .26 |
| sd | 1,206 | 1,386 | 1,648 | 1,641 | .048 | .057 | .056 | .057 |
| 75%-ile | 5,297 | 5,780 | 5,845 | 6,338 | .28 | .28 | .28 | .28 |
| 25%-ile | 3,739 | 4,093 | 4,108 | 4,577 | .22 | .23 | .22 | .22 |
| N-firms | 470 | 508 | 531 | 571 | 470 | 508 | 531 | 571 |
| Average Coeffcient of Variation of wage | .26 | .27 | .27 | .27 | .026 | .026 | .026 | .026 |
| sd | .05 | .056 | .061 | .058 | .0049 | .006 | .0057 | .0058 |
| 75%-ile | .3 | .3 | .3 | .3 | .028 | .029 | .028 | .028 |
| 25%-ile | .23 | .24 | .24 | .24 | .023 | .023 | .023 | .023 |
| N-firms | 470 | 508 | 531 | 571 | 470 | 508 | 531 | 571 |
| Correlation between average wage and sd of wage | .74 | .72 | .72 | .72 | .2 | .059 | .3 | .2 |
| Average wage for workers between 25 and 30 | 15,484 | 16,980 | 16,299 | 17,615 | 9.6 | 9.7 | 9.7 | 9.8 |
| sd | 3,179 | 3,801 | 3,287 | 3,569 | .2 | .22 | .2 | .21 |
| 75%-ile | 17,339 | 19,114 | 18,343 | 19,777 | 9.8 | 9.9 | 9.8 | 9.9 |
| 25%-ile | 13,193 | 14,256 | 13,909 | 15,026 | 9.5 | 9.6 | 9.5 | 9.6 |
| N-workers | 7,387 | 11,635 | 10,889 | 9,147 | 7,387 | 11,635 | 10,889 | 9,147 |
| Average wage for workers between 45 and 50 | 19,969 | 21,349 | 21,360 | 23,251 | 9.9 | 9.9 | 9.9 | 10 |
| sd | 6,288 | 7,180 | 7,325 | 7,845 | .29 | .3 | .31 | .32 |
| 75%-ile | 22,629 | 24,340 | 25,388 | 27,973 | 10 | 10 | 10 | 10 |
| 25%-ile | 15,771 | 16,439 | 16,166 | 17,372 | 9.7 | 9.7 | 9.7 | 9.8 |
| N-workers | 7,243 | 9,040 | 14,690 | 13,993 | 7,243 | 9,040 | 14,690 | 13,993 |

Table 7: Structure of wages within and between firms.

|  | Log monthly wage | | | Log monthly wage | | |
|---|---|---|---|---|---|---|
|  | 1987 | 1993 | 1997 | 1987 | 1993 | 1997 |
| Average wage | 16,372 | 17,043 | 18,534 | 9.7 | 9.7 | 9.8 |
| sd | 4,215 | 4,562 | 5,270 | .22 | .23 | .24 |
| 75%-ile | 17,866 | 18,946 | 20,408 | 9.8 | 9.8 | 9.9 |
| 25%-ile | 13,589 | 13,882 | 14,906 | 9.5 | 9.5 | 9.6 |
| N-workers | 24,119 | 26,552 | 24,695 | 24,119 | 26,552 | 24,695 |
| Average of firm average wage | 15,473 | 15,990 | 17,165 | 9.6 | 9.7 | 9.7 |
| sd | 1,612 | 1,800 | 1,937 | .096 | .1 | .1 |
| 75%-ile | 16,602 | 17,080 | 18,244 | 9.7 | 9.7 | 9.8 |
| 25%-ile | 14,364 | 14,583 | 15,620 | 9.6 | 9.6 | 9.6 |
| N-firms | 119 | 147 | 134 | 119 | 147 | 134 |
| Average of sd of wage | 3,251 | 3,520 | 3,922 | .18 | .19 | .19 |
| sd | 1,036 | 1,096 | 1,286 | .045 | .044 | .047 |
| 75%-ile | 3,896 | 4,112 | 4,750 | .21 | .21 | .22 |
| 25%-ile | 2,544 | 2,813 | 3,047 | .15 | .16 | .16 |
| N-firms | 119 | 147 | 134 | 119 | 147 | 134 |
| Average Coefficient of | | | | | | |
| Variation of wage | .21 | .22 | .23 | .019 | .019 | .02 |
| sd | .052 | .053 | .058 | .0046 | .0044 | .0047 |
| 75%-ile | .24 | .25 | .26 | .021 | .022 | .023 |
| 25%-ile | .17 | .18 | .19 | .016 | .017 | .017 |
| N-firms | 119 | 147 | 134 | 119 | 147 | 134 |
| Correlation between average | | | | | | |
| wage and sd of wage | .72 | .69 | .76 | .52 | .52 | .59 |
| Average wage for workers | | | | | | |
| between 25 and 30 | 15,648 | 15,685 | 16,686 | 9.6 | 9.6 | 9.7 |
| sd | 2,931 | 2,817 | 2,929 | .17 | .17 | .16 |
| 75%-ile | 17,131 | 17,175 | 18,047 | 9.7 | 9.8 | 9.8 |
| 25%-ile | 13,556 | 13,625 | 14,673 | 9.5 | 9.5 | 9.6 |
| N-workers | 3,296 | 4,617 | 3,691 | 3,296 | 4,617 | 3,691 |
| Average wage for workers | | | | | | |
| between 45 and 50 | 17,214 | 17,925 | 19,416 | 9.7 | 9.8 | 9.8 |
| sd | 4,677 | 5,332 | 5,951 | .24 | .26 | .27 |
| 75%-ile | 18,985 | 19,998 | 21,828 | 9.9 | 9.9 | 10 |
| 25%-ile | 13,867 | 14,080 | 15,118 | 9.5 | 9.6 | 9.6 |
| N-workers | 3,101 | 4,443 | 3,933 | 3,101 | 4,443 | 3,933 |

Table 8: Wage dynamics (defined as wage in year $t$ minus wage in year $t-1$).

