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Wage Structure and Labor Mobility in Norway, 1980–97

Arngrim Hunnes, Jarle Møen, and Kjell G. Salvanes

9.1 Introduction

In the 1980s and 1990s, most Western European countries broke the trend of increasing the size of the welfare state and the use of solidaristic wage policies that were developed in the 1950s and continued 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—most notably Sweden—were forced to reassess their welfare policies, and centralized wage negotiations were abandoned. Norway went in a different direction and resisted the trend observed in other developed countries in this period. In the early 1980s, wages were negotiated at the industry level, but in 1986 to 1987, bargaining was further centralized to the national level. In the early 1990s, the so-called solidarity alternative wage policy was introduced. This strengthened the guarantied negotiated minimum wage for the lowest paid (Wallerstein, Golden, and Lange 1997; Kahn 1998; Freeman 1997). It is notable that the earnings distribution did not increase as in most other countries but stayed compressed until the mid-1990s (Aaberge et al. 2000).[1] The return to education in Norway is fairly low and stable. Ordinary least squares (OLS) estimates from Mincer regressions suggest that the marginal return to one extra year of education is about 5 percent; see, for example, Barth and Røed (2001).

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1. See Kahn (1998) and Hægeland, Klette, and Salvanes (1999) for explanations for the increased wage compression.

Because of high wage compression and strong labor market institutions, the Norwegian economy differs from most other Western economies. However, we do not know much about the precise workings of the labor market in Norway. To what extent do different firms follow different wage policies? Do such differences relate to how workers move between firms? What are the effects of different wage bargaining regimes? The empirical branch of personnel economics has long been hampered by a lack of representative data sets. Norway is one of a handful of countries that has produced rich linked employer–employee data suitable for such analysis.[2] A special feature of our data is detailed information on occupational hierarchies and very detailed information on wage compensation for normal hours and overtime as well as bonuses. There is also very good information on hours worked. We match these data to the main register-based employer-employee data set, containing detailed information on firm and worker characteristics.[3]

Our chapter is very descriptive in nature, and it should be read as a detailed country study together with the other country studies in this volume. The chapter has three parts. First, we describe the wage setting and employment protection institutions in Norway. Next, we describe the Norwegian data sets. Finally, we document a large number of stylized facts regarding wage structure and labor mobility within and between Norwegian firms. We cover the period from 1980 to 1997. One topic analyzed is within- and between-firm wage dispersion and whether wage dispersion has been stable over time. Although overall wage dispersion has been stable, there might still have been changes in the individual components of the variance both across firms and across worker groups. There might also have been increased sorting of workers across firms. We document these types of patterns and also those of worker mobility for different groups of firms and workers. A unique feature of our data is that we can compare mobility across occupations within firms for white-collar workers as opposed to the more standard mobility patterns across firms. Another feature is the ability to compare wage and worker mobility for white- and blue-collar workers separately. The wage setting institutions are very different for white- and blue-collar workers. There is no centrally bargained wage for white-collar workers, whereas blue-collar workers have a two-tier system with both national (or industry) and firm-level negotiations. In this way, we have an extra institutional "experiment" within the country. Furthermore, the period we analyze was volatile in terms of business-cycle movements. Hence, our

2. Some work on both the job and worker turnover and wage structure has been undertaken before, but very little has been conducted on wage mobility within and between firms. See Salvanes (1997), Salvanes and Førre (2003), and Margolis and Salvanes (2001).

3. See Møen, Salvanes, and Sørensen (2004) for a description of the main employer-employee data set used in several previous studies.

data are well suited for studying the cyclical pattern of wage and worker mobility.

The remainder of the chapter is organized as follows. In section 9.2, we describe the macroeconomic conditions in the period we are analyzing. Section 9.3 presents the institutional setting in Norway, and section 9.4 presents the data we are using. In section 9.5, we look at the wage structure and labor mobility in detail. Section 9.6 summarizes our empirical findings.

9.2 Macroeconomic Conditions

Table 9.1 and figure 9.1 show unemployment and growth rates for Norway for each of the years from 1972 to 2002. We see that the macroeconomic conditions have not been stable in the period covered by our analysis, 1980 to 1997. There was a mild downturn in the early 1980s, with a peak in the business cycle around 1985 to 1987. The unemployment rate was then about 2 percent of the labor force. From 1988 onward, Norway experienced its worst economic recession in the postwar period, when the unemployment rate was about 6 percent. After 1993, growth picked up, and 1997 was a peak year in the relatively stable period after the mid-1990s. Given these business-cycle fluctuations, we have picked 1981 and 1993 as two low-growth years and 1986 to 1987 and 1997 as two high-growth years in our empirical analysis.

The Norwegian government plays an important part in coordinating wage settlements, and this had important implications for wage determination in the period analyzed. For instance, wage negotiations in 1988 were undertaken with considerable concern about the future of the Norwegian economy. Partly because of the oil price fall in 1986, the Norwegian krone had been devalued by 10 percent in May 1986. The largest employer association, the Norwegian Employers Confederation (NAF), the predecessor of the Confederation of Norwegian Business and Industry (NHO), called a lockout that failed, largely because of disagreement among the employers. This led to reductions in work time and high increases in wages in 1986. After the subsequent downturn in the economy, the main labor union, the Norwegian Confederation of Trade Unions (LO), and NAF/NHO agreed to a moderate wage increase in 1988. To ensure that all groups followed suit, the Storting (the Norwegian national assembly) passed a law that wages could not increase by more than 5 percent, in line with the outcome of the wage settlements between the LO and NHO. A similar law was passed in 1989. Therefore, a wage-freeze policy at 5 percent nominal increase was in place in these two years.

In 1990, the income regulation laws expired, yet the LO and NHO agreed that wage increases should still be moderate because of high unemployment and the weak competitive position of the trading sector. In 1992, the agreement among the labor market organizations on wage restraint was

Table 9.1 **Macroeconomic conditions: Unemployment and economic growth**

Year	Unemployment rate	Economic growth (% change in GDP) 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

Sources: The unemployment rate is taken from the Norwegian Labour Force Survey (AKU) published by Statistics Norway (1974, 1978, 1984, 1997, 2003a). The economic growth numbers are computed based on numbers from Statistics Norway (2003b).

Notes: In the computation of economic growth, the GDP numbers are fixed at 2000 prices. The formula used is $\text{growth}_{\text{GDP}} = 100(\ln\text{GDP}_t - \ln\text{GDP}_{t-\text{yr}})/\text{yr}$, where $t = 1971, \ldots, 2002$, and $\text{yr} \in (1,2,5)$. The years 1981 and 1993 indicate low-growth years. The years 1986 and 1997 indicate high-growth years.

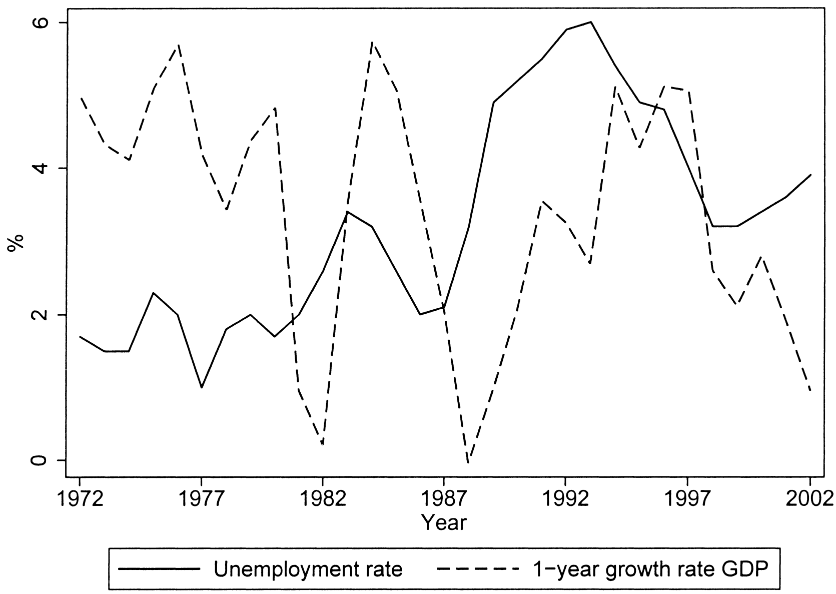

Fig. 9.1 Unemployment rate and one-year growth rate GDP

formalized in the Solidarity Alternative. In 1994, a major revision was undertaken by industry, yet wage growth was moderate, following the lead from the metal industry. In 1996 and 1998, however, proposed agreements in line with the Solidarity Alternative were rejected in ballots. This led to strikes and subsequent agreements on higher wage growth.

9.3 Institutional Setting

This section describes wage setting institutions in Norway for different worker groups and institutions for employment protection.

9.3.1 Wage Setting

In the private sector in Norway, about half of the labor force is covered by collective agreements (Stokke, Evju, and Frøland 2003).[4] Union density, that is, the share of employees who are members of a union, is somewhat lower: 43 percent in the private sector (Stokke, Evju, and Frøland 2003). These figures were very stable in the period we analyze (Wallerstein, Golden, and Lange 1997). Bargaining coverage is higher than union density because firms covered by a collective agreement follow the agreement

4. See Holden and Salvanes (2005) for more details on the wage setting process.

for all employees. However, in contrast to many other European countries, extension mechanisms imposing regulations from collective agreements onto the nonunionized sectors are not used in Norway.

The largest employees' association is the LO, to which about half of all union members belong. The traditional stronghold of the LO is among blue-collar workers in the manufacturing industry, but the LO is also prominent in some private service sectors, and for nonprofessionals and unskilled employees in the public sector. The LO is organized as union branches, to a large degree covering different industry sectors. Other employees' associations are the Confederation of Vocational Unions (YS), covering many of the same workers as the LO; the Confederation of Higher Education Unions (UHO), covering teachers, nurses, the police, and so on; and *Akademikerne* (The Federation of Norwegian Professional Associations), covering employees with higher education. On the employers' side, the NHO is the dominant association in the private sector, being the main counterpart of the LO. The NHO has about 16,000 member companies, employing about 490,000 employees in Norway (Stokke, Evju, and Frøland 2003); that is, about one-quarter of the total workforce of 2.3 million.

For employees covered by collective agreements, wage setting takes place at two levels: national (or industry) and the firm level (wage drift). Central negotiations concern collective agreements, wage regulations, working hours, working conditions, pensions, medical benefits, and so on. 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 lockouts within the contract period of the collective (i.e., central) agreements (Holden 1998). Collective agreements usually last for two years. Since 1964, the main revisions to the collective agreements have been undertaken every second year, in even years (most recently in 2006). The draft agreement in a main revision is subject to a ballot among 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 is 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
- 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 raises 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, specifying only 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 wages are mainly set at the firm level and thus reflect conditions at the firm level. It should also be noted that there is no national, statutory minimum wage for all workers in Norway. Minimum wages only apply to workers covered by collective agreements.

Although blue-collar wages are negotiated centrally, there is considerable variation between sectors with regard to the number of firms with local bargaining and the importance of the wage drift—the change in wages due to local negotiations. Figure 9.2 shows the total wage change in the period 1970 to 1996 for blue-collar workers. As can be seen from the figure, quite a large proportion of total wage gains are realized at the local level; see also Holden and Rødseth (1990). This means that the sector minimum

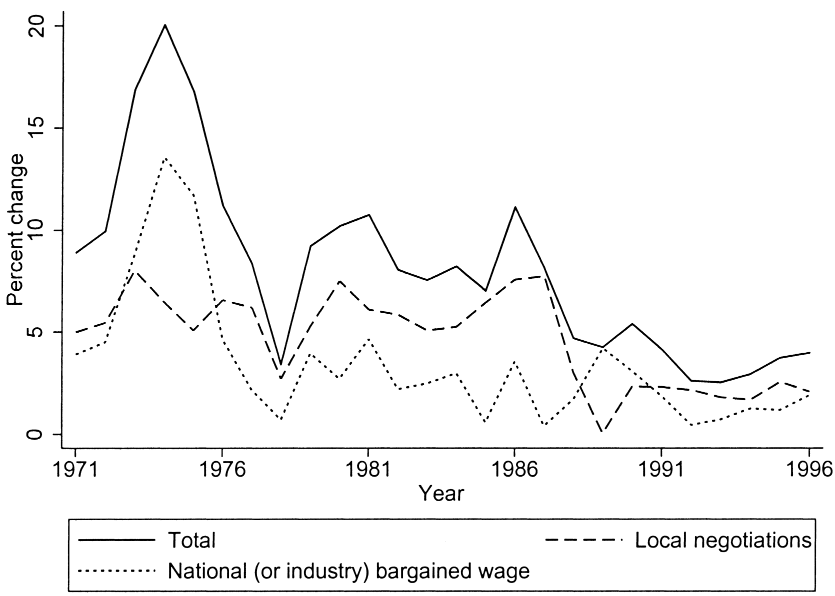

Fig. 9.2 Total wage change in Norway decomposed by national (or industry) and locally bargained wage in the private sector in Norway

Source: The Norwegian Technical Calculation Committee for Wage Settlements (TBU).

wage will not be binding for several firms as 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.

9.3.2 Employment Protection

Rules regarding individual and collective dismissals, as well as those about the flexibility of industrial plants with respect to temporary hiring and the use of subcontractors, are important aspects of employment protection and thus the costs of adjustment for firms.[5] The different types of constraints regulating the hiring and firing of workers are not completely transparent because, in addition to national laws, collective agreements between employers and workers' organizations are also very important in regulating the adjustment of the labor factor. These agreements may differ across industries and workers, depending upon workers' age, tenure, and so on.

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 layoffs 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, and so on. In general, it is possible, but very difficult, to replace an individual worker in a given job with another worker. Hence, there is strong employment protection in Norway. The law on employment states that the general rule for laying off a worker for *economic reasons* is that it can occur only when the job is "redundant" and the worker cannot be retained in another capacity. This regulation covers all workers regardless of how long they have been employed. Requirements for collective dismissals in Norway basically follow the common minimum standards for European Union (EU) countries. It is important to note that a firm can dismiss workers not only when it is making a loss but also when it is performing poorly. There is no actual 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 many, if not most, dismissal cases are taken to court. This is costly for firms.

When it comes to other costs of dismissal, the employment law states that employment is terminable with one month's notice for workers with

5. A new law of employment protection and the use of time-limited labor contracts has been proposed by the government and is to be decided upon in 2005. The main proposals are to allow more flexible use of fixed-term contracts and more flexible use of overtime work.

tenure of less than or equal to five years. This one-month notice period is at the lower end of the spectrum compared to many countries. However, most workers have a three-months'-notice requirement for both parties to the contract. Although there is no generalized legal requirement for severance pay in Norway, agreements in the private sector require lump-sum payments to workers aged between fifty and fifty-five. As an example, in the contract between the LO and NHO, a worker who is fifty and has been working for ten consecutive years in the firm, or twenty years in total, is eligible for one to two months' pay. Similar agreements exist for the other unions. Some EU-countries have even stronger job protection rules, including, for instance, general compensation, a social plan for retraining, or transfer to another plant within a firm. Although not mandatory, some of these other requirements are also commonplace in Norway. 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) may have significant fixed components.

