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# Wage Dispersion between and within Plants
## Sweden 1985–2000

Oskar Nordström Skans, Per-Anders Edin, and Bertil Holmlund

### 7.1 Introduction

Over the period lasting from the late 1960s to the mid-1980s, Sweden experienced a sharp decline in wage inequality. Overall wage inequality fell along with educational wage differentials and wage differentials between younger and older workers. This development came to a halt in the mid-1980s, and the subsequent years have seen a reversal of previous trends. The rise in wage inequality since the mid-1980s has been particularly marked for private-sector workers (le Grand et al. 2001).

The causes of the fall of Swedish wage inequality have been discussed in Edin and Holmlund (1995), Hibbs (1990), and other contributions. Institutional factors almost certainly played a role. The so-called solidarity wage policy pursued by the major trade union confederation was clearly attempting to reduce wage differentials and appeared to have been successful in these ambitions. However, there is also evidence that the usual supply and demand factors played some role, in particular concerning the evolution of educational wage differentials. Changes in the university wage premium (college versus high school) are strongly negatively correlated with changes in the relative supply of university educated people in the labor force up to the mid-1990s. From the mid-1990s, however, this pattern no

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longer holds. The university wage premium has continued to increase despite a continuous increase in the relative supply of university-educated people in the labor force (Gustavsson 2006).

Earlier studies of changes in Swedish wage inequality have been silent on the question as to what extent the changes are attributable to changes in dispersion between and within firms or plants. The main contribution of the present chapter is to document how wage dispersion between and within plants has evolved since the mid-1980s. We use hitherto largely unexploited data and find a continuous rise in between-plant wage inequality. This development may reflect increased sorting of workers by skill levels, so that high-skilled and low-skilled workers to a greater extent are found in different plants. Another possibility is that the importance of rent sharing at the plant level has increased, perhaps reflecting stronger local unions or more scope for differential wage outcomes due to a greater between-plant variation in the ability to pay. Our data do not allow clean tests of alternative hypotheses, but they suggest that both sorting and genuine plant effects may have become more important.

Our chapter also includes a fairly detailed descriptive analysis of the associations between worker mobility at the plant level and various measures of wage inequality within and between plants. This analysis confirms some well-known stylized facts: most mobility takes place in the lower part of the plant's wage distribution, both in terms of exit and entry; mobility rates are strongly procyclical; and smaller plants experience higher mobility.

The plan of this chapter is as follows. We begin in section 7.2 by giving a brief overview of the Swedish labor market institutions, the turbulent macroeconomic events of the 1990s, and evolution of labor mobility and fixed-term contracts as a background to the later analysis of wages and mobility.[1] Section 7.3 describes the data, section 7.4 provides snapshots of plant wages and mobility, and section 7.5 portrays in some detail the evolution of the wage structure. Section 7.6 provides a discussion, and section 7.7 concludes.

## 7.2 Background

### 7.2.1 Employment Protection Legislation

Swedish legislation on employment protection dates back to the 1974 Employment Protection Act, which has remained largely intact over the past three decades. The law presumes that an employment contract is valid until further notice, unless stated otherwise. An employer must provide a valid reason for terminating a contract. "Lack of work" is a valid reason,

1. This section draws on various sources, in particular Holmlund (2003) and Holmlund and Storrie (2002).

and the employer's assessment of whether there is lack of work cannot be disputed in court. Workers have to be notified of layoffs several months ahead of their implementation and layoffs must, in general, proceed according to seniority. No redundancy pay is stipulated in the law, although such pay may be part of employer-union deals at the plant level.

The legislation allows for temporary (fixed-term) contracts. For example, the law has always permitted the use of temporary contracts to replace an absent worker. Another common form of temporary contract involves project work in construction or research. Contracts for probationary periods are also allowed.

During the 1990s, there have been no significant reforms of the Employment Protection Act concerning the termination of open-ended contracts. There have, however, been several changes to the statutory regulation of fixed-term contracts. In January 1994, the maximum permitted duration for probationary contracts and those motivated by a temporary increase in labor demand were prolonged from six to twelve months. However, this was immediately repealed in January 1995. The reforms of 1997 were arguably more important. The employer was now given the opportunity to hire for a fixed duration without having to specify a particular reason. However, an employer could only use a maximum of five such contracts, and a particular individual could not be employed under such a contract for more than twelve months during a three-year period. If the plant is newly established, the period may be extended to eighteen months.