| | $\Delta$ monthly wages | | | | $\Delta$ log monthly wages | | | |
|---|---|---|---|---|---|---|---|---|
| | 1981 | 1986 | 1993 | 1997 | 1981 | 1986 | 1993 | 1997 |
| Average change in wage | -93 | 902 | 358 | 744 | -.0037 | .046 | .019 | .035 |
| sd | 1,230 | 1,265 | 1,506 | 1,607 | .065 | .062 | .074 | .092 |
| 75%-ile | 428 | 1,325 | 522 | 980 | .025 | .071 | .027 | .045 |
| 25%-ile | -764 | 236 | -75 | 111 | -.043 | .013 | -.0042 | .0054 |
| N-workers | 50,444 | 60,580 | 68,870 | 69,884 | 50,444 | 60,580 | 68,870 | 69,884 |
| Average of firm average | | | | | | | | |
| change in wage | -169 | 819 | 278 | 666 | -.008 | .046 | .016 | .034 |
| sd | 628 | 471 | 383 | 504 | .037 | .027 | .024 | .026 |
| 75%-ile | 187 | 1,058 | 477 | 904 | .012 | .06 | .026 | .046 |
| 25%-ile | -547 | 570 | 63 | 354 | -.03 | .031 | .0036 | .019 |
| N-firms | 470 | 508 | 531 | 571 | 470 | 508 | 531 | 571 |
| Average of sd of | | | | | | | | |
| change in wage | 956 | 1,001 | 990 | 1,336 | .053 | .053 | .061 | .077 |
| sd | 402 | 465 | 859 | 850 | .024 | .028 | .052 | .061 |
| 75%-ile | 1,120 | 1,182 | 1,217 | 1,590 | .06 | .061 | .072 | .093 |
| 25%-ile | 693 | 712 | 580 | 843 | .039 | .039 | .033 | .042 |
| N-firms | 470 | 508 | 531 | 571 | 470 | 508 | 531 | 571 |
| Average Coefficient of | | | | | | | | |
| Variation in change in wage | 257 | 1,644 | 568 | 1,148 | .017 | .081 | .028 | .056 |
| sd | 1,859 | 2,403 | 1,825 | 2,293 | .1 | .12 | .11 | .13 |
| 75%-ile | 983 | 2,669 | 905 | 1,727 | .055 | .14 | .046 | .081 |
| 25%-ile | -707 | 263 | -62 | 114 | -.035 | .014 | -.0035 | .0063 |
| N-workers | 1,294 | 814 | 2,713 | 2,883 | 1,294 | 814 | 2,713 | 2,883 |
| Average change in wage for | | | | | | | | |
| workers with tenure < 3 years | 203 | 1,214 | 578 | 1,050 | .014 | .067 | .031 | .054 |
| sd | 1,347 | 1,438 | 1,375 | 1,832 | .076 | .076 | .088 | .11 |
| 75%-ile | 791 | 1,797 | 932 | 1,505 | .053 | .1 | .049 | .075 |
| 25%-ile | -547 | 385 | -27 | 161 | -.033 | .022 | -.0017 | .0086 |
| N-workers | 4,842 | 13,344 | 10,751 | 10,965 | 4,842 | 13,344 | 10,751 | 10,965 |
| Average change in wage for | | | | | | | | |
| workers with tenure $\geq$3 years | -170 | 815 | 318 | 686 | -.0086 | .041 | .017 | .031 |
| sd | 1,156 | 1,197 | 1,524 | 1,554 | .059 | .056 | .07 | .086 |
| 75%-ile | 318 | 1,193 | 461 | 898 | .018 | .062 | .024 | .04 |
| 25%-ile | -814 | 209 | -84 | 106 | -.045 | .011 | -.0048 | .0051 |
| N-workers | 25,215 | 46,885 | 58,052 | 58,830 | 25,215 | 46,885 | 58,052 | 58,830 |

Table 9: Wage dynamics

| | Δ log monthly wage | | | Δ log monthly wage | | |
|---|---|---|---|---|---|---|
| | 1987 | 1993 | 1997 | 1987 | 1993 | 1997 |
| Average change in wage | 376 | 349 | 466 | .03 | .021 | .024 |
| sd | 1,481 | 1,380 | 1,524 | .088 | .084 | .082 |
| 75%-ile | 930 | 592 | 798 | .064 | .035 | .043 |
| 25%-ile | -370 | -127 | -11 | -.021 | -.0085 | -.00066 |
| N-workers | 21,897 | 24,333 | 21,411 | 21,897 | 24,333 | 21,411 |
| Average of firm average | | | | | | |
| change in wage | 466 | 190 | 390 | .036 | .013 | .022 |
| sd | 490 | 416 | 454 | .032 | .03 | .025 |
| 75%-ile | 806 | 332 | 613 | .06 | .023 | .036 |
| 25%-ile | 154 | -53 | 101 | .017 | -.0025 | .0047 |
| N-firms | 119 | 147 | 134 | 119 | 147 | 134 |
| Average sd of | | | | | | |
| change in wage | 1,164 | 888 | 1,158 | .075 | .056 | .065 |
| sd | 705 | 666 | 575 | .034 | .039 | .028 |
| 75%-ile | 1,346 | 1,112 | 1,430 | .087 | .068 | .086 |
| 25%-ile | 809 | 508 | 725 | .057 | .031 | .044 |
| N-firms | 119 | 147 | 134 | 119 | 147 | 134 |
| Average Coefficient of | | | | | | |
| Variation in change in wage | 424 | 326 | 803 | .033 | .016 | .041 |
| sd | 1,900 | 2,160 | 2,289 | .12 | .11 | .12 |
| 75%-ile | 1,024 | 1,141 | 1,635 | .069 | .067 | .086 |
| 25%-ile | -513 | -384 | -112 | -.03 | -.021 | -.0052 |
| N-workers | 672 | 346 | 740 | 672 | 346 | 740 |
| Average change in wage for | | | | | | |
| workers with tenure < 3 years | 701 | 719 | 790 | .056 | .049 | .047 |
| sd | 1,600 | 1,753 | 1,953 | .11 | .11 | .11 |
| 75%-ile | 1,334 | 1,270 | 1,350 | .095 | .078 | .08 |
| 25%-ile | -136 | -31 | 54 | -.0091 | -.0017 | .0032 |
| N-workers | 5,056 | 3,603 | 3,642 | 5,056 | 3,603 | 3,642 |
| Average change in wage for | | | | | | |
| workers with tenure ≥ 3 years | 279 | 285 | 399 | .022 | .016 | .02 |
| sd | 1,428 | 1,294 | 1,411 | .078 | .077 | .074 |
| 75%-ile | 833 | 499 | 691 | .057 | .029 | .037 |
| 25%-ile | -433 | -137 | -27 | -.024 | -.0091 | -.0015 |
| N-workers | 16,841 | 20,730 | 17,769 | 16,841 | 20,730 | 17,769 |