The workforce flexibility of an economy can be enhanced by allowing fixed-term contracts in addition to standard contracts, and by the use of temporary work agencies. In many Organization for Economic Cooperation and Development (OECD) countries, there has been a strong trend toward 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 temporarily. However, it is not as restrictive as it appears, as 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 accumulated duration of successive contracts. In general, the use of temporary work agencies is prohibited, but substantial latitude exists for service-sector occupations. Restrictions for the number of renewals exist, and two years is the maximum for accumulated 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-cited study by Emerson (1987) ranks Italy as having the strongest employment protection rules, while the United Kingdom and, on some criteria, Denmark, are at the other end of the spectrum. Norway is ranked together with Sweden, France, and, to a lesser extent, Germany (when all regulations are taken together) as an intermediate country with a fairly high degree of protection. Obviously, intercountry comparisons are difficult. The most recent comparison was made by the OECD in 1999, where Norway was ranked at number twelve out of nineteen OECD countries in the late 1980s, and as number nineteen out of twenty-six OECD countries in 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; Salvanes and Førre 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 Schiantarelli (2003) for an analysis of the effect of labor adjustment costs in Norway.

9.4 Data

Like other Scandinavian countries, Norway has rich and high quality linked employer-employee data sets. The sources and structure are basically the same as the data sets used in Denmark, Sweden, and France. The basis of the Norwegian data is administrative files from Statistics Norway and plant-level information from the annual census for manufacturing plus a similar data set for private and public service sectors. Information on research and development (R&D) and trade statistics has been added as well. See Møen, Salvanes, and Sørensen (2004) and Salvanes and Førre (2003) for a general description of the Norwegian linked employer-employee data sets.

In this chapter, we take advantage of two new data sets, one for white-collar workers and one for blue-collar workers. We can match these to the linked employer-employee data as they both use the same series of person identifiers. Both these data sets are from the NHO, the main employers' association in Norway. The white-collar data set is the main data set used in this chapter. Its main advantage over data that has been available so far is that it contains information on hourly wages, overtime hours, pay, and bonus pay as well as detailed information on occupations. The main employer-employee data set contains only information on annual earnings and education, but none about occupations.

9.4.1 White-Collar Data

The white-collar data contain employment and wage data information from the NHO, which has about 16,000 member companies. Seventy-three percent of these companies have fewer than twenty person-years (both blue- and white-collar workers). The member companies employ about 450,000 workers, mainly in construction, services, and manufacturing in Norway (NHO 2004).[6] There is a bias toward manufacturing. Many of the member companies in the NHO operate in export and import competing industries. The total labor force in Norway is about 2.3 million workers, of whom about half were employed in the public sector in the year 2000;

6. Note that this data set is very similar to the Swedish data set used in Oyer (chapter 12 in this volume) and the Finnish one used in Uusitalo and Vartiainen (chapter 5 in this volume).

hence, the NHO covers roughly 40 percent of private-sector employment. In terms of private-sector gross domestic product (GDP), the members of the NHO produce about 40 percent.

The data is based on establishment records for all white-collar workers employed by firms that are members of the NHO confederation. Norwegian law requires all employers to report data on wages and employment annually to Statistics Norway. Until 1997, the 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, as the wage data were a major source of information for the collective bargaining process in Norway between the NHO and the unions. See Holden and Salvanes (2005) for an assessment of the wage data from this source as compared to other sources of earnings data from Norwegian registers.

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

As mentioned, we have merged the NHO data set with the main administrative matched employer-employee database. This database contains a rich set of information on workers and plants for the period 1986 to 2002. In principle, this merging allows us to identify CEOs and vice CEOs indirectly. One of the reasons for merging the NHO data set with the administrative register, besides obtaining more information, is that it is unclear whether the information reported in the NHO statistics pertains to plants, firms, or a combination of the two.[8] Compare this with section 9.4.3 for how this problem is solved. On average, we could match 97 percent of workers with plants and 93 percent with firms.

Main Variables

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

Occupation. Each worker is assigned an occupational group and a level *within* the occupational group. The groups are labeled A through F: Group A is technical white-collar workers, Group B is foremen, Group C is ad-

7. The year 1987 is missing. However, the data set for each year contains lagged values; hence, we were able to reconstruct 1987 by using lagged values in the 1988 file. This is, of course, not a perfect reconstruction, as we do not have information on workers who left the data set in 1987 and were not in the 1988 file.

8. The register data covers the year 1986 and onward, and the merging between the NHO data set and the register data is almost perfect. However, we do not have register data for the years 1980 to 1985. In order to construct the link between workers and plants in this period, we used various methods. Important sources of information were the job start date in the 1986 register data and the links provided in the 1980 census data.

ministration, 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 varies by group and ranges from 1 (F) to 7 (A). Table 9.2 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. That information is one of the unique features of this data set, and it gives us a picture of how the hierarchical structure looks within each firm. For example, we are able to study mobility within a firm and questions related to promotion.

We define an occupation as a combination of group and level. That gives us twenty-two occupations.[9] To create a single hierarchy within a firm, we aggregate the twenty-two 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 utilized the NHO's descriptions of the different occupational groups. Still, such a harmonization across occupational groups is difficult. One problem lies in the fact that some levels are overlapping with respect to responsibility in the organization. For example, even though we aggregate occupational Groups A31 and A32 into the same level (see table 9.3), we know that they differ in responsibility, as A31 involves management of other workers while A32 does not (however, they are both ranked above the A4 level). Furthermore, the levels defined within each group do not necessarily align; for example, level 1 within Group B seems closest to level 1 within Group A, but also overlaps with level 2. Level 2 within Group B is closest to level 3 within Group A, but also overlaps with level 2. Table 9.4 shows the distribution of workers on the seven levels. Note that in terms of white-collar workers, the typical firm is not "pyramid shaped." Most workers are at the middle levels.

Wage. We use monthly salary (on September 1st) for white-collar workers including the value of fringe benefits and excluding overtime and bonuses. Indirect costs to the firm such as payroll tax, pensions, and so on are not included. We transform nominal wages to real wages using the Consumer Price Index with base year 1990 (Statistics Norway 2004).

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

Bonuses. This variable gives the monthly average value of bonuses, commissions, and production bonuses during the twelve months prior to September 1st.

9. In the data set, we also have a much richer set of four-digit job codes. These are less consistently used across firms and, perhaps, also within firms across time. We have, therefore, not yet utilized this information.

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

Table 9.2 **Distribution of workers in occupational groups**

	Year			
Occupational group	1981	1986	1993	1997
A0	0.40	0.50	0.51	0.55
A1	2.18	2.58	3.69	4.13
A2	4.80	6.50	6.91	6.89
A31	4.44	5.22	4.34	4.64
A32	5.66	6.64	8.76	8.34
A41	1.45	1.63	1.36	1.19
A42	7.30	7.34	7.34	8.43
A5	4.83	4.80	4.08	4.61
A6	1.79	1.68	1.61	1.33
B1	0.59	0.54	0.68	0.76
B2	2.24	1.93	1.95	1.92
B3	11.96	9.16	7.27	6.35
C0	0.91	1.02	1.07	1.11
C1	5.54	5.51	6.59	6.41
C2	8.82	9.80	10.33	10.61
C3	13.34	14.09	14.60	13.89
C4	9.88	7.92	6.28	5.80
D1	0.33	0.24	0.36	0.29
D2	0.96	0.68	0.92	0.86
E1	1.44	1.20	0.93	0.79
E2	3.04	2.91	1.81	1.91
F	8.09	8.10	8.63	9.20
Total	100.00	100.00	100.00	100.00

Tenure. To create the tenure variable, we used the job start variable that is present in the administrative register data.

Restrictions on the Sample

We put the following restrictions on the sample:

1. To remove outliers in the data, we imposed the restriction that the monthly wage should be at least 2,000 NOK measured in 1980 kroner.
2. The number of hours worked per week is thirty or above; that is, we look at full-time workers.
3. The number of full-time workers in each firm is at least twenty-five in year t.
4. The number of full-time workers in each firm is at least twenty-five in year $t-1$.[11]

11. This restriction, agreed on by all project members present at an National Bureau of Economic Research (NBER) meeting in Boston in April 2004, introduces a selection bias in the entry and exit rates related to firms crossing the twenty-five worker threshold.

Table 9.3 Harmonization of levels

Level	Occupational groups
7 (top)	A0, C0
6	A1, B1, C1
5	A2
4	A31, A32, B2, C2
3	A41, A42, B3, C3, D1, E1
2	A5, F, D2, E2
1 (bottom)	A6, C4

Table 9.4 Distribution of workers in harmonized levels

	Year			
Level	1981	1986	1993	1997
7 (top)	1.32	1.52	1.58	1.66
6	8.31	8.62	10.95	11.30
5	4.80	6.50	6.91	6.89
4	21.16	23.59	25.38	25.50
3	35.82	33.67	31.85	30.94
2	16.92	16.49	15.44	16.58
1 (bottom)	11.67	9.61	7.89	7.13
Total	100.00	100.00	100.00	100.00

Because our data set only contains white-collar workers, this means that we are looking at large firms by Norwegian standards. In 1993, a firm with twenty-five full-time white-collar workers had, on average, sixty blue-collar workers. Table 9.5 shows the effect of our restrictions on the number of workers and firms.

9.4.2 Blue-Collar Data

Our blue-collar data set was obtained from *Teknologibedriftenes Landsforening* (TBL), (the Federation of Norwegian Manufacturing Industries).[12] The TBL is by far the largest federation within the NHO. As of December 2003, the TBL has about 1,150 member companies employing about 66,000 workers. The member companies operate in industrial sectors ranging from mechanical and electrical engineering to information technology, furnishing, and textile industries (TBL 2004). The data set covers blue-collar workers only, and consists of quarterly observations for the period 1986 to 1998; that is, a span of thirteen years.[13] Each quarter covers on

12. Because these data are used only in a small part of our analysis, this description will be somewhat briefer than our description of the white-collar data.
13. The 4th quarter of 1987 is missing.

Table 9.5 **The effect (i.e., the difference between each row in the table) of restrictions on the number of white-collar workers and firms in the sample**

	1981	1986	1993	1997
	No. of white-collar workers			
No restrictions	74,075	91,911	100,087	111,336
Outliers	74,074	91,896	99,648	110,516
Hours per week ≥30	73,776	91,695	94,404	104,899
Firmsize ≥25 in year t	60,657	78,587	80,831	87,533
Firmsize ≥25 in year $t-1$	56,838	73,600	76,449	79,259
	No. of firms			
No restrictions	2,348	2,622	2,682	3,838
Outliers	2,348	2,622	2,638	3,715
Hours per week ≥30	2,327	2,614	2,509	3,518
Firmsize ≥25 in year t	532	591	586	679
Firmsize ≥25 in year $t-1$	467	506	521	565

average 34,000 workers. Examples of principal variables are pay (fixed, piece, and overtime) and hours worked (regular hours, piece hours, and overtime). Each worker is classified on the basis of a three-digit code describing which working group the worker belongs to; therefore, we have information on what kind of job the worker is doing.

We have linked these data to information from administrative registers in the same way as we have linked the white-collar data; compare with section 9.4.1.

Merging Blue- and White-Collar Data

A logical next step is to merge the blue- and white-collar data sets to get one sample with information about whole firms. This is possible because the TBL is a member of the NHO. Hence, the firms in our blue-collar data set are a subsample of the firms in our white-collar data set. Most member firms in the TBL belong to Sector 38 (Manufacture of fabricated metal products, machinery, and equipment). We, therefore, have constrained the merging of blue- and white-collar data to this sector.[14] When combining the data, we have adjusted for the fact that some of the information is not directly comparable. For example, the TBL data report quarterly wage while the NHO data report monthly wage. Also, because the TBL data span 1986 to 1998 and the NHO data span 1980 to 1997, we are restricted to the period 1986 to 1997.

After cleaning up the merged sample by removing firms with only blue-collar or white-collar workers and putting the same restrictions on the sample as given in section 9.4.1, we are left with a sample of 24,268 work-

14. When talking about blue-collar workers in this chapter, we mean blue-collar workers in Sector 38.

ers in 1987; 26,805 in 1993; and 25,446 in 1997. Numbers of firms are 119, 149, and 139, respectively. This implies that we are able to link approximately 25 percent of the NHO firms with the TBL firms.[15]

9.4.3 Defining Plant and Firm

In this subsection, we explain briefly how we were able to link employees to plants and firms—a link that is crucial. Both the white- and blue-collar data set contain an employer identification number, which is the employer's member number in the TBL (blue-collar data) or NHO (white-collar data).[16] It has not been possible to establish whether this employer identification represents a plant, a firm, or a combination of the two. It is also unclear how plant and firm restructuring is handled. To overcome these obstacles, we take advantage of the National Employer-Employee register, which links employers and employees for administrative purposes related to tax and social benefits.[17] 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 plant and firm information from the Employer-Employee register.[18] In fact, the person identification number is the key variable that allows us to merge the new data sets with other firm and worker information to which we have access.

9.5 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 to 1987, 1993, and 1997. These years comprise two peak years and two trough years in the business cycle as explained in section 9.2. The white-collar results consist of all white-collar workers covered by the NHO and include 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 (Sector 38). This sector comprises about half of the labor force in the man-

15. This number is approximate as we look at the number of firms after imposing the restrictions in section 9.4.1.

16. The member numbers in the TBL and NHO are not compatible.

17. 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.

18. The original person identification number both in the white- and blue-collar data sets and in all national administrative registers is the individuals' 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 original series and the recoded personal identification numbers used in our data sets is maintained by Statistics Norway only.

ufacturing sector and both high-tech and low-tech firms as explained in section 9.4.2. It is important to distinguish between the wage structures for white-collar and blue-collar workers in Norway, as the institutional setting for wage determination is quite different in the private sector. As explained in section 9.3.1, white-collar workers have their wages mainly set at the firm or plant level, whereas blue-collar workers' wages are mainly set by central bargaining. Robustness tests will be presented where we use plant-level results instead of firm-level results. Recall also that firms included in our analysis have more than twenty-five workers in each year. This means that we are assessing relatively large firms by Norwegian standards.