Another important element of the 1997 law was the opportunity to strike collective agreements on derogations from statutory law regarding fixed-term contracts at the local level, provided that the parties had a central agreement in other matters. Prior to 1997, these agreements could only be made at the central level.

Comparisons with employment protection in other countries suggest that the Swedish legislation is relatively stringent, although not as stringent as in several Southern European countries (see Organization for Economic Cooperation and Development [OECD] 2004).

### 7.2.2 Collective Bargaining

Union density in Sweden has hovered above or around 80 percent of the number of employees over the past couple of decades. The coverage of collective agreements is even higher, as the collective agreements typically are extended to nonunion workers. A high degree of union membership is an integral part of what has been referred to as the Swedish Model. Indeed, labor legislation concerning employment protection and worker codetermination is based on the presumption that the overwhelming majority of the workers are union members.

The fact that the provision of unemployment insurance is closely linked to union membership is almost certainly an important explanation of the

high unionization rate. Three other Nordic countries with very high union density—Denmark, Finland, and Iceland—also organize their unemployment insurance through union-affiliated insurance funds. There is by now a reasonable amount of evidence suggesting that such institutional details explain some of the country differences in unionization (see, e.g., Boeri, Brugiavini, and Calmfors 2001).[2]

Postwar wage determination in Sweden has frequently been associated with centralized wage bargaining as well as so-called solidarity wage policy. Nationwide coordination of wage negotiations was implemented from the mid-1950s and continued for almost three decades. The key players in these negotiations were the Swedish trade union confederation (LO) and the Swedish employers' federation (SAF). The guiding principle for LO's wage policy, as laid out in several influential documents by their economists Gösta Rehn and Rudolf Meidner, was "equal pay for equal work." One implication of this principle was that wages should not be made dependent on the ability to pay among particular plants or industries. In theory, the policy recognized the need for wage differentials among workers so as to reflect differences in qualifications. In practice, there was always a clear egalitarian ambition in LO's wage demands.

The centralized wage negotiations came under increasing stress during the late 1970s, when some employer organizations argued that the central frame agreements left too little room for flexibility at the local and industry level. A significant step toward more decentralized wage bargaining came in 1983, when the metalworkers' union and their employer counterpart sidestepped the national negotiations and opted for an industry agreement. Wage negotiations after 1983 have mainly taken place at the industry level, albeit with exceptions in the early 1990s when double-digit inflation and an emerging macroeconomic crisis led the government to initiate a coordinated "stabilization drive" so as to achieve a deceleration of wage inflation. The drive took the form of a government-appointed commission that delivered a proposal for economy-wide wage restraint for the period 1991 to 1993. This involved negotiations with over 100 organizations, and the proposal was finally accepted across the whole labor market. The following years involved a return to largely uncoordinated industry-wide bargaining.

In the summer of 1996, several blue-collar unions in the manufacturing sector launched an important initiative that eventually materialized as the

2. Union density has fallen sharply over the period 2006 to 2007. By October 2007, union density stood at 72 percent according to data from the labor force surveys (Kjellberg 2007). This development can almost certainly be largely explained by new policies concerning the financing of unemployment insurance that came into effect in 2007. The policies raised the cost of being insured and has resulted in a sharp fall in membership in unemployment insurance funds. A substantial number of workers leaving the unemployment insurance funds have also chosen to leave the unions.

so-called Industrial Agreement (IA) of 1997. The agreement was struck by the blue- and white-collar unions as well as employer organizations in the industrial sector and was mainly concerned with procedural "rules of the game." It represented an attempt to establish consensus around timetables for negotiations, the role of mediators, and rules for conflict resolution. A group of "impartial chairs" have been appointed, and the agreement states rules for when and how these chairs could intervene in the negotiation process.

The IA has served as a model for similar agreements in the public sector (and also in parts of the service sector). As of 2002, over 50 percent of the labor force is covered by IA-type agreements. The IA also came to serve as a model for government policies concerning industrial relations. A new national mediation institute (*Medlingsinstitutet*) has been created (in operation from June 2000) with the power to appoint mediators even without the consent of the parties concerned.

The IA innovations that emerged in the late 1990s represent a move toward more informal coordination in wage bargaining. Perhaps paradoxically, the move toward informal macro-coordination in wage bargaining has taken place simultaneously with a clear shift toward stronger local influence over the distribution of wage increases. Pay setting in the public sector is a case in point. Previous rigid wage scales have been abandoned, and there is, at least in theory, substantial room for wage adjustments tailored to the needs of recruiting and retaining employees.