Table 10: Mobility. Panel A: all jobs.

| | All firms | | | | Firms with 100+ employees | | | |
|---|---|---|---|---|---|---|---|---|
| | 1981 | 1986 | 1993 | 1997 | 1981 | 1986 | 1993 | 1997 |
| Number of firms | 470 | 508 | 531 | 571 | 144 | 170 | 174 | 173 |
| Employees | 121 | 145 | 145 | 139 | 287 | 332 | 341 | 345 |
| sd | 198 | 294 | 291 | 302 | 297 | 453 | 448 | 491 |
| Number of occupations | 13 | 13 | 13 | 12 | 16 | 16 | 16 | 15 |
| sd | 3.8 | 3.9 | 3.8 | 3.9 | 2.5 | 2.6 | 3.2 | 3.1 |
| Number of levels | 6.1 | 6.2 | 6.1 | 6 | 6.7 | 6.8 | 6.7 | 6.6 |
| sd | .92 | .89 | .91 | .94 | .49 | .45 | .57 | .59 |
| Employment growth | -.019 | .063 | -.028 | -.015 | .015 | .085 | .076 | .035 |
| sd | .23 | .2 | .45 | .27 | .32 | .21 | .73 | .38 |
| Exit rate (all) | .16 | .14 | .14 | .16 | .11 | .093 | .081 | .094 |
| Exit rate | .16 | .15 | .14 | .16 | .16 | .13 | .11 | .13 |
| sd | .1 | .1 | .13 | .12 | .11 | .084 | .079 | .07 |
| Exit rate top quartile of firm wages | .12 | .13 | .13 | .15 | .12 | .12 | .11 | .12 |
| sd | .12 | .12 | .14 | .14 | .11 | .1 | .1 | .079 |
| Exit rate bottom quartile of firm wages | .23 | .19 | .17 | .18 | .23 | .17 | .14 | .15 |
| sd | .15 | .15 | .16 | .16 | .13 | .1 | .11 | .097 |
| Entry rate | .13 | .19 | .13 | .17 | .14 | .18 | .14 | .16 |
| sd | .11 | .1 | .13 | .13 | .12 | .099 | .14 | .13 |
| Entry rate top quartile of firm wages | .078 | .11 | .11 | .13 | .086 | .12 | .12 | .11 |
| sd | .11 | .11 | .15 | .13 | .11 | .11 | .17 | .12 |
| Entry rate bottom quartile of firm wages | .21 | .32 | .17 | .23 | .23 | .3 | .17 | .22 |
| sd | .17 | .17 | .16 | .19 | .16 | .15 | .16 | .17 |
| % of workers who switch jobs internally | .11 | .11 | .1 | .1 | .11 | .11 | .1 | .1 |
| sd | .098 | .094 | .085 | .092 | .098 | .074 | .068 | .088 |
| % of new jobs filled internally | .47 | .35 | .48 | .41 | .47 | .37 | .5 | .43 |
| sd | .3 | .21 | .26 | .26 | .26 | .18 | .2 | .22 |
| % of workers with tenure ≥ 5 years | .068 | .56 | .67 | .62 | .077 | .56 | .69 | .67 |
| sd | .15 | .24 | .24 | .24 | .15 | .24 | .2 | .23 |
| Corr(exit rate, average wage) | -.16 | -.12 | -.055 | .0042 | -.13 | -.14 | .038 | .13 |
| Corr(exit rate, average wage change) | -.0096 | .019 | -.0045 | .036 | .009 | -.06 | .022 | -.077 |
| Corr(exit rate, sd of wage) | -.078 | -.027 | .039 | .11 | -.063 | -.098 | .14 | .25 |
| Corr(entry rate, average wage) | -.062 | -.14 | .034 | -.17 | .065 | -.03 | .068 | -.12 |
| Corr(entry rate, average wage change) | .016 | .037 | -.085 | .012 | .024 | .041 | -.14 | .025 |
| Corr(entry rate, sd of wage) | .052 | .058 | .069 | -.044 | .14 | .2 | .0098 | .0061 |

Table 11: Mobility. Panel B: high level jobs.