9.5.1 Wage Structure in Norway

Wage Dispersion for Workers, 1980–1997

Figures 9.3 and 9.4 depict the development of average wage by presenting the average wage and the 90th, 75th, 25th, and 10th percentiles from 1981 to 1997. When we consider white-collar workers alone, we notice that the overall real wage increase has been about 20 percent in the period. Blue-collar workers' wages have had a similar increase. Noticeable in both cases is a slight increase in real wages around 1985 and then a drop in the late 1980s due to the wage freeze at 5 percent nominal rises in 1988 and 1989. Real wages started to rise again in the 1990s. The different portions

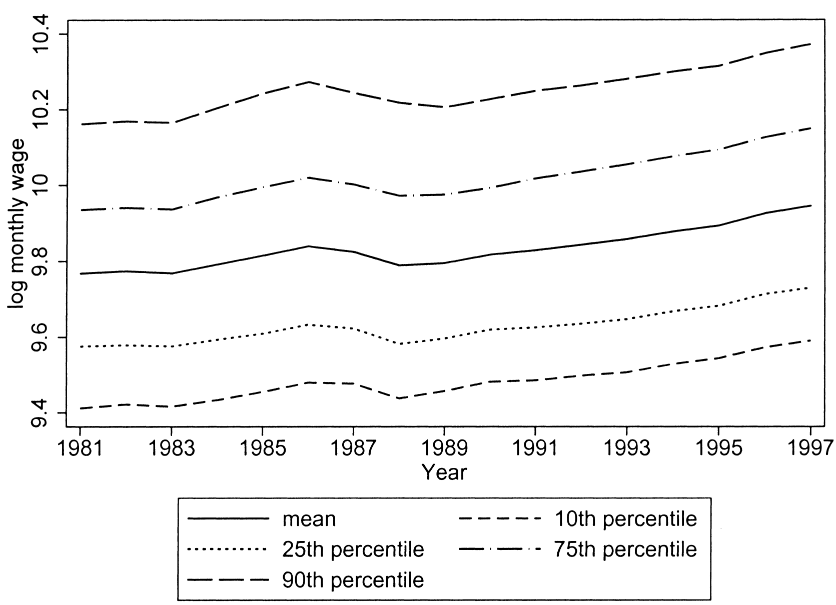

Fig. 9.3 Log monthly wage for white-collar workers in the private sector

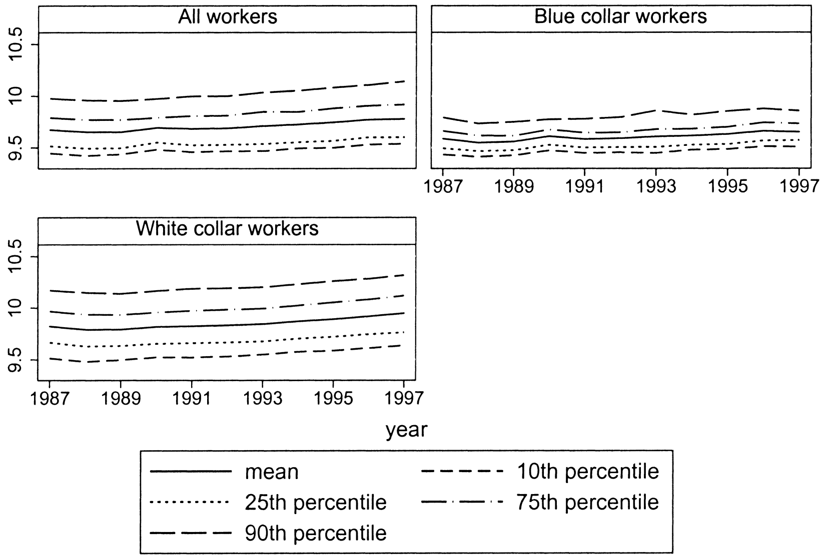

Fig. 9.4 Log monthly wage for workers in the machinery and equipment industry (Sector 38)

Note: Graphs by all workers/blue-collar workers/white-collar workers.

of the wage distribution basically follow the same pattern, and wage dispersion did not increase in this period either within the group of white-collar workers or for all workers taken together. A rather stable wage distribution is also confirmed by the estimated kernel densities presented in figure 9.5 and for both white- and blue-collar workers in figures 9.6, 9.7, and 9.8. The results confirm previous findings (Salvanes, Burgess, and Lane 1999; Aaberge et al. 2000) of no increase in wage dispersion in Norway in this period,[19] and differ substantially from the development in other OECD countries and notably for other Scandinavian countries (see Skans, Edin, and Holmlund [chapter 7 in this volume] and Oyer [chapter 12 in this volume] for Sweden and Uusitalo and Vartianen [chapter 5 in this volume] for Finland).

From figures 9.7 and 9.8, we see that there is more wage variance among white-collar workers than among blue-collar workers. This is to be expected because white-collar workers include high-wage management as well as low-end staff positions. In addition, the wage of white-collar workers is mainly determined locally (so-called wage drift), while the wage of blue-collar workers is mainly determined though centralized collective

19. There is some evidence that wage dispersion increased in the late 1980s. See Faggio, Salvanes, and Reenen (2007), using earnings data going beyond 1997.

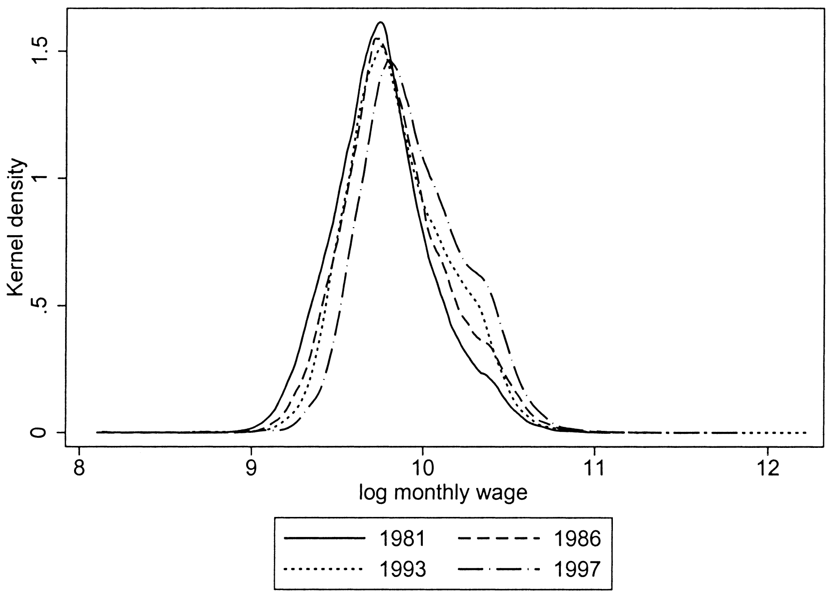

Fig. 9.5 Kernel densities for white-collar workers in the private sector

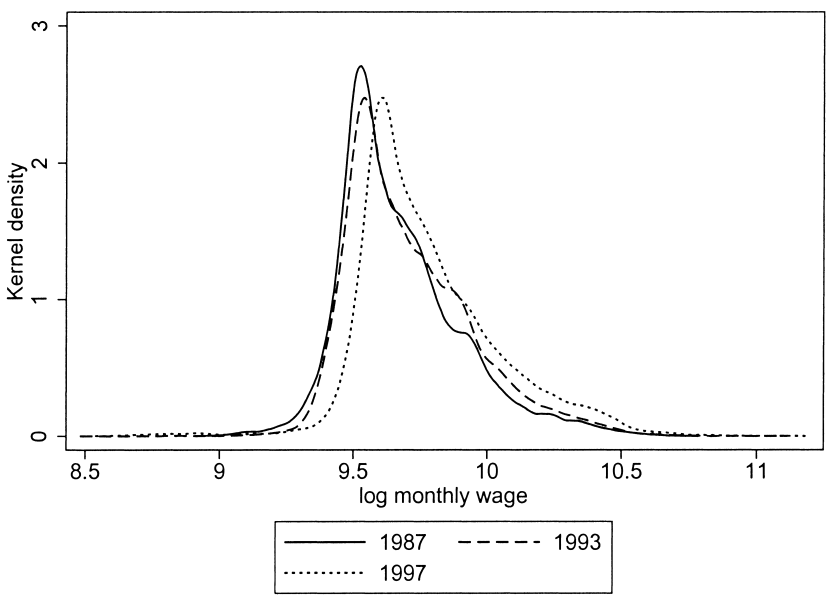

Fig. 9.6 Kernel densities for both blue- and white-collar workers in the machinery and equipment industry (Sector 38)

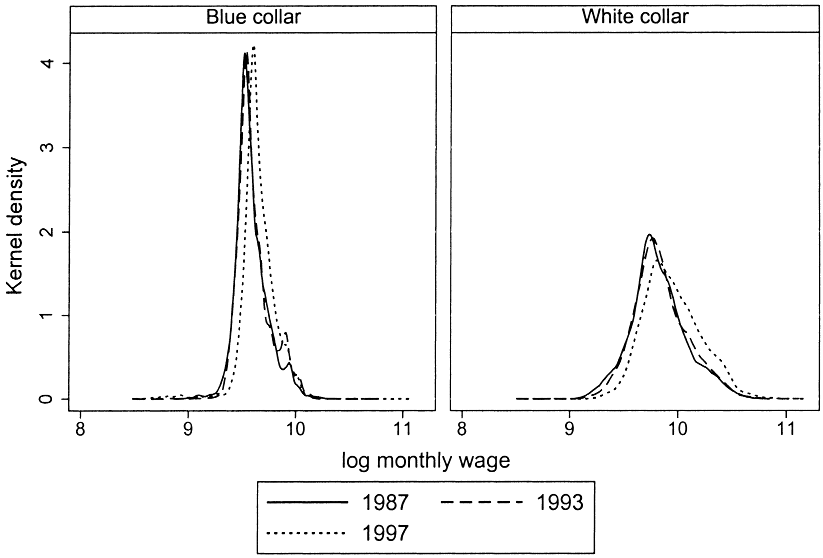

Fig. 9.7 Kernel densities for workers in the machinery and equipment industry (Sector 38)

Note: Graphs by group.

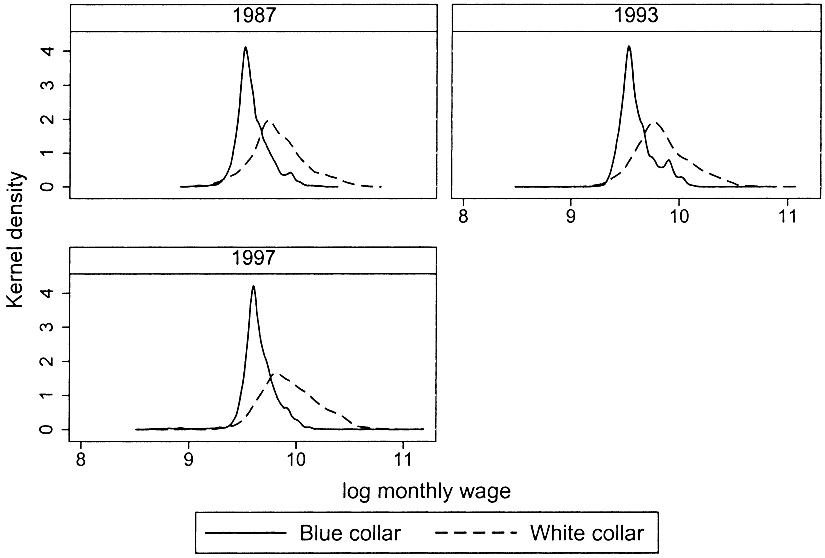

Fig. 9.8 Kernel densities for workers in the machinery and equipment industry (Sector 38) by year

Note: Graphs by year.

agreements. See section 9.3.1 for more about this. Hence, white-collar wages are more strongly influenced by firm heterogeneity.

In table 9A.1 in the appendix, we present more detailed measures for the structure of wage levels for white-collar workers.[20] In table 9A.2 in the appendix, the same type of results are presented for white- and blue-collar workers in the machinery and equipment industry (Sector 38). In these tables, we also report the wage distribution by age. From the lower panel of table 9A.1, we see that older white-collar workers (age forty-five to fifty) have a higher wage level than younger workers (age twenty-five to thirty) as expected but also higher wage dispersion than younger workers. This implies that pay for unobserved characteristics is correlated with the age of the workers. Both groups seem to follow a similar pattern of wage increases over time, but wage dispersion appears to be increasing for older workers.

Within- and Between-Firm Wage Dispersion

In this section, we assess the variation of wages at the firm level. Is the modest and stable overall wage dispersion in Norway representative for all firms, or are there large differences in wage structure across firms? From the institutional setting, we would expect that centralized wage setting induces very similar wage structures across firms, but we also know that wage drift is important (see figure 9.2), particularly for white-collar workers. In addition, we know that technological change, increased international trade, and outsourcing are distributed unequally across firms. These forces have been as important in Norway as in most other countries and may lead to differences in wage dispersion across firms (Salvanes and Førre 2003). Such possible differences may, of course, reflect different factors such as productivity differences, differences in wage policy, or differences in the composition of the workforce.

Recall that the average wage increase is about 20 percent for white-collar workers in the period we are analyzing. In figure 9.9, we present the real wage increase at the firm level for both the mean wage level and different parts of the distribution. We see that the wage increase has been very similar for different parts of the wage distribution of firms. This implies that there has not been any increased wage dispersion across firms over time in Norway. More detailed results, and results for blue- and white-collar workers together in the machinery and equipment industry can be found in tables 9A.3 and 9A.4 in the appendix.

In order to further assess the wage structures within and between firms, we decompose the wage structure. These results are presented in figure 9.10 for white-collar workers only and in figure 9.11 for blue- and white-collar workers in the machinery and equipment industry (Sector 38).

20. Table 9A.12 presents the same numbers at plant level instead of firm level.

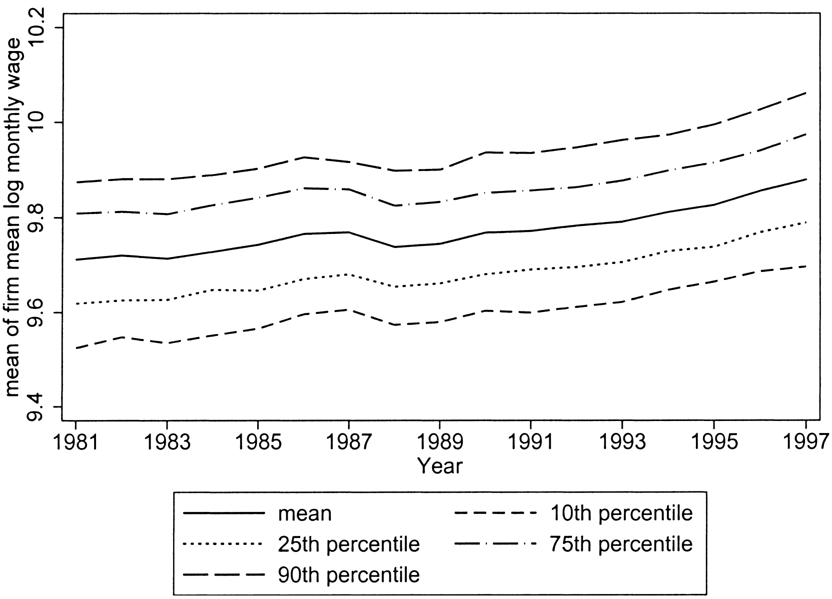

Fig. 9.9 Mean of firm mean log monthly white-collar wage in the private sector

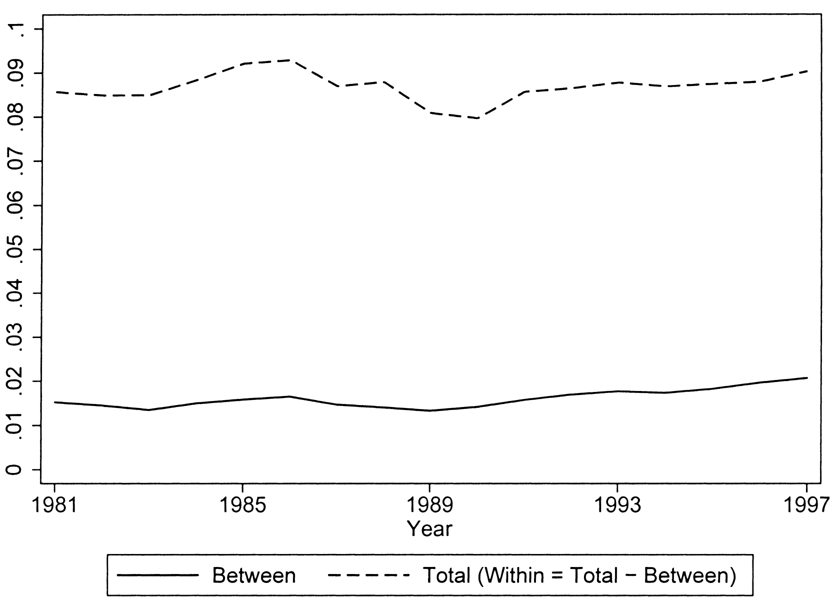

Fig. 9.10 Decomposition of log monthly wages for white-collar workers in the private sector

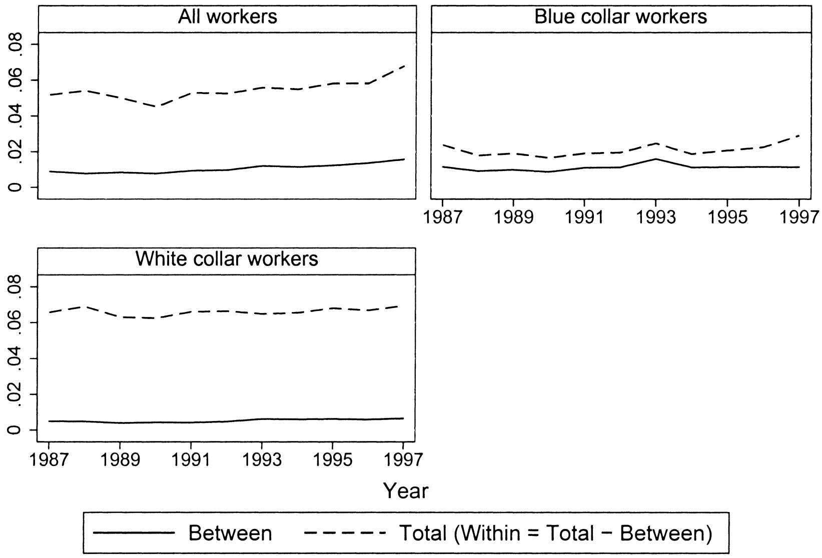

Fig. 9.11 Decomposition of log monthly wage for workers in the machinery and equipment industry (Sector 38)

Note: Graphs by all workers/blue-collar workers/white-collar workers.