### 7.2.3 The Macroeconomy in Turmoil

During the 1980s, Swedish labor market performance was widely appreciated as a remarkable success story. Whereas unemployment in Western Europe climbed to double-digit figures, the Swedish unemployment rate remained exceptionally low by international standards. The average unemployment rate during the 1980s was around 2 percent, and by the end of the decade, it had fallen to 1.5 percent. Employment-to-population rates were also exceptionally high by international standards. In 1990, total employment had risen to 83 percent of the working age population, whereas the average European figure was 61 percent, and the OECD average was 65 percent.

In the early 1990s, the picture of outstanding Swedish labor market performance changed dramatically. Between 1990 and 1993, unemployment increased from 1.6 percent to 8.2 percent, and total employment declined to 73 percent of the working age population (see table 7.1). The level of gross domestic product (GDP) fell from peak to trough by 6 percent over a three-year period. For five successive years in the mid-1990s, official unemployment was stuck at around 8 percent, whereas extended measures of unemployment reached double-digit figures.

Why did Swedish unemployment rise so sharply in the early 1990s? It can

**Table 7.1 Macroeconomic conditions**

| | | | Economic growth[c] | | |
|---|---|---|---|---|---|
| Year | Unemployment[a] | Employment[b] | 1 year | 2 year | 5 year |
| 1980 | 2.0 | 79.9 | 1.67 | 5.57 | 6.83 |
| 1981 | 2.5 | 79.4 | –0.19 | 1.47 | 5.51 |
| 1982 | 3.2 | 79.1 | 1.24 | 1.05 | 8.55 |
| 1983 | 3.5 | 79.0 | 1.88 | 3.14 | 8.68 |
| 1984 | 3.1 | 79.4 | 4.31 | 6.27 | 9.18 |
| 1985 | 2.8 | 80.3 | 2.22 | 6.62 | 9.77 |
| **1986** | **2.7** | **80.9** | **2.79** | **5.07** | **13.04** |
| 1987 | 2.1 | 81.4 | 3.40 | 6.28 | 15.45 |
| 1988 | 1.7 | 82.2 | 2.60 | 6.09 | 16.27 |
| 1989 | 1.5 | 82.9 | 2.75 | 5.42 | 14.53 |
| **1990** | **1.6** | **83.1** | **1.03** | **3.80** | **13.20** |
| 1991 | 3.0 | 81.0 | –1.08 | –0.06 | 8.94 |
| 1992 | 5.2 | 77.3 | –1.18 | –2.25 | 4.11 |
| 1993 | 8.2 | 72.6 | –2.00 | –3.15 | –0.56 |
| 1994 | 8.0 | 71.5 | 4.16 | 2.09 | 0.82 |
| **1995** | **7.7** | **72.2** | **4.05** | **8.39** | **3.84** |
| 1996 | 8.1 | 71.6 | 1.29 | 5.40 | 6.32 |
| 1997 | 8.0 | 70.7 | 2.44 | 3.76 | 10.22 |
| 1998 | 6.5 | 71.5 | 3.65 | 6.17 | 16.56 |
| 1999 | 5.6 | 72.9 | 4.58 | 8.39 | 17.03 |
| **2000** | **4.7** | **74.2** | **4.33** | **9.10** | **17.33** |
| 2001 | 4.0 | 75.3 | 0.92 | 5.29 | 16.91 |

*Note:* Numbers in bold refer to the years studied in section 7.4.

[a]Share of labor force.

[b]Share of working aged (sixteen to sixty-four) population.

[c]Change in real GDP.

be argued that the main causes were a series of adverse macroeconomic shocks, partly self-inflicted by bad policies and partly caused by unfavorable international developments. The policy failures date back to the 1970s and include an inability to pursue a sufficiently restrictive aggregate demand policy so as to bring inflation under control. This inflationary bias in policy was especially pronounced in the late 1980s, when it was fueled by financial liberalization. The timing of financial liberalization and a major tax reform in 1990 to 1991, which contributed to a slump in the housing market, was not well designed. When macroeconomic policy finally took a firm anti-inflationary stand in 1991, the economy was already edging toward recession. The depth of the recession was reinforced by the international recession of the early 1990s and by increasing real interest rates.