| | All firms | | | | Firms with 100+ employees | | | |
|---|---|---|---|---|---|---|---|---|
| | 1981 | 1986 | 1993 | 1997 | 1981 | 1986 | 1993 | 1997 |
| Number of firms | 468 | 504 | 525 | 552 | 144 | 170 | 174 | 173 |
| Employees | 18 | 24 | 28 | 29 | 40 | 56 | 69 | 75 |
| sd | 29 | 80 | 106 | 140 | 43 | 133 | 177 | 245 |
| Number of occupations | 3.3 | 3.4 | 3.3 | 3.2 | 4.3 | 4.5 | 4.3 | 4.3 |
| sd | 1.3 | 1.4 | 1.4 | 1.4 | .97 | 1.1 | 1.2 | 1.2 |
| Number of levels | 2.2 | 2.3 | 2.2 | 2.2 | 2.7 | 2.8 | 2.7 | 2.7 |
| sd | .74 | .75 | .77 | .75 | .49 | .45 | .54 | .55 |
| Employment growth | .052 | .13 | .061 | .055 | .097 | .11 | .19 | .05 |
| sd | .47 | .55 | .64 | .5 | .55 | .33 | .97 | .28 |
| Exit rate (all) | .14 | .12 | .13 | .14 | .098 | .078 | .085 | .1 |
| Exit rate | .13 | .14 | .14 | .15 | .12 | .12 | .11 | .13 |
| sd | .16 | .16 | .17 | .17 | .12 | .11 | .11 | .097 |
| Exit rate top quartile of firm wages | .14 | .15 | .16 | .18 | .13 | .15 | .12 | .15 |
| sd | .23 | .24 | .26 | .26 | .17 | .17 | .15 | .15 |
| Exit rate bottom quartile of firm wages | .14 | .14 | .14 | .13 | .14 | .096 | .11 | .13 |
| sd | .24 | .24 | .24 | .23 | .18 | .14 | .16 | .15 |
| Entry rate | .072 | .11 | .11 | .12 | .081 | .11 | .13 | .11 |
| sd | .12 | .13 | .17 | .17 | .12 | .12 | .17 | .13 |
| Entry rate top quartile of firm wages | .065 | .12 | .13 | .15 | .071 | .12 | .15 | .14 |
| sd | .17 | .22 | .24 | .26 | .15 | .17 | .22 | .19 |
| Entry rate bottom quartile of firm wages | .067 | .12 | .094 | .11 | .086 | .13 | .11 | .097 |
| sd | .16 | .21 | .21 | .23 | .15 | .16 | .19 | .16 |
| % of workers who switch jobs internally | .15 | .15 | .11 | .11 | .16 | .15 | .11 | .12 |
| sd | .19 | .18 | .15 | .16 | .15 | .13 | .12 | .13 |
| % of new jobs filled internally | .48 | .46 | .39 | .38 | .64 | .56 | .51 | .52 |
| sd | .44 | .39 | .4 | .4 | .37 | .32 | .35 | .35 |
| % of workers with tenure ≥ 5 years | .073 | .63 | .67 | .67 | .083 | .62 | .71 | .72 |
| sd | .19 | .29 | .27 | .29 | .18 | .27 | .21 | .24 |
| Corr(exit rate, average wage) | -.13 | -.093 | .022 | .14 | -.061 | -.14 | .046 | .15 |
| Corr(exit rate, average wage change) | .044 | .071 | .023 | -.013 | -.075 | .0033 | .011 | -.14 |
| Corr(exit rate, sd of wage) | -.011 | .0073 | .12 | .069 | -.036 | -.028 | .064 | .17 |
| Corr(entry rate, average wage) | -.014 | -.018 | .15 | .12 | .045 | .038 | .018 | .043 |
| Corr(entry rate, average wage change) | .025 | .011 | -.059 | .0011 | .064 | .059 | -.025 | -.02 |
| Corr(entry rate, sd of wage) | .11 | .099 | .17 | .092 | .086 | .17 | .011 | .14 |

Table 12: Mobility. Panel C: low level jobs.

| | All firms | | | | Firms with 100+ employees | | | |
|---|---|---|---|---|---|---|---|---|
| | 1981 | 1986 | 1993 | 1997 | 1981 | 1986 | 1993 | 1997 |
| Number of firms | 458 | 494 | 509 | 538 | 144 | 170 | 172 | 169 |
| Employees | 19 | 20 | 16 | 15 | 43 | 39 | 33 | 31 |
| sd | 29 | 29 | 32 | 31 | 42 | 42 | 50 | 50 |
| Number of occupations | 2.1 | 2.1 | 1.9 | 1.8 | 2.5 | 2.5 | 2.3 | 2.2 |
| sd | .83 | .83 | .83 | .78 | .74 | .8 | .88 | .77 |
| Number of levels | 1.6 | 1.6 | 1.5 | 1.5 | 1.8 | 1.7 | 1.6 | 1.6 |
| sd | .5 | .5 | .5 | .5 | .43 | .46 | .49 | .49 |
| Employment growth | -.045 | .2 | -.11 | -.087 | .023 | .12 | -.093 | -.058 |
| sd | .56 | .84 | .53 | .55 | .7 | .48 | .58 | .65 |
| Exit rate (all) | .22 | .18 | .15 | .17 | .15 | .11 | .092 | .11 |
| Exit rate | .24 | .2 | .15 | .17 | .22 | .17 | .15 | .15 |
| sd | .19 | .19 | .2 | .2 | .13 | .13 | .15 | .17 |
| Exit rate top quartile of firm wages | .17 | .16 | .13 | .15 | .13 | .14 | .12 | .12 |
| sd | .26 | .25 | .25 | .26 | .16 | .18 | .19 | .21 |
| Exit rate bottom quartile of firm wages | .31 | .24 | .18 | .2 | .3 | .21 | .18 | .18 |
| sd | .3 | .29 | .28 | .29 | .21 | .19 | .23 | .23 |
| Entry rate | .2 | .29 | .15 | .21 | .22 | .29 | .17 | .19 |
| sd | .21 | .21 | .2 | .24 | .19 | .17 | .18 | .21 |
| Entry rate top quartile of firm wages | .13 | .18 | .12 | .16 | .12 | .19 | .12 | .15 |
| sd | .24 | .27 | .26 | .29 | .2 | .22 | .22 | .25 |
| Entry rate bottom quartile of firm wages | .32 | .47 | .18 | .27 | .34 | .46 | .22 | .25 |
| sd | .33 | .35 | .29 | .35 | .28 | .27 | .27 | .29 |
| % of workers who switch jobs internally | .048 | .057 | .073 | .059 | .051 | .046 | .072 | .062 |
| sd | .11 | .12 | .13 | .13 | .087 | .08 | .11 | .094 |
| % of new jobs filled internally | .16 | .13 | .25 | .17 | .19 | .13 | .29 | .23 |
| sd | .28 | .23 | .36 | .29 | .27 | .2 | .33 | .3 |
| % of workers with tenure ≥ 5 years | .047 | .44 | .63 | .6 | .058 | .45 | .67 | .66 |
| sd | .13 | .29 | .32 | .33 | .13 | .26 | .27 | .29 |
| Corr(exit rate, average wage) | -.19 | -.13 | -.0023 | -.082 | -.23 | -.27 | .069 | -.13 |
| Corr(exit rate, average wage change) | .082 | .036 | -.012 | -.014 | .027 | .0094 | .11 | -.049 |
| Corr(exit rate, sd of wage) | -.052 | .0073 | -.03 | -.058 | -.13 | -.045 | -.16 | -.078 |
| Corr(entry rate, average wage) | -.18 | -.29 | -.1 | -.24 | -.15 | -.32 | -.21 | -.31 |
| Corr(entry rate, average wage change) | .13 | .092 | -.045 | .012 | .24 | .14 | -.072 | -.076 |
| Corr(entry rate, sd of wage) | .06 | .16 | .04 | -.011 | .013 | .17 | .14 | .06 |