Corresponding numbers are given in tables 9A.9 and 9A.10 in the appendix.[21] As expected, only 15 to 20 percent of the wage variation for white-collar workers are between firms. Thus, most of the wage dispersion in Norway is within firms. It is important to note, however, that there was a slight increase in the magnitude of firm wage differences at the end of the period (see also figure 9.13). Somehow, the firms became more different over time. Turning to the results for both white- and blue-collar workers in the same firms, we notice in figure 9.11 that there is a big difference between white- and blue-collar workers and between sectors. First, the total variance is, as expected, much larger for white-collar workers within the same sector. Second, the total variance for white-collar workers is also, as expected, lower within the machinery and equipment industry (Sector 38) than when private services are included as in figure 9.10. Hence, because there is less variance within the machinery and equipment industry and because blue-collar workers are in the majority here, the total variance for both groups taken together is lower than the results shown for white-collar workers only in figure 9.11. However, again the within-firm part dominates the between-firm part, and there is a slight increase in the between-firm

21. Table 9A.13 gives the numbers for white-collar workers, where we use plants instead of firms.

part at the end of the period. One slightly puzzling result, however, is that when we compare the between-firm part for blue- and white-collar workers separately within the machinery and equipment industry (Sector 38), the between-firm part is far bigger for blue-collar workers than for white-collar workers (see the details in table 9A.10 in the appendix). Because firm-level negotiations are much more important for white-collar workers than for blue-collar workers, we would have expected the opposite. As can be seen from figure 9.2, the wage drift part is also very important for blue-collar workers, so this may partly explain the puzzle.

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 9.12 after controlling for type of education, gender, and age in a Mincer wage equation estimated annually (corresponding numbers are given in table 9A.9 in the appendix). Two important findings are evident. We basically get the same result in the first part of the period. Between-firm wage dispersion accounts for about 17 percent of the total 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 9.13, where we report the ratio of the between-firm and total variation. The large increase in differences in wages

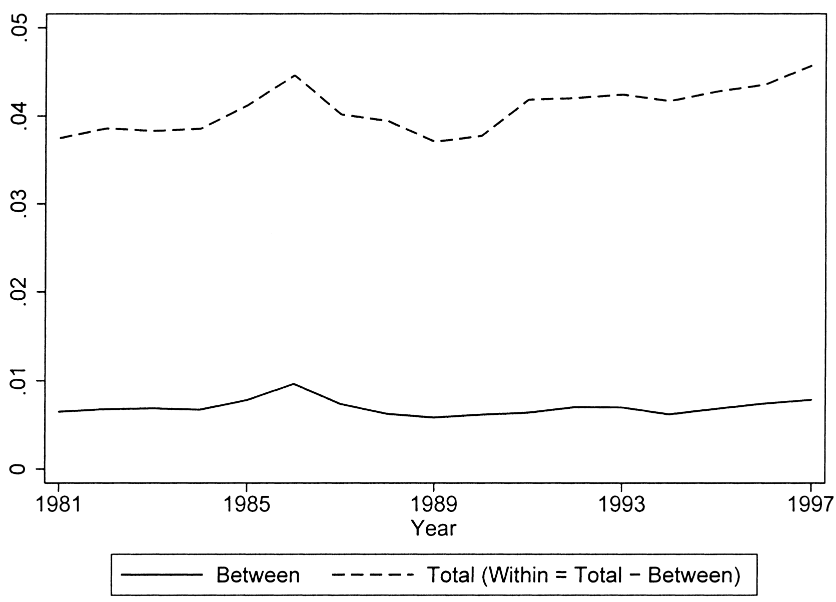

Fig. 9.12 Decomposition of residuals from Mincer equations for white-collar workers in the private sector

Fig. 9.13 Fraction of total variance for white-collar workers in the private sector explained by between-firm effects

due to changes in the workforce 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 that assess reallocation of jobs and workers (Salvanes and Førre 2003). Salvanes and Førre find that the bulk of reallocation of jobs is between firms *within* five-digit sectors, indicating that structural change at this level 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.

It is interesting to compare our results with other Scandinavian countries that have different wage setting institutions. Sweden started out with centralized wage bargaining like Norway's, but in the early 1980s it basically decentralized wage bargaining to the industry level and, unlike Norway, did not recentralize. Finland has had partly decentralized wage bargaining at the industry level since the early 1980s, and, as in Norway, plant-level bargaining has been important over the whole period. When we compare 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 were similar. According to Skans, Edin, and Holmlund (chapter 7 in this volume), the firm-level part constituted about

20 percent until about 1990, and then it increased to about 30 percent of wage dispersion in Sweden around the 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 both in Sweden and in Norway, but in Sweden, real firm effects also exist. Finland is very different from Norway and Sweden in that the total wage dispersion is much smaller and constant throughout the period. Furthermore, Finland is vastly different when it comes to the importance of firm effects: the firm effect was negligible in the beginning and explains the entire wage dispersion from the late 1990s (Uusitalo and Vartiainen, chapter 5 in this volume).

9.5.2 Firm Size

Davis and Haltiwanger (1996) have shown firm size to be important in explaining wage differences. Figure 9.14 shows the average of log monthly wage for white-collar workers distributed by firm size. Here we use a sample where the firm size restriction is at least two white-collar workers instead of twenty-five white-collar workers. In line with the previous literature, we find that wages increase with firm size. Note that the wage differences between different firm size classes are roughly unchanged over time.

To picture the wage dispersion, we use the coefficient of variation between and within firms.[22] Figure 9.15 shows that wage dispersion within firms tends to increase with firm size, while wage dispersion between firms tends to decrease with firm size.[23]

9.5.3 Wage Dynamics

Figure 9.16 presents the average log wage changes for private-sector, white-collar workers. We notice that wage growth differs strongly over the business cycle for this group of workers. Wage growth is much higher for the two peak periods of 1985 to 1986 and 1996 to 1997 than at the two low-point years. From 1980 to 1981, there is even a decline in real average wages. This procyclical pattern is strong and characterizes all segments of the wage change distribution.

When comparing the group of workers moving between firms to all workers (presented in figure 9.16), the results indicate that most moves are voluntary, as movers have a much higher wage increase than the overall average for almost the whole period. Table 9A.3 in the appendix reports the wage changes for different parts of the distribution, and we see that the

22. We have no controls, that is, we look at the raw wage data.

23. Davis and Haltiwanger (1996, 364) write: "The negative relationship 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."

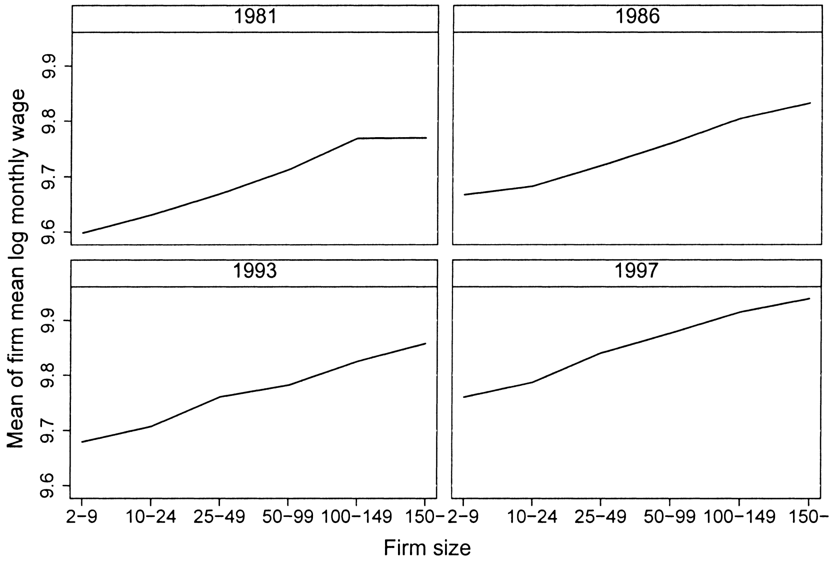

Fig. 9.14 Mean of firm mean log monthly wage by firm size: White-collar workers in the private sector

Note: Graphs by year.

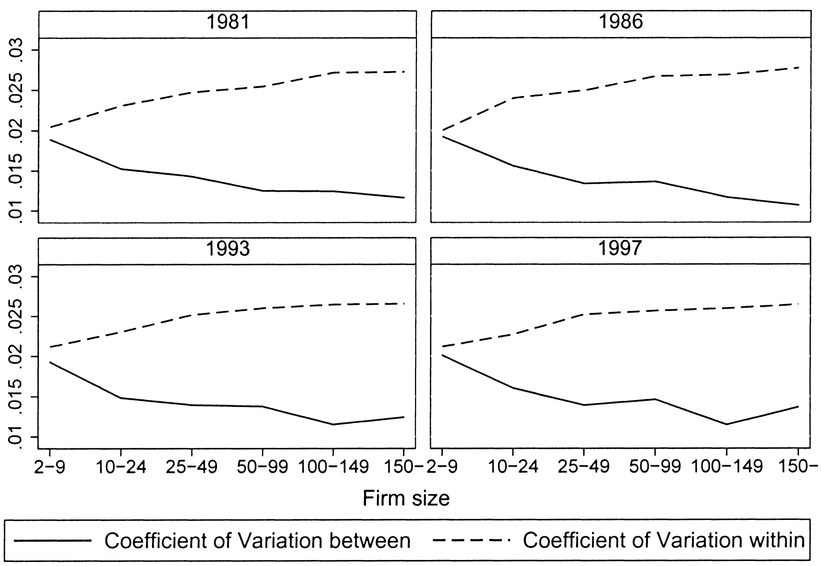

Fig. 9.15 Coefficient of variation within and between firms: White-collar workers in the private sector

Note: Graphs by year.

Fig. 9.16 Average change in log monthly wage for all white-collar workers and for white-collar workers who switch firms in the private sector

same pattern is especially strong for the 75th percentile. Again the cyclical patterns are strong, pointing to voluntary moves.

Figure 9.17 presents the wage increases for short- and long-tenured workers. As we would expect, workers with short tenure have much higher wage increases than workers who have stayed with the firm for a while. Again the cyclical pattern is strong.

Turning to the sample of both blue- and white-collar workers presented in table 9A.4 in the appendix, a procyclical 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. Results for movers and differences between short- and long-tenured workers hold also for this group of workers.

9.5.4 Worker Mobility within and across Firms

In this section, we present patterns of worker mobility across firms, that is, firings and separations, as well the worker mobility rates within firms, for example, promotions. We want to assess the distribution of worker exit and entry rates both across groups of workers and firms and over the business cycle. A novel feature is that we can calculate internal turnover rates and entry rates for different occupations within the firms. We will focus on the results for white-collar workers in the manufacturing sector and private services.

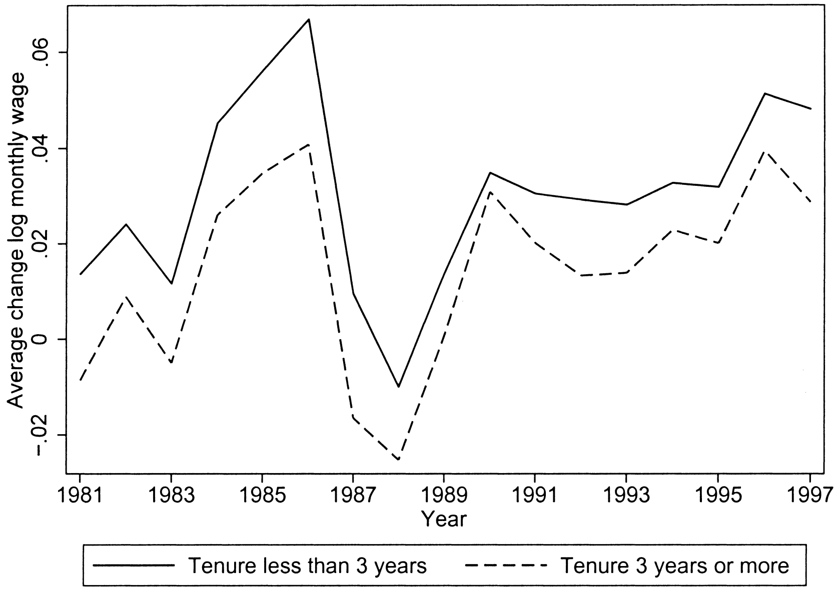

Fig. 9.17 Average change in log monthly wage for all white-collar workers in the private sector, by tenure

Worker Exit and Entry Rates

We start by presenting in figure 9.18 the development and size distribution for all firms defined as 25 or more workers both in t and $t - 1$ in the white-collar data set as well as for large firms defined as 100 or more workers, to make the results comparable across countries. Note that none of these groups will be representative for the Norwegian economy, as firms with 25 or more white-collar workers are relatively large in Norway. However, from figure 9.19, we see that the size distribution for all firms is very stable. For "all firms," that is, 25 or more white collar workers, average firm size increased from 121 employees in 1981 to 139 in 1997. For firms with 100 or more white collar workers, size increased from 287 to 345 employees.

In order to illustrate the patterns of worker mobility, we present in figures 9.20, 9.21, and 9.22 exit and entry rates by year, firm size, and for lower and upper segments of the wage distribution. Tables 9A.5, 9A.6, and 9A.7 in the appendix provide more detailed information.[24] The exit rate or worker separation rate for all white-collar workers taken together is about 15 percent annually for all firms in our sample, and about 10 percent for large firms. Salvanes and Førre (2003), using a data set without a lower

24. Table 9A.8 in the appendix provides numbers for both white- and blue-collar workers in the machinery and equipment industry (Sector 38). Table 9A.14 provides numbers for white-collar workers by plant instead of firm.

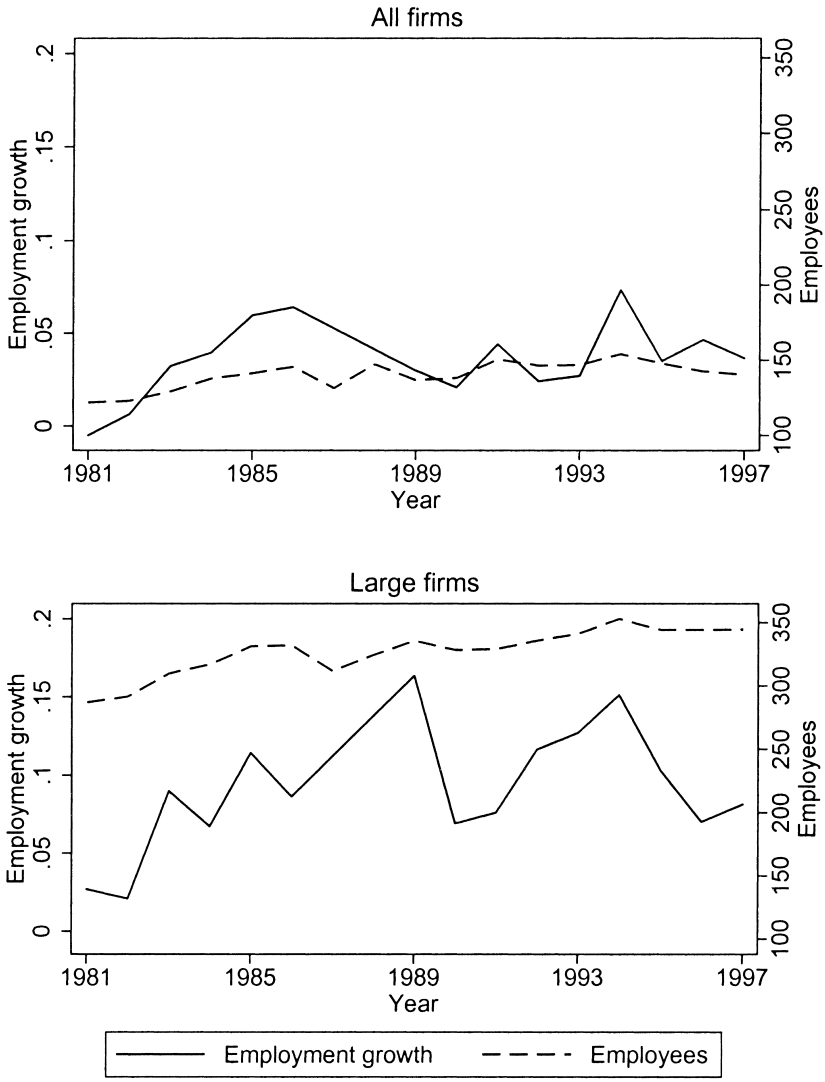

Fig. 9.18 Number of white-collar workers and employment growth for firms in the private sector, by firm size

Note: Large firms defined as at least 100 white collar workers.

limit on firm size, find an exit rate around 25 percent. This is only slightly below results for the U.S. economy. The entry or hiring rate is between 14 percent and 19 percent for all firms and between 9 percent and 12 percent for large firms. One observation, therefore, is that the turnover rates are high for white-collar workers and that they decrease with firm size as

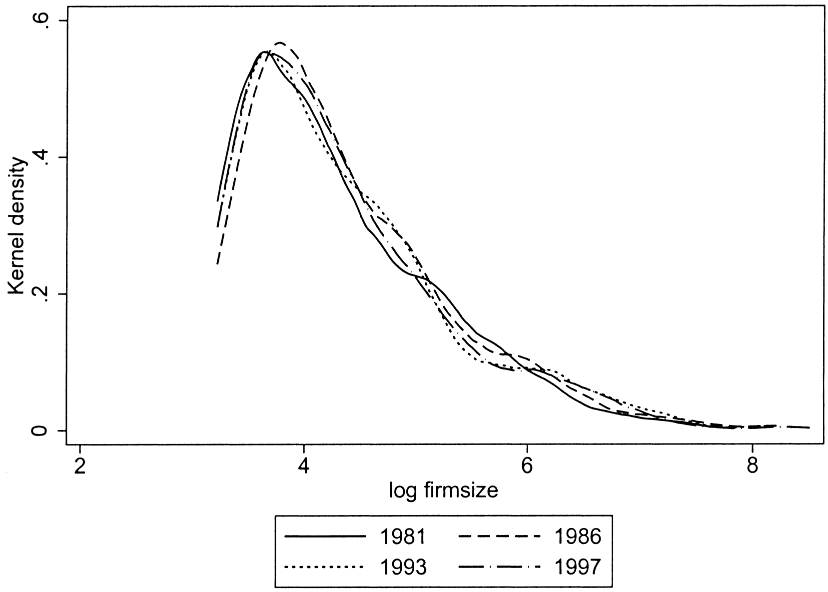

Fig. 9.19 Kernel density log firm size: White-collar data

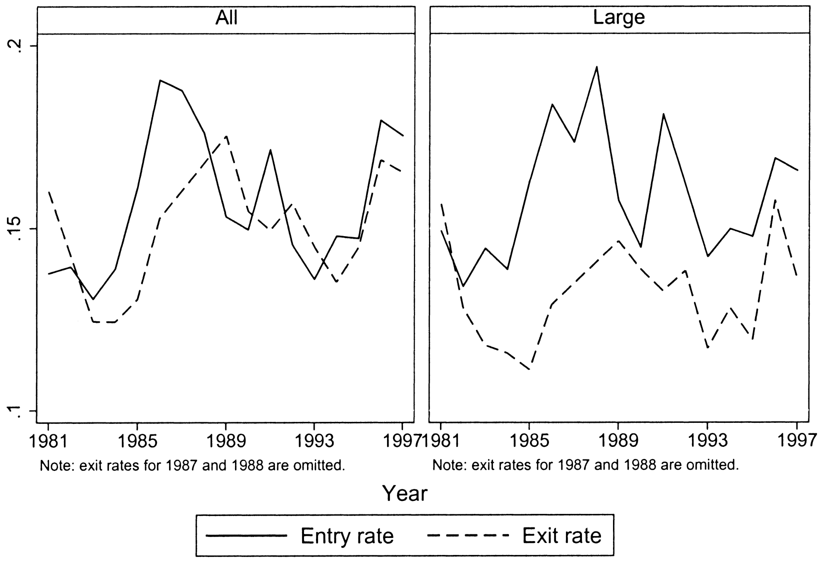

Fig. 9.20 Firm-level exit and entry rates: White-collar workers in the private sector

Notes: Large firms defined as at least 100 white-collar workers. Graphs by all/large firms.

expected. These findings are in line with previous work using other data sets and different parts of the firm size distribution (Salvanes and Førre 2003). Looking at different segments of the workforce, see figures 9.21 and 9.22, we notice that white-collar workers in low-paid jobs have much higher exit and entry rates than workers in high-paid jobs.[25] Thus, low-paid jobs are more volatile than high-paid jobs. Figure 9.23 shows the kernel densities for exit and entry rates at the firm level. The cyclical pattern is quite interesting for worker flows. The exit rate is quite stable over the cycle, whereas the job destruction rate that comprises one part of the exit rate is for many countries found to be countercyclical (for the United States, see Davis and Haltiwanger [1992]; for Norway, see Salvanes [1997]). This pattern appears to be true for all segments of the firms. It is the entry rate that varies over the cycle in a procyclical fashion. Looking at job creation rate only, a part of the entry rate, the standard result is that it is stable over the cycle. This pattern also appears to be true for all segments of the workforce, but it seems to be more pronounced for the lower-level jobs.

In table 9A.5 in the appendix, we see that entry rates are positively correlated with wage growth, suggesting that growing firms raise wages to attract new workers. Somewhat surprisingly, the relationship between wage growth and the worker exit rates is much weaker. One would expect wage growth to be negatively correlated with the exit rate, and to some extent this is so for low-level jobs. For workers in high-level jobs, however, table 9A.6 shows that there is significant, positive correlation between wage growth and exit rates. One explanation could be that managers in successful firms get attractive outside offers. Within-firm wage dispersion does not seem related to exit rates, nor to entry rates with one exception. For high-level jobs, there is significant positive correlation between wage dispersion and entry.

Internal Worker Dynamics

Because we have information on the internal structure of the firms' labor market, we can assess the internal worker turnover rates. Two measures will be presented: internal turnover rates across occupations and the share hired from within the firm.[26] We look at twenty-two different occupations; compare with section 9.4.1. The number of occupations represented in each firm has been stable over the period. The average is thirteen for all firms and sixteen for large firms. The number of hierarchical levels has also

25. Low and high pay is here defined as being in the bottom or top quartile of the within-firm wage distribution, respectively. Very similar results can be found in tables 9A.6 and 9A.7 in the appendix, looking at high- and low-level jobs rather than high- and low-paid workers. High- and low-level jobs are defined as follows: first, we calculate median wages for all jobs; then we rank all jobs by their median wage. High-level jobs are those jobs whose median wage is in the top 20 percent of the wage distribution, and low-level jobs are those in the bottom 20 percent.

26. See Hunnes, Møen, and Salvanes (2003) for more details on this.

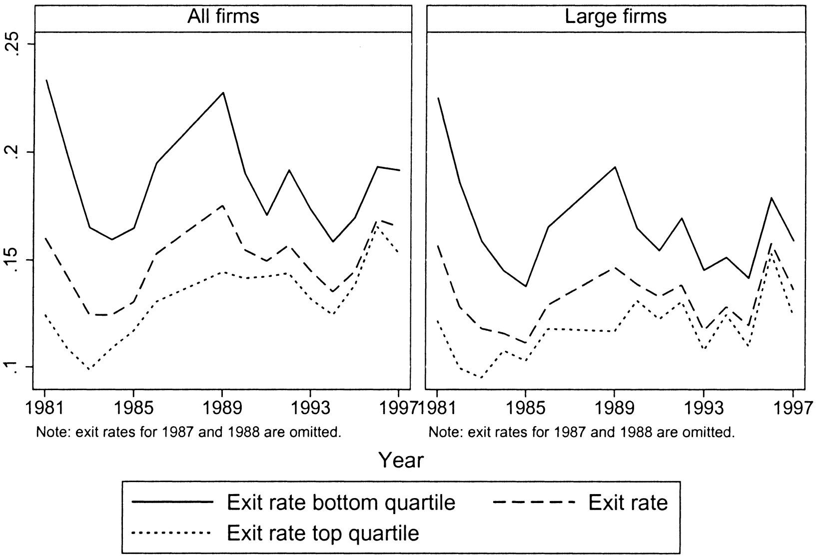

Fig. 9.21 Firm-level exit rates: White-collar workers in the private sector, split by top/bottom quartile of the within-firm wage distribution

Notes: Large firms defined as at least 100 white-collar workers. Graphs by all/large firms.

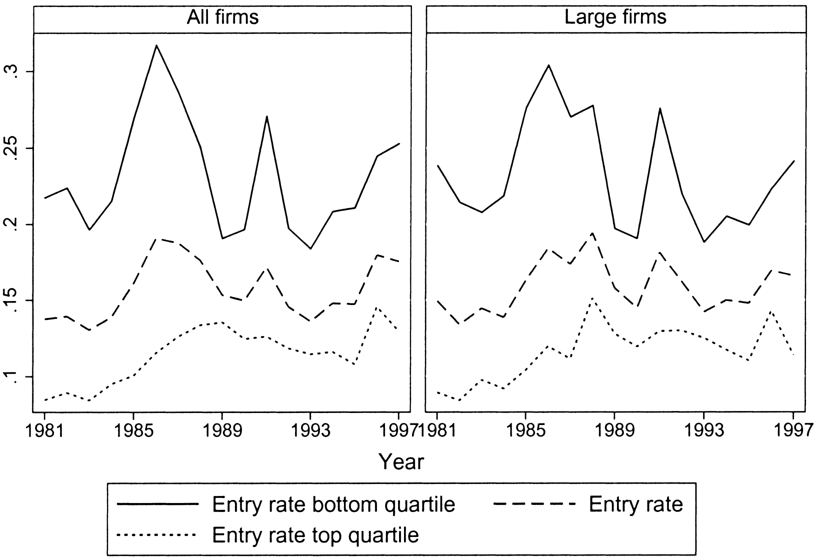

Fig. 9.22 Firm-level entry rates: White-collar workers in the private sector, split by top/bottom quartile of the within-firm wage distribution

Notes: Large firms defined as at least 100 white-collar workers. Graphs by all/large firms.

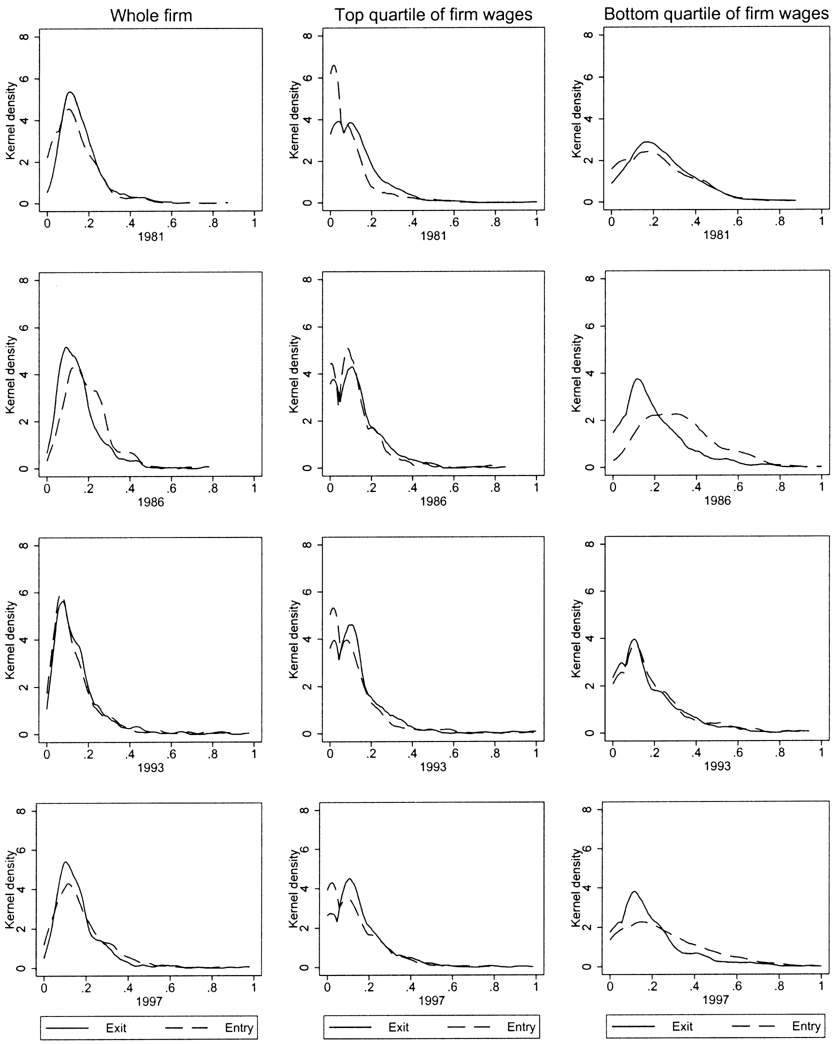

Fig. 9.23 Kernel densities for firm-level exit and entry rates: White-collar workers in the private sector

been stable over time. The average is six for all firms and 6.8 for the 100 or more firms. The number of levels appears to be larger for Norwegian firms than the figure Oyer (chapter 12 in this volume) reports for Swedish firms.