Table 13: Mobility. Panel A: all jobs.

| | All firms | | | Firms with 100+ employees | | |
|---|---|---|---|---|---|---|
| | 1987 | 1993 | 1997 | 1987 | 1993 | 1997 |
| Number of firms | 119 | 147 | 134 | 55 | 60 | 61 |
| Employees | 203 | 181 | 184 | 377 | 368 | 338 |
| sd | 288 | 265 | 242 | 352 | 337 | 293 |
| Number of occupations | 11 | 12 | 12 | 15 | 16 | 15 |
| sd | 4.1 | 4.1 | 4 | 2.5 | 2.9 | 2.9 |
| Number of levels | 5.6 | 5.7 | 5.7 | 6.2 | 6.4 | 6.5 |
| sd | 1.1 | 1.1 | 1.2 | .79 | .72 | .65 |
| Employment growth | -.064 | -.034 | .092 | -.074 | .047 | .18 |
| sd | .25 | .33 | .33 | .22 | .41 | .41 |
| Exit rate (all) | .24 | .13 | .12 | .21 | .1 | .099 |
| Exit rate | .21 | .11 | .12 | .23 | .11 | .13 |
| sd | .12 | .1 | .074 | .13 | .11 | .072 |
| Exit rate top quartile of firm wages | .25 | .1 | .12 | .26 | .11 | .12 |
| sd | .2 | .11 | .087 | .2 | .13 | .079 |
| Exit rate bottom quartile of firm wages | .22 | .14 | .15 | .24 | .15 | .16 |
| sd | .14 | .14 | .13 | .11 | .15 | .12 |
| Entry rate | .12 | .083 | .15 | .12 | .11 | .16 |
| sd | .087 | .1 | .11 | .083 | .13 | .11 |
| Entry rate top quartile of firm wages | .096 | .084 | .11 | .1 | .092 | .13 |
| sd | .1 | .12 | .11 | .089 | .12 | .1 |
| Entry rate bottom quartile of firm wages | .18 | .11 | .24 | .17 | .15 | .26 |
| sd | .17 | .15 | .19 | .13 | .18 | .17 |
| % of workers who switch jobs internally | .05 | .05 | .047 | .05 | .055 | .052 |
| sd | .052 | .044 | .046 | .048 | .039 | .039 |
| % of new jobs filled internally | .32 | .43 | .27 | .34 | .43 | .29 |
| sd | .26 | .3 | .24 | .25 | .23 | .21 |
| % of workers with tenure $\geq 5$ years | .54 | .74 | .65 | .56 | .69 | .62 |
| sd | .27 | .19 | .18 | .27 | .19 | .2 |
| Corr(exit rate, average wage) | .043 | .054 | -.097 | -.1 | -.042 | -.2 |
| Corr(exit rate, average wage change) | -.033 | -.049 | .025 | .042 | -.061 | .029 |
| Corr(exit rate, sd of wage) | .043 | .038 | -.1 | -.062 | -.1 | -.23 |
| Corr(entry rate, average wage) | -.013 | .021 | .076 | -.031 | -.21 | .12 |
| Corr(entry rate, average wage change) | -.017 | -.074 | -.28 | -.087 | .085 | -.16 |
| Corr(entry rate, sd of wage) | -.088 | .054 | -.024 | -.11 | -.11 | .056 |

Table 14: Decomposition of log monthly wage, white collar workers.

| Year | Total | Between |
|------|--------|---------|
| 1981 | 0.0857 | 0.0152 |
| 1982 | 0.0849 | 0.0145 |
| 1983 | 0.0851 | 0.0135 |
| 1984 | 0.0885 | 0.0150 |
| 1985 | 0.0925 | 0.0160 |
| 1986 | 0.0933 | 0.0166 |
| 1987 | 0.0870 | 0.0147 |
| 1988 | 0.0879 | 0.0140 |
| 1989 | 0.0813 | 0.0135 |
| 1990 | 0.0799 | 0.0143 |
| 1991 | 0.0867 | 0.0158 |
| 1992 | 0.0872 | 0.0169 |
| 1993 | 0.0888 | 0.0177 |
| 1994 | 0.0884 | 0.0175 |
| 1995 | 0.0890 | 0.0183 |
| 1996 | 0.0891 | 0.0198 |
| 1997 | 0.0928 | 0.0209 |

Table 15: Decomposition of log monthly wage.

| Year | Total | Between | Group of workers |
|------|-------|---------|------------------|
| 1987 | 0.0501 | 0.0088 | All |
| 1988 | 0.0527 | 0.0077 | All |
| 1989 | 0.0493 | 0.0083 | All |
| 1990 | 0.0449 | 0.0077 | All |
| 1991 | 0.0512 | 0.0092 | All |
| 1992 | 0.0510 | 0.0096 | All |
| 1993 | 0.0542 | 0.0118 | All |
| 1994 | 0.0536 | 0.0113 | All |
| 1995 | 0.0567 | 0.0122 | All |
| 1996 | 0.0545 | 0.0129 | All |
| 1997 | 0.0593 | 0.0140 | All |
| 1987 | 0.0639 | 0.0047 | White collar |
| 1988 | 0.0667 | 0.0047 | White collar |
| 1989 | 0.0622 | 0.0040 | White collar |
| 1990 | 0.0623 | 0.0043 | White collar |
| 1991 | 0.0629 | 0.0040 | White collar |
| 1992 | 0.0632 | 0.0047 | White collar |
| 1993 | 0.0614 | 0.0057 | White collar |
| 1994 | 0.0624 | 0.0054 | White collar |
| 1995 | 0.0644 | 0.0057 | White collar |
| 1996 | 0.0632 | 0.0055 | White collar |
| 1997 | 0.0654 | 0.0058 | White collar |
| 1987 | 0.0223 | 0.0115 | Blue collar |
| 1988 | 0.0168 | 0.0093 | Blue collar |
| 1989 | 0.0183 | 0.0098 | Blue collar |
| 1990 | 0.0163 | 0.0087 | Blue collar |
| 1991 | 0.0180 | 0.0110 | Blue collar |
| 1992 | 0.0185 | 0.0108 | Blue collar |
| 1993 | 0.0238 | 0.0160 | Blue collar |
| 1994 | 0.0181 | 0.0113 | Blue collar |
| 1995 | 0.0200 | 0.0113 | Blue collar |
| 1996 | 0.0188 | 0.0107 | Blue collar |
| 1997 | 0.0188 | 0.0103 | Blue collar |