Figure 9.24 shows that about 10 percent of the workers switch jobs internally. The number of new jobs filled internally is about 40 percent for all white-collar workers. The numbers are similar across different firm sizes. Tables 9A.5, 9A.6, and 9A.7 in the appendix present further details. The

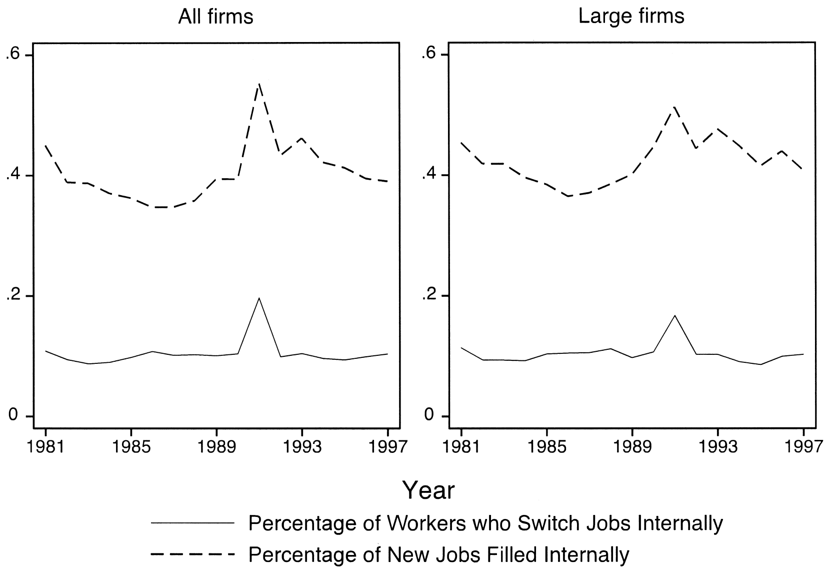

Fig. 9.24 Percentage of employees who switch jobs internally and percentage of jobs filled internally: White-collar workers in the private sector

Notes: Large firms defined as at least 100 white-collar workers. Graphs by all/large firms.

number of internally filled jobs is much lower at the lower end of the job-level distribution. We would expect that those jobs are filled externally, as the ports of entry jobs are at the bottom. In table 9A.8 in the appendix, we report results for blue- and white-collar workers together in the machinery and equipment industry. Blue-collar workers comprise the bulk of the jobs because the data are from the manufacturing sector. The external turnover rates are much the same as for white-collar workers. The internal rates are quite different, being also half the rate of white-collar workers. The percentages of jobs filled internally are also much lower. Blue-collar jobs are primarily filled externally.

9.6 Concluding Remarks

To what extent do different firms follow different wage policies? Do such differences relate to how workers move between firms? What are the effects of different wage bargaining regimes? The aim of this chapter has been threefold: first, to describe the Norwegian wage setting and employment protection institutions; next, to describe data sets available for empirical analysis; and, finally, to document stylized facts about the wage structure and the worker mobility patterns in Norway. We analyze within- and between-firm wage differences and worker entry and exit rates in the period

1980 to 1997. Norway is an interesting case to study for several reasons. The Norwegian economy is very open, but wage dispersion in Norway has remained low, while most OECD countries have experienced a strong increase. Also, certain labor market institutions are different from other European countries. Most notably, centralized wage bargaining is quite important. Differences in wage bargaining institutions between white- and blue-collar workers within Norway provide an additional dimension for comparison.

Norway is a high-wage country. Average monthly white-collar wage in the early 1990s was about NOK 20,000, the equivalent of 2,500 EURO. Average monthly wage across both blue- and white-collar workers in the machinery and equipment industry was about NOK 17,000. Real white-collar wages grew 18 percent over the sixteen-year period 1981 to 1997. Wage dispersion was low and stable with a coefficient of variation for white-collar workers of 31.8 percent in 1981 and 32.4 percent in 1997; that is, the standard deviation of white-collar wages was less than a third of the wage level. Country studies from Finland, Germany, Italy, Sweden, and Denmark find coefficients of variation in wages in the interval 33 to 41 percent. We find that wage dispersion among blue-collar workers is much smaller than wage dispersion among white-collar workers. This is to be expected, as blue-collar workers are a much more homogeneous group.

An important question we have analyzed is to what extent firms differ in their wage setting. Numerous economic models portray all firms as similar, using the "representative firm" metaphor. How far from the truth is this simplification? We find that most of the wage variation in Norway is within firms. The average standard deviation of wages within firms is 79 percent of the overall standard deviation. Still, firms vary considerably in their average wage level. The standard deviation of average firm wages is about 13 percent of the overall average wage, and between-firm wage variation represents 17 to 23 percent of the overall wage variation. The between share has increased over time, suggesting that firms are becoming somewhat more dissimilar. This development is related to changes in the workforce composition and disappears when observable worker characteristics are controlled for.

The correlation between the firm's average wage and the standard deviation of wages within the firm is positive and significant, both when we look at the wage level and the log of wages. Hence, high-wage firms have larger within-firm wage dispersion than low-wage firms. Whether this is because high-wage firms are more heterogeneous with respect to the composition of the workforce or because high-wage firms follow a different wage policy is an interesting and important question that we will pursue in future work.

Firms may differ not only with respect to average wage and wage dispersion, but also with respect to average wage growth. Looking into this, we find some heterogeneity. The interquartile range in average wage growth across firms is 3 to 4 percentage points in the 1980s, and about 2 percentage points in the 1990s. These numbers are for white-collar workers. Wage growth is strongly procyclical. When looking at the sample of both blue- and white-collar workers in the machinery and equipment industry, however, the procyclical pattern is less pronounced. This might be related to centralized wage bargaining being more important for blue-collar workers. Workers who change firms have above average wages growth in all years. This finding suggests that there are more voluntary moves than layoffs, even during economic downturns.

In our sample, dominated by relatively large firms, about 15 percent of the workers leave their employer each year. This is a fairly low number compared to other countries. A previous study for Norway, using the entire universe of firms, have found the exit rate to be about 25 percent. We find that the exit rate is very stable over the business cycle. This may seem surprising, but it is in line with previous studies suggesting that higher job destruction rates in bad years are counteracted by less voluntary job changes. The entry rate, on the other hand, is highly procyclical, and varies between 14 to 19 percent. Previous studies suggest that this is driven by more voluntary job changes is good years, while the job creation rates are fairly stable over the cycle. Entry and exit rates are much higher for workers in low-level jobs than for workers in high-level jobs. Hence, low-level jobs have, on average, a shorter duration.

There is substantial heterogeneity in entry and exit rates across firms. Some of this heterogeneity is explained by firm characteristics. First, we find that entry and exit rates are smaller in large firms than in small firms. Obviously, large internal labor markets offer better career opportunities within firms. Second, entry rates are positively correlated with wage growth, suggesting that growing firms raise wages to attract new workers. Somewhat surprisingly, the relationship between wage growth and the worker exit rates is much weaker. One would expect wage growth to be negatively correlated with the exit rate, and to some extent this is so for low-level jobs. For workers in high-level jobs, however, there is significant, positive correlation between wage growth and the exit rate. One explanation could be that managers in successful firms get attractive outside offers.

Having information about the internal structure of firms' labor markets, we are not restricted to analyzing worker mobility across firms. Looking at within-firm job mobility, we find that about 10 percent of white-collar workers change occupation each year. Occupations are broadly defined in our data; hence, these workers should experience a significant shift in their job content. The share of workers changing occupation internally is similar for small and large firms, and the number is also stable over the business cycle. The share of new white-collar jobs filled internally varies between 35 and 46 percent. There is more external hiring in good years. Consistent with the hypothesis that low-level jobs are "ports of entry" into the firms, we find that the share of jobs filled internally is much lower for low-level jobs than for high-level jobs. The difference is particularly large in large firms. Among blue-collar workers, the share of workers who change occupation within firms is much lower than for white-collar workers. The share of new jobs filled internally is also much lower.

Future work on the Norwegian data should go deeper into the importance of sorting and clarify further to what extent different wage structures reflect differences in the workforce composition and to what extent they reflect managerial choices. How has sorting of workers developed over time and what are possible driving forces? How do different managerial choices with respect to wage policy affect firm productivity? A related issue is the effect of technological change and innovativeness on the wage structure. Finally, there is more work to be done on the effect of different wage bargaining regimes, exploiting differences between blue- and white-collar workers, different sectors, and different time periods.

Appendix

Additional Tables

Table 9A.1 **Structure of wages within and between firms (white-collar workers in the private sector)**

	Monthly wage				Log monthly wage			
	1981	1986	1993	1997	1981	1986	1993	1997
Average wage	18,259	19,694	20,001	21,855	9.768	9.840	9.858	9.945
SD	5,810	6,560	6,455	7,072	0.293	0.305	0.296	0.300
90th percentile	25,872	28,934	29,175	31,959	10.161	10.273	10.281	10.372
10th percentile	12,231	13,090	13,447	14,625	9.412	9.480	9.507	9.590
No. of workers	56,838	73,600	76,449	79,259	56,838	73,600	76,449	79,259
Average of firm average wage	17,226	18,201	18,677	20,395	9.713	9.766	9.791	9.879
SD	2,350	2,404	2,656	2,977	0.135	0.130	0.135	0.141
90th percentile	20,114	21,231	22,023	24,360	9.875	9.926	9.962	10.061
10th percentile	14,042	15,114	15,601	16,686	9.525	9.596	9.622	9.697
No. of firms	467	506	521	565	467	506	521	565
Average of SD of wage	4,568	5,006	5,121	5,566	0.249	0.255	0.253	0.252
SD	1,206	1,381	1,653	1,641	0.048	0.053	0.051	0.048
90th percentile	6,125	6,713	6,852	7,421	0.302	0.312	0.310	0.308
10th percentile	2,999	3,356	3,537	3,744	0.194	0.200	0.197	0.198
No. of firms	467	506	521	565	467	506	521	565
Average CV of wage	0.263	0.273	0.271	0.270	0.026	0.026	0.026	0.026
SD	0.050	0.055	0.061	0.057	0.005	0.005	0.005	0.005
90th percentile	0.323	0.341	0.339	0.334	0.031	0.031	0.032	0.031
10th percentile	0.197	0.208	0.204	0.204	0.020	0.021	0.020	0.020
No. of firms	467	506	521	565	467	506	521	565

(continued)

Table 9A.1 (continued)

	Monthly wage				Log monthly wage			
	1981	1986	1993	1997	1981	1986	1993	1997
Correlation (average wage, SD wage)	0.738	0.732	0.727	0.726	0.203	0.155	0.364	0.333
Significance level	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
Average wage for workers between 25 and 30	15,486	16,984	16,304	17,630	9.627	9.716	9.679	9.757
SD	3,179	3,795	3,282	3,547	0.201	0.216	0.200	0.201
90th percentile	19,725	22,120	20,564	22,202	9.890	10.004	9.931	10.008
10th percentile	11,774	12,626	12,483	13,386	9.374	9.444	9.432	9.502
No. of workers	7,378	11,628	10,833	9,123	7,378	11,628	10,833	9,123
Average wage for workers between 45 and 50	19,970	21,352	21,368	23,262	9.858	9.920	9.919	10.003
SD	6,291	7,182	7,327	7,845	0.290	0.305	0.312	0.316
90th percentile	28,747	32,092	31,592	34,461	10.266	10.376	10.361	10.448
10th percentile	13,576	14,309	14,094	15,250	9.516	9.569	9.554	9.632
No. of workers	7,231	9,031	14,641	13,962	7,231	9,031	14,641	13,962

Notes: The numbers are real wages, transformed from nominal wages using the Consumer Price Index from Statistics Norway with base year 1990. SD = standard deviation; CV = coefficient of variation.

Table 9A.2 **Structure of wages within and between firms (all workers in the machinery and equipment industry; sector 38)**

	Monthly wage			Log monthly wage		
	1987	1993	1997	1987	1993	1997
Average wage	16,328	16,989	18,311	9.673	9.710	9.779
SD	4,241	4,586	5,374	0.227	0.236	0.261
90th percentile	21,487	22,805	25,364	9.975	10.035	10.141
10th percentile	12,664	12,938	13,873	9.447	9.468	9.538
No. of workers	24,268	26,805	25,446	24,268	26,805	25,446
Average of firm average wage	15,436	15,930	16,877	9.620	9.649	9.703
SD	1,621	1,807	2,010	0.097	0.104	0.109
90th percentile	17,625	18,629	19,383	9.755	9.814	9.847
10th percentile	13,583	14,123	14,787	9.508	9.544	9.585
No. of firms	119	149	139	119	149	139
Average of SD of wage	3,278	3,549	4,026	0.185	0.191	0.212
SD	1,027	1,142	1,219	0.044	0.047	0.044
90th percentile	4,734	4,910	5,464	0.251	0.259	0.274
10th percentile	2,057	2,201	2,487	0.131	0.136	0.153
No. of firms	119	149	139	119	149	139
Average CV of wages	0.210	0.220	0.236	0.019	0.020	0.022
SD	0.052	0.056	0.054	0.005	0.005	0.004
90th percentile	0.278	0.297	0.309	0.026	0.026	0.028
10th percentile	0.141	0.149	0.169	0.014	0.014	0.016
No. of firms	119	149	139	119	149	139
Correlation (average wage, SD wage)	0.718	0.690	0.762	0.501	0.489	0.447
Significance level	0.000	0.000	0.000	0.000	0.000	0.000
Average wage for workers between 25 and 30	15,642	15,650	16,571	9.642	9.643	9.701
SD	2,935	2,836	2,999	0.175	0.171	0.165
90th percentile	19,744	19,658	20,284	9.891	9.886	9.918
10th percentile	12,689	12,671	13,606	9.448	9.447	9.518
No. of workers	3,299	4,654	3,781	3,299	4,654	3,781
Average wage for workers between 45 and 50	17,211	17,888	19,338	9.723	9.755	9.831
SD	4,678	5,341	5,959	0.236	0.259	0.268
90th percentile	23,035	24,954	27,825	10.045	10.125	10.234
10th percentile	13,151	13,200	14,155	9.484	9.488	9.558
No. of workers	3,102	4,474	3,988	3,102	4,474	3,988

Notes: See table 9A.1 notes.

Table 9A.3 Wage dynamics for white-collar workers in the private sector

	Δ monthly wage				Δ log monthly wage			
	1981	1986	1993	1997	1981	1986	1993	1997
Average change in wage	–93	903	329	709	–0.004	0.047	0.016	0.032
SD	1,228	1,263	1,430	1,488	0.065	0.061	0.054	0.068
90th percentile	1,276	2,274	1,241	2,057	0.074	0.116	0.064	0.093
10th percentile	–1,226	–79	–308	–131	–0.066	–0.005	–0.018	–0.007
No. of workers	49,975	60,499	68,162	69,210	49,975	60,499	68,162	69,210
Average of firm average change in wage	–171	820	246	623	–0.008	0.046	0.013	0.030
SD	627	471	369	494	0.036	0.027	0.019	0.023
90th percentile	514	1,396	666	1,186	0.031	0.075	0.034	0.057
10th percentile	–849	267	–176	120	–0.050	0.016	–0.010	0.006
No. of firms	467	506	521	565	467	506	521	565
Average of SD of change in wage	955	1,001	892	1,198	0.052	0.053	0.047	0.059
SD	399	464	823	777	0.024	0.028	0.028	0.037
90th percentile	1,381	1,499	1,434	2,019	0.076	0.077	0.078	0.095
10th percentile	552	562	373	503	0.029	0.031	0.021	0.026
No. of firms	467	506	521	565	467	506	521	565
Average change in wage for workers who change firms	242	1,644	533	1,091	0.015	0.081	0.025	0.050
SD	1,838	2,403	1,708	2,141	0.098	0.117	0.075	0.099
90th percentile	2,405	4,414	2,128	3,424	0.132	0.220	0.100	0.0157
10th percentile	–1,512	–465	–443	–215	–0.068	–0.026	–0.021	–0.011
No. of workers	1,265	814	2,688	2,842	1,265	814	2,688	2,842
Average change in wage for workers with tenure <3	205	1,215	549	1,000	0.014	0.067	0.028	0.048
SD	1,342	1,434	1,260	1,712	0.075	0.075	0.064	0.085
90th percentile	1,750	2,788	1,726	2,808	0.105	0.151	0.091	0.135
10th percentile	–1,109	–32	–300	–137	–0.062	–0.002	–0.016	–0.007
No. of workers	4,766	13,314	10,626	10,829	4,766	13,314	10,626	10,829
Average change in wage for workers with tenure ≥3	–170	815	289	655	–0.009	0.041	0.014	0.029
SD	1,156	1,196	1,454	1,436	0.059	0.055	0.051	0.063
90th percentile	1,116	2,085	1,128	1,873	0.060	0.103	0.058	0.084
10th percentile	–1,236	–84	–310	–131	–0.068	–0.005	–0.019	–0.007
No. of workers	25,065	46,834	57,469	58,295	25,065	46,834	57,469	58,295

Notes: Change in wage is wage in year t minus wage in year $t - 1$. The numbers are real wages, transformed from nominal wages using the Consumer Price Index from Statistics Norway with base year 1990. SD = standard deviation.