Table 16: Regression of ln monthly wage. The reference group is male with high school or less. All levels are significant at the 1% significance level, and all standard errors are 0.016 or less.

| Year | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 |
|---|---|---|---|---|---|---|
| Female | -0.222 | -0.212 | -0.197 | -0.182 | -0.175 | -0.18 |
| MSc Engineering | 0.483 | 0.482 | 0.472 | 0.491 | 0.487 | 0.48 |
| BSc Engineering | 0.178 | 0.179 | 0.183 | 0.2 | 0.198 | 0.183 |
| MBA | 0.468 | 0.464 | 0.469 | 0.474 | 0.478 | 0.477 |
| MSc Scientific subject | 0.296 | 0.309 | 0.324 | 0.284 | 0.307 | 0.128 |
| MSc Economics or Law | 0.434 | 0.406 | 0.401 | 0.423 | 0.429 | 0.419 |
| BSc Business | 0.257 | 0.263 | 0.271 | 0.28 | 0.286 | 0.27 |
| Age | 0.043 | 0.042 | 0.043 | 0.044 | 0.045 | 0.046 |
| $Age^2/100$ | -0.042 | -0.042 | -0.042 | -0.044 | -0.045 | -0.048 |
| Constant | 8.744 | 8.762 | 8.73 | 8.71 | 8.724 | 8.754 |
| Observations | 56924 | 56377 | 60825 | 64651 | 65426 | 73654 |
| R-squared | 0.56 | 0.54 | 0.55 | 0.56 | 0.55 | 0.52 |

| Year | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 |
|---|---|---|---|---|---|---|
| Female | -0.172 | -0.166 | -0.161 | -0.162 | -0.178 | -0.17 |
| MSc Engineering | 0.461 | 0.443 | 0.427 | 0.431 | 0.432 | 0.43 |
| BSc Engineering | 0.191 | 0.191 | 0.189 | 0.186 | 0.189 | 0.192 |
| MBA | 0.471 | 0.46 | 0.453 | 0.463 | 0.468 | 0.467 |
| MSc Scientific subject | 0.306 | 0.316 | 0.299 | 0.329 | 0.338 | 0.349 |
| MSc Economics or Law | 0.402 | 0.376 | 0.379 | 0.403 | 0.409 | 0.424 |
| BSc Business | 0.284 | 0.298 | 0.284 | 0.288 | 0.308 | 0.304 |
| Age | 0.046 | 0.046 | 0.044 | 0.043 | 0.045 | 0.047 |
| $Age^2/100$ | -0.047 | -0.047 | -0.045 | -0.044 | -0.046 | -0.048 |
| Constant | 8.728 | 8.672 | 8.718 | 8.762 | 8.739 | 8.687 |
| Observations | 54798 | 66871 | 71082 | 66830 | 74233 | 76472 |
| R-squared | 0.54 | 0.55 | 0.54 | 0.52 | 0.51 | 0.51 |

| Year | 1993 | 1994 | 1995 | 1996 | 1997 | |
|---|---|---|---|---|---|---|
| Female | -0.168 | -0.166 | -0.167 | -0.162 | -0.165 | |
| MSc Engineering | 0.428 | 0.423 | 0.418 | 0.418 | 0.418 | |
| BSc Engineering | 0.194 | 0.193 | 0.189 | 0.191 | 0.194 | |
| MBA | 0.478 | 0.472 | 0.452 | 0.445 | 0.445 | |
| MSc Scientific subject | 0.354 | 0.362 | 0.358 | 0.371 | 0.357 | |
| MSc Economics or Law | 0.44 | 0.439 | 0.421 | 0.405 | 0.404 | |
| BSc Business | 0.311 | 0.307 | 0.296 | 0.301 | 0.3 | |
| Age | 0.049 | 0.05 | 0.052 | 0.054 | 0.054 | |
| $Age^2/100$ | -0.049 | -0.05 | -0.052 | -0.053 | -0.054 | |
| Constant | 8.662 | 8.639 | 8.614 | 8.595 | 8.609 | |
| Observations | 76737 | 75821 | 78925 | 79963 | 79472 | |
| R-squared | 0.51 | 0.51 | 0.5 | 0.5 | 0.48 | |

Table 17: The ratio between the between variation and the total variation.

| Year | ln wage decomposition | Residual decomposition |
|------|----------------------|------------------------|
| 1981 | 0.1775 | 0.1737 |
| 1982 | 0.1707 | 0.1768 |
| 1983 | 0.1590 | 0.1807 |
| 1984 | 0.1699 | 0.1756 |
| 1985 | 0.1734 | 0.1924 |
| 1986 | 0.1782 | 0.2171 |
| 1987 | 0.1690 | 0.1843 |
| 1988 | 0.1594 | 0.1588 |
| 1989 | 0.1657 | 0.1600 |
| 1990 | 0.1786 | 0.1652 |
| 1991 | 0.1820 | 0.1509 |
| 1992 | 0.1941 | 0.1646 |
| 1993 | 0.1990 | 0.1625 |
| 1994 | 0.1977 | 0.1465 |
| 1995 | 0.2051 | 0.1561 |
| 1996 | 0.2220 | 0.1690 |
| 1997 | 0.2258 | 0.1672 |

Table 18: Structure of wages within and between plants.

| | Monthly wages | | | | Log monthly wages | | | |
|---|---|---|---|---|---|---|---|---|
| | 1981 | 1986 | 1993 | 1997 | 1981 | 1986 | 1993 | 1997 |
| Average wage | 18,610 | 19,972 | 20,488 | 22,285 | 9.8 | 9.9 | 9.9 | 10 |
| sd | 5,935 | 6,598 | 6,610 | 7,152 | .29 | .3 | .3 | .3 |
| 75%-ile | 21,101 | 22,937 | 24,039 | 26,184 | 10 | 10 | 10 | 10 |
| 25%-ile | 14,679 | 15,500 | 15,788 | 17,123 | 9.6 | 9.6 | 9.7 | 9.7 |
| N-workers | 49,407 | 67,974 | 70,353 | 71,522 | 49,407 | 67,974 | 70,353 | 71,522 |
| Average of plant average wage | 17,750 | 18,676 | 19,055 | 20,777 | 9.7 | 9.8 | 9.8 | 9.9 |
| sd | 2,409 | 2,558 | 2,742 | 3,063 | .13 | .13 | .14 | .14 |
| 75%-ile | 19,266 | 20,248 | 20,541 | 22,571 | 9.8 | 9.9 | 9.9 | 10 |
| 25%-ile | 16,192 | 17,008 | 17,191 | 18,828 | 9.7 | 9.7 | 9.7 | 9.8 |
| N-plants | 552 | 628 | 637 | 713 | 552 | 628 | 637 | 713 |
| Average of sd of wage | 4,801 | 5,190 | 5,214 | 5,645 | .25 | .26 | .25 | .25 |
| sd | 1,310 | 1,456 | 1,765 | 1,731 | .047 | .053 | .059 | .056 |
| 75%-ile | 5,577 | 6,039 | 5,928 | 6,492 | .28 | .29 | .28 | .28 |
| 25%-ile | 3,920 | 4,220 | 4,198 | 4,596 | .22 | .23 | .22 | .22 |
| N-plants | 552 | 628 | 637 | 713 | 552 | 628 | 637 | 713 |
| Average Coefficient of Variation of wage | .27 | .28 | .27 | .27 | .026 | .026 | .026 | .026 |
| sd | .053 | .059 | .067 | .061 | .0048 | .0054 | .0059 | .0056 |
| 75%-ile | .3 | .31 | .3 | .3 | .029 | .029 | .029 | .028 |
| 25%-ile | .23 | .24 | .23 | .23 | .023 | .023 | .023 | .022 |
| N-plants | 552 | 628 | 637 | 713 | 552 | 628 | 637 | 713 |
| Correlation between average wage and sd of wage | .72 | .7 | .69 | .69 | .27 | .2 | .32 | .25 |
| Average wage for workers between 25 and 30 | 15,699 | 17,174 | 16,500 | 17,813 | 9.6 | 9.7 | 9.7 | 9.8 |
| sd | 3,178 | 3,797 | 3,289 | 3,470 | .2 | .22 | .2 | .2 |
| 75%-ile | 17,583 | 19,360 | 18,561 | 19,977 | 9.8 | 9.9 | 9.8 | 9.9 |
| 25%-ile | 13,396 | 14,520 | 14,140 | 15,340 | 9.5 | 9.6 | 9.6 | 9.6 |
| N-workers | 6,401 | 11,137 | 10,316 | 8,251 | 6,401 | 11,137 | 10,316 | 8,251 |
| Average wage for workers between 45 and 50 | 20,406 | 21,750 | 22,069 | 23,868 | 9.9 | 9.9 | 10 | 10 |
| sd | 6,476 | 7,284 | 7,534 | 7,951 | .29 | .31 | .32 | .32 |
| 75%-ile | 23,220 | 25,126 | 26,791 | 29,078 | 10 | 10 | 10 | 10 |
| 25%-ile | 16,075 | 16,625 | 16,536 | 17,836 | 9.7 | 9.7 | 9.7 | 9.8 |
| N-workers | 6,299 | 8,181 | 13,283 | 12,511 | 6,299 | 8,181 | 13,283 | 12,511 |