Table 9A.4 **Wage dynamics for all workers in the machinery and equipment industry (sector 38)**

	Δ monthly wage			Δ log monthly wage		
	1987	1993	1997	1987	1993	1997
Average change in wage	341	308	473	0.027	0.017	0.024
SD	1,423	1,269	1,513	0.084	0.072	0.080
90th percentile	1,686	1,402	1,822	0.112	0.083	0.097
10th percentile	–1,180	–489	–506	–0.060	–0.027	–0.027
No. of workers	20,401	22,957	19,489	20,401	22,957	19,489
Average of firm average change in wage	444	175	396	0.034	0.011	0.022
SD	488	364	473	0.031	0.023	0.026
90th percentile	1,054	579	884	0.077	0.035	0.049
10th percentile	–121	–178	–98	–0.004	–0.013	–0.010
No. of firms	119	149	139	119	149	139
Average of SD of change in wage	1,127	820	1,146	0.072	0.049	0.065
SD	696	656	610	0.034	0.033	0.031
90th percentile	1,678	1,417	1,956	0.102	0.078	0.097
10th percentile	598	260	473	0.040	0.016	0.031
No. of firms	119	149	139	119	149	139
Average change in wage for workers who change firms	297	346	597	0.025	0.016	0.023
SD	1,684	2,222	2,406	0.103	0.114	0.140
90th percentile	2,205	2,679	3,362	0.142	0.157	0.159
10th percentile	–1,355	–1,169	–1,998	–0.084	–0.070	–0.119
No. of workers	609	319	697	609	319	697
Average change in wage for workers with tenure <3	617	612	736	0.050	0.039	0.041
SD	1,558	1,573	1,955	0.106	0.095	0.106
90th percentile	2,398	2,234	2,403	0.181	0.141	0.141
10th percentile	–1,073	–505	–545	–0.059	–0.025	–0.031
No. of workers	4,488	3,272	3,289	4,488	3,272	3,289
Average change in wage for workers with tenure ≥ 3	264	257	420	0.021	0.014	0.020
SD	1,373	1,203	1,401	0.075	0.067	0.073
90th percentile	1,492	1,221	1,665	0.099	0.072	0.085
10th percentile	–1,220	–487	–492	–0.060	–0.027	–0.025
No. of workers	15,913	19,685	16,200	15,913	19,685	16,200

Notes: See table 9A.3 notes.

Table 9A.5 **Mobility: white-collar workers in the private sector (all jobs)**

	All firms				Firms with 100+ employees			
	1981	1986	1993	1997	1981	1986	1993	1997
No. of firms	467	506	521	565	144	170	174	173
Employees	122	145	147	140	287	332	341	345
SD	199	294	293	304	297	453	448	491
No. of occupations	13	13	13	12	16	16	16	15
SD	4	4	4	4	3	3	3	3
No. of levels	6	6	6	6	7	7	7	7
SD	1	1	1	1	0	0	1	1
Employment growth	0.00	0.06	0.03	0.04	0.03	0.09	0.13	0.08
SD	0.23	0.20	0.46	0.27	0.32	0.21	0.74	0.38
Exit rate (all)	0.16	0.14	0.14	0.16	0.11	0.09	0.08	0.10
Exit rate	0.16	0.15	0.14	0.17	0.16	0.13	0.12	0.14
SD	0.10	0.10	0.13	0.12	0.11	0.08	0.08	0.07
Exit rate, top quartile	0.12	0.13	0.13	0.15	0.12	0.12	0.11	0.12
SD	0.12	0.12	0.14	0.14	0.11	0.10	0.10	0.08
Exit rate, bottom quartile	0.23	0.19	0.17	0.19	0.22	0.17	0.15	0.16
SD	0.15	0.15	0.16	0.16	0.13	0.11	0.11	0.10
Entry rate	0.14	0.19	0.14	0.18	0.15	0.18	0.14	0.17
SD	0.11	0.10	0.13	0.13	0.12	0.10	0.14	0.13

Entry rate, top quartile	0.08	0.12	0.11	0.13	0.09	0.12	0.13	0.11
SD	0.12	0.12	0.15	0.13	0.12	0.11	0.17	0.12
Entry rate, bottom quartile	0.22	0.32	0.18	0.25	0.24	0.30	0.19	0.24
SD	0.17	0.17	0.17	0.20	0.16	0.15	0.16	0.18
Percentage of employees who switch jobs internally	0.11	0.11	0.10	0.10	0.11	0.11	0.10	0.10
SD	0.10	0.09	0.08	0.09	0.10	0.07	0.07	0.09
Percentage of new jobs filled internally	0.45	0.35	0.46	0.39	0.45	0.36	0.48	0.41
SD	0.29	0.21	0.26	0.25	0.26	0.18	0.20	0.22
Percentage of workers who have been at firm 5+ years	0.07	0.56	0.67	0.62	0.08	0.56	0.69	0.67
SD	0.15	0.24	0.23	0.24	0.15	0.24	0.20	0.23
Correlation (exit rate, average wage)	–0.158	–0.126	–0.061	0.008	–0.118	–0.143	0.017	0.134
Significance level	0.001	0.005	0.166	0.841	0.159	0.063	0.820	0.079
Correlation (exit rate, average wage change)	0.002	0.054	–0.010	0.132	0.006	–0.065	–0.050	0.223
Significance level	0.963	0.224	0.825	0.002	0.942	0.400	0.512	0.003
Correlation (exit rate, SD wage)	–0.080	–0.033	0.029	0.127	–0.061	–0.098	0.122	0.261
Significance level	0.085	0.453	0.511	0.003	0.467	0.205	0.107	0.001
Correlation (entry rate, average wage)	–0.099	–0.151	0.018	–0.186	0.007	–0.028	0.052	–0.136
Significance level	0.032	0.001	0.674	0.000	0.930	0.716	0.494	0.074
Correlation (entry rate, average wage change)	0.062	0.233	0.114	0.111	0.132	0.254	0.029	0.091
Significance level	0.182	0.000	0.009	0.008	0.115	0.001	0.704	0.233
Correlation (entry rate, SD wage)	0.033	0.058	0.063	–0.056	0.098	0.204	0.000	–0.010
Significance level	0.476	0.192	0.152	0.181	0.243	0.008	0.998	0.891

Note: Top and bottom quartiles are quartiles in the within-firm wage distribution.

Table 9A.6 **Mobility: white-collar workers in the private sector (high-level jobs)**

	All firms				Firms with 100+ employees			
	1981	1986	1993	1997	1981	1986	1993	1997
No. of firms	465	503	515	546	144	170	174	173
Employees	18	24	29	29	40	56	69	75
SD	29	81	107	141	43	133	177	245
No. of occupations	3	3	3	3	4	4	4	4
SD	1	1	1	1	1	1	1	1
No. of levels	2	2	2	2	3	3	3	3
SD	1	1	1	1	0	0	1	1
Employment growth	0.05	0.13	0.06	0.06	0.10	0.11	0.19	0.05
SD	0.47	0.55	0.65	0.50	0.55	0.33	0.99	0.29
Exit rate (all)	0.14	0.12	0.13	0.15	0.10	0.08	0.09	0.10
Exit rate	0.13	0.14	0.14	0.15	0.12	0.12	0.11	0.13
SD	0.16	0.16	0.17	0.17	0.12	0.11	0.11	0.10
Exit rate, top quartile	0.13	0.15	0.16	0.19	0.13	0.15	0.12	0.15
SD	0.23	0.24	0.26	0.27	0.17	0.17	0.16	0.15
Exit rate, bottom quartile	0.14	0.14	0.14	0.13	0.14	0.10	0.11	0.13
SD	0.24	0.24	0.25	0.23	0.18	0.14	0.16	0.15
Entry rate	0.07	0.11	0.11	0.12	0.08	0.11	0.13	0.11
SD	0.12	0.13	0.17	0.17	0.12	0.12	0.17	0.13
Entry rate, top quartile	0.07	0.12	0.14	0.15	0.07	0.12	0.15	0.14
SD	0.17	0.22	0.25	0.25	0.15	0.17	0.22	0.19

Entry rate, bottom quartile	0.07	0.12	0.10	0.11	0.09	0.13	0.11	0.10
SD	0.16	0.21	0.21	0.23	0.15	0.16	0.19	0.16
Percentage of employees who switch jobs internally	0.15	0.15	0.11	0.11	0.16	0.15	0.11	0.12
SD	0.19	0.17	0.15	0.15	0.15	0.13	0.12	0.13
Percentage of new jobs filled internally	0.48	0.46	0.39	0.37	0.64	0.56	0.51	0.52
SD	0.44	0.39	0.40	0.40	0.37	0.32	0.35	0.35
Percentage of workers who have been at firm 5+ years	0.07	0.63	0.67	0.67	0.08	0.62	0.71	0.72
SD	0.19	0.29	0.27	0.29	0.18	0.27	0.21	0.24
Correlation (exit rate, average wage)	–0.132	–0.098	0.015	0.159	–0.062	–0.140	0.044	0.175
Significance level	0.004	0.029	0.728	0.000	0.462	0.068	0.565	0.021
Correlation (exit rate, average wage change)	0.108	0.101	0.139	0.079	–0.012	–0.089	0.094	0.149
Significance level	0.020	0.024	0.002	0.065	0.890	0.247	0.217	0.051
Correlation (exit rate, SD wage)	–0.012	0.004	0.109	0.072	–0.036	–0.030	0.063	0.170
Significance level	0.801	0.933	0.014	0.101	0.669	0.699	0.405	0.026
Correlation (entry rate, average wage)	–0.018	–0.014	0.151	0.120	0.045	0.050	0.018	0.032
Significance level	0.707	0.750	0.001	0.005	0.595	0.520	0.809	0.677
Correlation (entry rate, average wage change)	0.067	0.136	0.034	0.033	0.100	0.144	–0.048	–0.022
Significance level	0.149	0.002	0.438	0.437	0.235	0.061	0.529	0.776
Correlation (entry rate, SD wage)	0.115	0.101	0.171	0.096	0.086	0.175	0.010	0.164
Significance level	0.014	0.024	0.000	0.027	0.306	0.022	0.892	0.031

Notes: See footnote 25 for definition of high-level jobs. Top and bottom quartiles are quartiles in the within-firm wage distribution.

Table 9A.7 **Mobility: white-collar workers in the private sector (low-level jobs)**

	All firms				Firms with 100+ employees			
	1981	1986	1993	1997	1981	1986	1993	1997
No. of firms	455	493	496	528	144	170	172	167
Employees	20	20	16	15	43	39	33	32
SD	29	29	32	31	42	42	50	50
No. of occupations	2	2	2	2	3	2	2	2
SD	1	1	1	1	1	1	1	1
No. of levels	2	2	1	1	2	2	2	2
SD	0	0	1	0	0	0	0	0
Employment growth	–0.04	0.20	0.09	0.12	0.03	0.13	0.11	0.13
SD	0.56	0.85	0.65	0.63	0.71	0.48	0.69	0.65
Exit rate (all)	0.22	0.17	0.17	0.20	0.14	0.11	0.11	0.12
Exit rate	0.24	0.20	0.16	0.18	0.22	0.17	0.15	0.17
SD	0.19	0.19	0.20	0.21	0.13	0.13	0.15	0.17
Exit rate, top quartile	0.16	0.16	0.13	0.16	0.12	0.14	0.11	0.12
SD	0.25	0.25	0.24	0.27	0.16	0.18	0.19	0.19
Exit rate, bottom quartile	0.31	0.24	0.21	0.22	0.30	0.21	0.20	0.23
SD	0.29	0.29	0.31	0.31	0.21	0.19	0.25	0.26
Entry rate	0.20	0.29	0.17	0.23	0.22	0.29	0.19	0.21
SD	0.21	0.21	0.20	0.24	0.19	0.17	0.18	0.20
Entry rate, top quartile	0.12	0.18	0.13	0.17	0.13	0.19	0.13	0.16
SD	0.23	0.27	0.26	0.28	0.20	0.22	0.22	0.24

Entry rate, bottom quartile	0.32	0.47	0.22	0.31	0.34	0.46	0.26	0.29
SD	0.33	0.35	0.30	0.36	0.28	0.27	0.28	0.29
Percentage of employees who switch jobs internally	0.05	0.06	0.07	0.06	0.05	0.05	0.07	0.06
SD	0.11	0.12	0.13	0.13	0.09	0.08	0.11	0.09
Percentage of new jobs filled internally	0.15	0.13	0.23	0.16	0.19	0.13	0.26	0.20
SD	0.28	0.23	0.34	0.28	0.26	0.20	0.30	0.27
Percentage of workers who have been at firm 5+ years	0.05	0.44	0.64	0.60	0.06	0.45	0.67	0.67
SD	0.13	0.29	0.31	0.33	0.13	0.26	0.27	0.28
Correlation (exit rate, average wage)	–0.199	–0.131	0.011	–0.081	–0.245	–0.287	0.080	–0.155
Significance level	0.000	0.004	0.815	0.062	0.003	0.000	0.296	0.045
Correlation (exit rate, average wage change)	0.036	0.019	–0.100	–0.087	0.019	–0.047	–0.141	–0.059
Significance level	0.445	0.675	0.026	0.050	0.825	0.542	0.065	0.451
Correlation (exit rate, SD wage)	–0.047	0.004	–0.045	–0.043	–0.123	–0.059	–0.182	–0.020
Significance level	0.327	0.927	0.330	0.350	0.145	0.442	0.017	0.800
Correlation (entry rate, average wage)	–0.179	–0.286	–0.122	–0.241	–0.155	–0.317	–0.221	–0.248
Significance level	0.000	0.000	0.007	0.000	0.064	0.000	0.004	0.001
Correlation (entry rate, average wage change)	0.126	0.170	0.048	0.098	0.097	0.196	0.016	0.111
Significance level	0.008	0.000	0.287	0.026	0.248	0.011	0.834	0.154
Correlation (entry rate, SD wage)	0.075	0.154	0.047	–0.054	0.016	0.173	0.046	0.048
Significance level	0.117	0.001	0.311	0.238	0.845	0.024	0.554	0.540

Notes: See footnote 25 for definition of low-level jobs. Top and bottom quartiles are quartiles in the within-firm wage distribution.