Table 19: Wage dynamics

| | Δ monthly wages | | | | Δ log monthly wages | | | |
|---|---|---|---|---|---|---|---|---|
| | 1981 | 1986 | 1993 | 1997 | 1981 | 1986 | 1993 | 1997 |
| Average change in wage | -83 | 915 | 373 | 756 | -.003 | .046 | .019 | .035 |
| sd | 1,241 | 1,278 | 1,543 | 1,592 | .064 | .061 | .073 | .087 |
| 75%-ile | 446 | 1,353 | 546 | 1,012 | .026 | .071 | .028 | .045 |
| 25%-ile | -767 | 236 | -59 | 124 | -.042 | .012 | -.0032 | .0061 |
| N-workers | 43,962 | 56,418 | 63,933 | 63,657 | 43,962 | 56,418 | 63,933 | 63,657 |
| Average of plant average | | | | | | | | |
| change in wage | -147 | 820 | 286 | 658 | -.0063 | .045 | .016 | .033 |
| sd | 646 | 487 | 393 | 498 | .037 | .027 | .024 | .026 |
| 75%-ile | 204 | 1,103 | 480 | 906 | .014 | .06 | .026 | .044 |
| 25%-ile | -550 | 554 | 57 | 354 | -.028 | .03 | .0035 | .018 |
| N-plants | 552 | 628 | 637 | 713 | 552 | 628 | 637 | 713 |
| Average of sd of | | | | | | | | |
| change in wage | 950 | 994 | 978 | 1,241 | .05 | .051 | .058 | .069 |
| sd | 409 | 478 | 1,032 | 789 | .023 | .024 | .052 | .053 |
| 75%-ile | 1,124 | 1,189 | 1,200 | 1,514 | .06 | .06 | .069 | .082 |
| 25%-ile | 671 | 683 | 557 | 773 | .037 | .037 | .031 | .038 |
| N-plants | 552 | 628 | 637 | 712 | 552 | 628 | 637 | 712 |
| Average Coefficient of | | | | | | | | |
| Variation in change in wage | 120 | 1,603 | 602 | 1,060 | .009 | .079 | .03 | .05 |
| sd | 1,674 | 2,285 | 1,791 | 2,038 | .09 | .11 | .12 | .11 |
| 75%-ile | 744 | 2,568 | 937 | 1,447 | .042 | .13 | .046 | .068 |
| 25%-ile | -790 | 295 | -41 | 179 | -.041 | .015 | -.0017 | .0085 |
| N-workers | 1,927 | 918 | 3,592 | 4,207 | 1,927 | 918 | 3,592 | 4,207 |
| Average change in wage for | | | | | | | | |
| workers with tenure < 3 years | 254 | 1,230 | 560 | 1,051 | .016 | .067 | .03 | .053 |
| sd | 1,364 | 1,429 | 1,410 | 1,768 | .076 | .074 | .087 | .11 |
| 75%-ile | 889 | 1,843 | 907 | 1,516 | .055 | .1 | .046 | .073 |
| 25%-ile | -499 | 397 | -23 | 181 | -.031 | .023 | -.0015 | .0093 |
| N-workers | 3,918 | 12,849 | 11,339 | 10,587 | 3,918 | 12,849 | 11,339 | 10,587 |
| Averge change in wage for | | | | | | | | |
| workers with tenure ≥ 3 years | -165 | 822 | 333 | 697 | -.0082 | .04 | .017 | .031 |
| sd | 1,154 | 1,215 | 1,566 | 1,548 | .058 | .055 | .07 | .082 |
| 75%-ile | 326 | 1,215 | 485 | 916 | .018 | .062 | .025 | .04 |
| 25%-ile | -819 | 208 | -70 | 117 | -.044 | .011 | -.0039 | .0056 |
| N-workers | 22,318 | 43,237 | 52,534 | 53,010 | 22,318 | 43,237 | 52,534 | 53,010 |

Table 20: Mobility. Panel A: all jobs.

| | All firms | | | | Firms with 100+ employees | | | |
|---|---|---|---|---|---|---|---|---|
| | 1981 | 1986 | 1993 | 1997 | 1981 | 1986 | 1993 | 1997 |
| Number of plants | 552 | 628 | 637 | 713 | 137 | 166 | 173 | 184 |
| Employees | 90 | 108 | 110 | 100 | 215 | 270 | 278 | 253 |
| sd | 105 | 164 | 187 | 163 | 151 | 255 | 300 | 265 |
| Number of occupations | 12 | 12 | 12 | 12 | 16 | 15 | 15 | 15 |
| sd | 3.5 | 3.7 | 3.8 | 3.7 | 2.3 | 2.9 | 3 | 2.8 |
| Number of levels | 6 | 6.1 | 6 | 5.9 | 6.6 | 6.7 | 6.6 | 6.6 |
| sd | .92 | .97 | 1 | .98 | .54 | .61 | .61 | .6 |
| Employment growth | .033 | .079 | -.018 | .035 | .12 | .11 | .12 | .22 |
| sd | .36 | .19 | .63 | 1.1 | .58 | .18 | 1.2 | 2.2 |
| Exit rate (all) | .12 | .12 | .13 | .17 | .06 | .062 | .077 | .096 |
| Exit rate | .14 | .13 | .14 | .15 | .11 | .1 | .12 | .14 |
| sd | .086 | .091 | .12 | .12 | .062 | .062 | .092 | .094 |
| Exit rate top quartile of firm wages | .1 | .11 | .13 | .15 | .089 | .096 | .12 | .15 |
| sd | .11 | .11 | .14 | .14 | .08 | .085 | .13 | .12 |
| Exit rate bottom quartile of firm wages | .21 | .17 | .16 | .17 | .17 | .13 | .13 | .15 |
| sd | .15 | .14 | .17 | .16 | .1 | .088 | .12 | .11 |
| Entry rate | .13 | .18 | .13 | .16 | .15 | .17 | .14 | .16 |
| sd | .12 | .11 | .13 | .14 | .15 | .11 | .15 | .15 |
| Entry rate top quartile of firm wages | .085 | .11 | .11 | .12 | .097 | .11 | .13 | .12 |
| sd | .13 | .11 | .14 | .14 | .15 | .11 | .17 | .14 |
| Entry rate bottom quartile of firm wages | .21 | .3 | .16 | .22 | .24 | .29 | .18 | .22 |
| sd | .18 | .18 | .17 | .2 | .18 | .15 | .16 | .2 |
| % of workers who switch jobs internally | .11 | .11 | .1 | .098 | .12 | .11 | .11 | .092 |
| sd | .11 | .1 | .083 | .089 | .11 | .085 | .072 | .086 |
| % of new jobs filled internally | .48 | .37 | .49 | .42 | .48 | .39 | .5 | .42 |
| sd | .31 | .23 | .28 | .29 | .28 | .21 | .23 | .26 |
| % of workers with tenure ≥ 5 years | .067 | .56 | .69 | .64 | .065 | .55 | .69 | .69 |
| sd | .16 | .26 | .24 | .26 | .15 | .27 | .22 | .24 |
| Corr(exit rate, average wage) | -.14 | -.17 | .0062 | .092 | -.11 | -.17 | .01 | .075 |
| Corr(exit rate, average wage change) | -.013 | -.021 | -.055 | -.0077 | -.011 | -.24 | -.14 | .048 |
| Corr(exit rate, sd of wage) | -.019 | -.039 | .037 | .12 | .057 | -.14 | .044 | .064 |
| Corr(entry rate, average wage) | -.07 | -.06 | .064 | -.066 | -.048 | -.032 | -.0047 | -.017 |
| Corr(entry rate, average wage change) | .02 | .0062 | -.11 | -.02 | .029 | .015 | -.14 | .046 |
| Corr(entry rate, sd of wage) | .029 | .078 | .092 | .015 | .056 | .16 | -.0066 | .048 |