Table 9A.8 **Mobility: all workers in the machinery and equipment industry (all jobs; sector 38)**

	All firms			Firms with 100+ employees		
	1987	1993	1997	1987	1993	1997
No. of firms	119	149	139	55	60	65
Employees	204	180	183	379	370	330
SD	290	265	242	353	338	290
No. of occupations	11	12	12	15	16	15
SD	4	4	4	2	3	3
No. of levels	6	6	6	7	7	7
SD	1	1	1	1	1	1
Employment growth	–0.08	–0.04	0.11	–0.09	0.05	0.21
SD	0.24	0.33	0.35	0.21	0.42	0.45
Exit rate (workers)	0.32	0.21	0.18	0.28	0.16	0.14
Exit rate	0.29	0.20	0.19	0.29	0.19	0.19
SD	0.14	0.15	0.10	0.13	0.13	0.09
Exit rate, top quartile	0.27	0.12	0.13	0.27	0.13	0.13
SD	0.20	0.12	0.10	0.20	0.14	0.08
Exit rate, bottom quartile	0.35	0.27	0.26	0.35	0.25	0.27
SD	0.17	0.20	0.16	0.12	0.17	0.15
Entry rate	0.18	0.14	0.23	0.19	0.17	0.28
SD	0.12	0.11	0.14	0.10	0.14	0.16
Entry rate, top quartile	0.11	0.09	0.13	0.12	0.11	0.16
SD	0.11	0.12	0.11	0.10	0.12	0.12
Entry rate, bottom quartile	0.30	0.21	0.39	0.29	0.25	0.43
SD	0.20	0.18	0.22	0.15	0.19	0.21
Percentage of employees who switch jobs internally	0.05	0.05	0.04	0.05	0.05	0.05
SD	0.05	0.04	0.04	0.05	0.04	0.04
Percentage of new jobs filled internally	0.23	0.29	0.18	0.23	0.30	0.19
SD	0.22	0.22	0.18	0.19	0.20	0.16
Percentage of workers who have been at firm 5+ years	0.54	0.74	0.63	0.56	0.69	0.61
SD	0.27	0.19	0.18	0.27	0.19	0.20
Correlation (exit rate, average wage)	0.009	0.031	–0.152	–0.190	–0.123	–0.320
Significance level	0.923	0.706	0.073	0.166	0.350	0.009
Correlation (exit rate, average wage change)	–0.041	0.101	–0.095	–0.068	–0.213	–0.168
Significance level	0.655	0.223	0.264	0.621	0.102	0.182
Correlation (exit rate, SD wage)	0.021	0.054	–0.134	–0.155	–0.216	–0.255
Significance level	0.825	0.514	0.117	0.257	0.098	0.040
Correlation (entry rate, average wage)	–0.097	–0.051	–0.119	–0.155	–0.326	–0.270
Significance level	0.294	0.537	0.164	0.259	0.011	0.030
Correlation (entry rate, average wage change)	0.161	0.128	0.221	0.133	0.115	0.103
Significance level	0.081	0.119	0.009	0.333	0.381	0.414
Correlation (entry rate, SD wage)	–0.163	0.019	–0.038	–0.227	–0.282	–0.112
Significance level	0.076	0.815	0.655	0.096	0.029	0.374

Note: Top and bottom quartiles are quartiles in the within-firm wage distribution.

Table 9A.9 **Decomposition of log monthly wage (white-collar workers in the private sector)**

Year	Total	Between
1981	0.0857	0.0152
1982	0.0849	0.0145
1983	0.0850	0.0135
1984	0.0884	0.0150
1985	0.0921	0.0158
1986	0.0929	0.0165
1987	0.0869	0.0147
1988	0.0879	0.0140
1989	0.0809	0.0133
1990	0.0797	0.0141
1991	0.0857	0.0157
1992	0.0865	0.0169
1993	0.0877	0.0177
1994	0.0869	0.0173
1995	0.0874	0.0182
1996	0.0879	0.0196
1997	0.0903	0.0207

Table 9A.10 **Decomposition of log monthly wage (all workers in the machinery and equipment industry; sector 38).**

	All workers		White collar		Blue collar	
Year	Total	Between	Total	Between	Total	Between
1987	0.0517	0.0089	0.0657	0.0049	0.0238	0.0115
1988	0.0541	0.0078	0.0689	0.0049	0.0179	0.0092
1989	0.0500	0.0084	0.0630	0.0040	0.0190	0.0099
1990	0.0451	0.0078	0.0625	0.0043	0.0166	0.0087
1991	0.0528	0.0094	0.0660	0.0043	0.0191	0.0111
1992	0.0525	0.0097	0.0664	0.0048	0.0195	0.0113
1993	0.0558	0.0120	0.0648	0.0062	0.0247	0.0160
1994	0.0549	0.0114	0.0654	0.0060	0.0187	0.0113
1995	0.0582	0.0124	0.0679	0.0063	0.0207	0.0115
1996	0.0582	0.0137	0.0668	0.0059	0.0225	0.0115
1997	0.0680	0.0158	0.0693	0.0065	0.0291	0.0114

Table 9A.11 The ratio between the between variation and the total variation (white-collar workers in the private sector)

Year	Log wage decomposition	Residual decomposition
1981	0.1777	0.1738
1982	0.1707	0.1762
1983	0.1587	0.1803
1984	0.1694	0.1752
1985	0.1716	0.1899
1986	0.1773	0.2164
1987	0.1688	0.1842
1988	0.1596	0.1590
1989	0.1641	0.1579
1990	0.1774	0.1638
1991	0.1832	0.1531
1992	0.1956	0.1674
1993	0.2012	0.1653
1994	0.1993	0.1493
1995	0.2083	0.1603
1996	0.2230	0.1712
1997	0.2289	0.1723

Table 9A.12 Structure of wages within and between plants (white-collar workers in the private sector)

	Monthly wage				Log monthly wage			
	1981	1986	1993	1997	1981	1986	1993	1997
Average wage	18,606	19,972	20,378	22,242	9.787	9.854	9.876	9.964
SD	5,901	6,580	6,576	7,130	0.293	0.303	0.297	0.299
90th percentile	26,376	29,280	29,652	32,344	10.180	10.285	10.297	10.384
10th percentile	12,415	13,258	13,632	14,874	9.427	9.492	9.520	9.607
No. of workers	48,226	65,825	65,839	68,900	48,226	65,825	65,839	68,900
Average of firm average wage	17,770	18,658	19,068	20,776	9.743	9.790	9.812	9.898
SD	2,404	2,553	2,723	3,027	0.132	0.134	0.135	0.140
90th percentile	20,618	21,813	22,496	24,696	9.893	9.947	9.985	10.077
10th percentile	14,654	15,344	15,881	17,264	9.566	9.608	9.649	9.731
No. of firms	535	613	614	688	535	613	614	688
Average of SD of wage	4,807	5,182	5,222	5,629	0.252	0.256	0.252	0.250
SD	1,303	1,452	1,774	1,727	0.047	0.053	0.055	0.051
90th percentile	6,420	6,944	7,036	7,468	0.309	0.315	0.313	0.306
10th percentile	3,150	3,410	3,406	3,657	0.193	0.196	0.192	0.189
No. of firms	535	613	614	688	535	613	614	688
Average CV of wages	0.268	0.276	0.271	0.268	0.026	0.026	0.026	0.025
SD	0.053	0.059	0.067	0.061	0.005	0.005	0.005	0.005
90th percentile	0.334	0.346	0.343	0.333	0.032	0.032	0.032	0.031
10th percentile	0.200	0.206	0.201	0.200	0.020	0.020	0.020	0.019
No. of firms	535	613	614	688	535	613	614	688
Correlation (average wage, SD wage)	0.718	0.701	0.693	0.692	0.261	0.198	0.369	0.337
Significance level	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Average wage for workers between 25 and 30	15,720	17,185	16,457	17,821	9.643	9.729	9.689	9.770
SD	3,180	3,784	3,269	3,460	0.199	0.214	0.197	0.194
90th percentile	19,890	22,298	20,703	22,260	9.898	10.012	9.938	10.011
10th percentile	11,927	12,784	12,647	13,606	9.387	9.456	9.445	9.518
No. of workers	6,232	10,752	9,660	8,050	6,232	10,752	9,660	8,050
Average wage for workers between 45 and 50	20,385	21,725	21,902	23,818	9.879	9.938	9.943	10.027
SD	6,409	7,235	7,496	7,947	0.288	0.304	0.313	0.315
90th percentile	29,510	32,617	32,255	34,960	10.292	10.393	10.381	10.462
10th percentile	13,945	14,614	14,372	15,539	9.543	9.590	9.573	9.651
No. of workers	6,161	7,939	12,419	12,009	6,161	7,939	12,419	12,009

Notes: See table 9A.1 notes.

Table 9A.13 **Wage dynamics for white-collar workers in the private sector (plants)**

	Δ monthly wage				Δ log monthly wage			
	1981	1986	1993	1997	1981	1986	1993	1997
Average change in wage	–80	917	349	725	–0.003	0.046	0.017	0.032
SD	1,243	1,271	1,489	1,495	0.064	0.060	0.054	0.066
90th percentile	1,316	2,307	1,271	2,085	0.075	0.115	0.066	0.094
10th percentile	–1,237	–80	–306	–112	–0.065	–0.005	–0.017	–0.006
No. of workers	42,734	54,712	59,319	60,755	42,734	54,712	59,319	60,755
Average of firm average change in wage	–150	819	257	620	–0.007	0.045	0.013	0.029
SD	645	483	378	486	0.037	0.026	0.019	0.023
90th percentile	539	1,428	686	1,163	0.032	0.076	0.034	0.055
10th percentile	–849	268	–173	118	–0.047	0.016	–0.009	0.006
No. of firms	535	613	614	688	535	613	614	688
Average of SD of change in wage	950	989	868	1,132	0.050	0.051	0.045	0.054
SD	405	479	994	729	0.022	0.024	0.029	0.033
90th percentile	1,380	1,498	1,456	1,870	0.073	0.074	0.076	0.085
10th percentile	516	532	353	482	0.027	0.029	0.019	0.024
No. of firms	535	613	614	687	535	613	614	687
Average change in wage for people who change firms	168	1,633	645	1,107	0.012	0.081	0.031	0.049
SD	1,713	2,314	1,810	2,072	0.090	0.110	0.081	0.093
90th percentile	2,149	4,317	2,345	3,303	0.123	0.211	0.112	0.145
10th percentile	–1,440	–343	–390	–106	–0.066	–0.016	–0.021	–0.006
No. of workers	1,690	811	2,312	3,261	1,690	811	2,312	3,261
Average change in wage for workers with tenure <3	257	1,251	577	1,023	0.017	0.068	0.030	0.049
SD	1,364	1,417	1,269	1,691	0.075	0.072	0.062	0.082
90th percentile	1,862	2,812	1,742	2,802	0.111	0.152	0.092	0.134
10th percentile	–1,091	–5	–277	–89	–0.060	0.000	–0.014	–0.005
No. of workers	3,769	12,133	9,363	9,494	3,769	12,133	9,363	9,494
Average change in wage for workers with tenure ≥3	–163	822	306	670	–0.008	0.040	0.015	0.029
SD	1,156	1,210	1,522	1,449	0.058	0.055	0.052	0.062
90th percentile	1,135	2,116	1,162	1,907	0.060	0.102	0.059	0.084
10th percentile	–1,242	–93	–310	–114	–0.067	–0.005	–0.018	–0.006
No. of workers	21,769	42,255	49,898	51,202	21,769	42,255	49,898	51,202

Notes: See table 9A.3 notes.

Table 9A.14 Mobility for white-collar workers (all jobs; plants)

	All firms				Firms with 100+ employees			
	1981	1986	1993	1997	1981	1986	1993	1997
No. of plants	535	613	614	688	134	162	169	181
Employees	90	107	107	100	215	267	262	248
SD	106	163	164	161	152	256	252	262
No. of occupations	12	12	12	12	16	15	15	15
SD	3	4	4	4	2	3	3	3
No. of levels	6	6	6	6	7	7	7	7
SD	1	1	1	1	1	1	1	1
Employment growth	0.03	0.08	0.02	0.04	0.10	0.11	0.15	0.10
SD	0.34	0.19	0.64	0.36	0.55	0.18	1.19	0.63
Exit rate (all)	0.12	0.12	0.13	0.17	0.06	0.06	0.07	0.10
Exit rate	0.14	0.13	0.14	0.16	0.12	0.10	0.11	0.15
SD	0.08	0.09	0.12	0.11	0.06	0.06	0.07	0.09
Exit rate, top quartile	0.11	0.11	0.13	0.15	0.09	0.09	0.11	0.15
SD	0.11	0.11	0.13	0.14	0.08	0.09	0.10	0.12
Exit rate, bottom quartile	0.21	0.17	0.17	0.18	0.17	0.13	0.13	0.16
SD	0.15	0.14	0.17	0.15	0.10	0.09	0.11	0.11
Entry rate	0.14	0.18	0.13	0.16	0.15	0.17	0.14	0.17
SD	0.12	0.11	0.12	0.13	0.13	0.10	0.13	0.14
Entry rate, top quartile	0.09	0.11	0.10	0.12	0.09	0.11	0.12	0.12
SD	0.13	0.11	0.13	0.13	0.13	0.10	0.14	0.13
Entry rate, bottom quartile	0.21	0.31	0.17	0.24	0.24	0.29	0.18	0.24
SD	0.18	0.18	0.16	0.20	0.18	0.15	0.14	0.19
Percentage of employees who switch jobs internally	0.11	0.11	0.10	0.10	0.12	0.11	0.11	0.09
SD	0.11	0.10	0.08	0.09	0.11	0.09	0.07	0.09

(*continued*)

Table 9A.14 (continued)

	All firms				Firms with 100+ employees			
	1981	1986	1993	1997	1981	1986	1993	1997
Percentage of new jobs filled internally	0.48	0.37	0.47	0.40	0.48	0.39	0.48	0.40
SD	0.30	0.23	0.27	0.27	0.28	0.21	0.22	0.25
Percentage of workers who have been at firm 5+ years	0.07	0.56	0.70	0.65	0.07	0.56	0.70	0.69
SD	0.16	0.26	0.23	0.25	0.15	0.26	0.21	0.24
Correlation (exit rate, average wage)	–0.155	–0.159	0.006	0.094	–0.116	–0.165	–0.005	0.076
Significance level	0.000	0.000	0.889	0.014	0.182	0.035	0.951	0.310
Correlation (exit rate, average wage change)	0.072	0.108	0.059	0.199	0.062	–0.067	–0.034	0.087
Significance level	0.098	0.008	0.145	0.000	0.476	0.396	0.661	0.245
Correlation (exit rate, SD wage)	–0.036	–0.038	0.028	0.136	0.053	–0.133	0.058	0.072
Significance level	0.400	0.346	0.483	0.000	0.540	0.091	0.452	0.338
Correlation (entry rate, average wage)	–0.079	–0.059	0.047	–0.065	0.018	–0.015	–0.011	–0.025
Significance level	0.067	0.145	0.241	0.087	0.832	0.851	0.891	0.739
Correlation (entry rate, average wage change)	0.072	0.283	0.206	0.220	0.085	0.306	0.179	0.086
Significance level	0.095	0.000	0.000	0.000	0.329	0.000	0.020	0.251
Correlation (entry rate, SD wage)	0.042	0.080	0.080	0.011	0.138	0.169	–0.009	0.049
Significance level	0.337	0.049	0.046	0.779	0.112	0.032	0.903	0.513

Note: Top and bottom quartiles are quartiles in the within-firm wage distribution.

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