Although the prospects for a sustained labor market improvement appeared remote in the mid-1990s, a strong recovery was, in fact, around the corner. From 1997 and onward, employment exhibited a marked increase

and unemployment fell precipitously. By the end of 2000, unemployment had reached 4 percent of the labor force, and it remained fairly constant at this level during 2001 and 2002. To some degree, this recovery reflects the unwinding of earlier shocks and a return to what may be close to the equilibrium unemployment rate. There is little doubt that the extremely low unemployment rate around the 1990s was not sustainable. Over the 1990s, several reforms may have facilitated a return to lower equilibrium unemployment. For example, unemployment insurance became less generous, a number of deregulations in product markets took place, and labor market reforms opened up for temporary work agencies.

### 7.2.4 Labor Mobility and Temporary Contracts

Available measures of labor mobility in Sweden reveal strong cyclical patterns. However, any statements about cycles versus trends are problematic considering the exceptionally deep and prolonged slump of the early 1990s. A noticeable change is the rapid growth of fixed-term employment contracts.

One source of information on labor mobility is the retrospective labor force surveys. Data on external job mobility—change of employer at least once during the past year—reveal annual mobility rates hovering between 6 and 12 percent since the mid-1960s. There is some evidence that internal mobility—change of position without changing employer—has shown a slight trend increase, at least up to the late 1980s.

Overall labor turnover has been markedly procyclical, with quits accounting for the overwhelming share of the total number of worker separations. For blue-collar workers in mining and manufacturing, the annual quit rate amounted to 22 percent over the period 1968 to 1988, to be compared with an average annual layoff rate of only 2 percent.[3] The importance of layoffs increased substantially during the slump of the 1990s, but separate data on quits and layoffs are not available after 1988. Other evidence, such as information on unemployment inflow and advance notification of layoffs, indicates sharply rising layoff rates in the early 1990s.

The distinction between quits and layoffs is often fuzzy, and especially fuzzy for fixed-term contracts that have grown relentlessly during the 1990s. As shown in figure 7.1, the sharp fall in total employment in the early 1990s was due to sharply falling employment in open-ended contracts. The number of fixed-term contracts stood at approximately the same level in the first quarter of 1994 as it did four years earlier. When the economy approached the cyclical peak in the late 1980s, we observe rising permanent employment along with a decline in the number of fixed-term contracts.

3. Quits are worker separations "initiated by the employee," whereas layoffs are separations "initiated by the employer." The data are based on surveys to firms and were collected by Statistics Sweden. Empirical studies of worker mobility in Sweden up to the early 1980s are reported in Holmlund (1984).

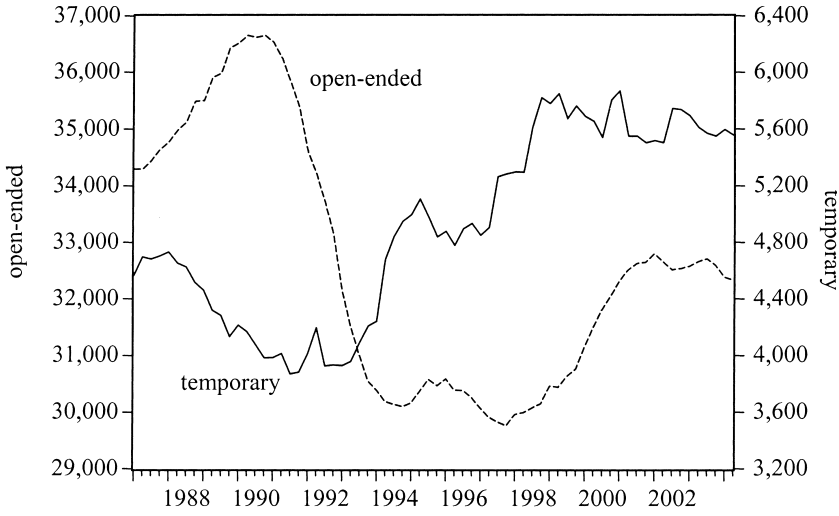


**Fig. 7.1 Wage and salary employment (100s) by type of contract, seasonally adjusted quarterly data 1987Q1 to 2004Q2**
*Source:* Labor force surveys, Statistics Sweden.

From the early 1990s and during most of the rest of the decade, there is a remarkable increase in fixed-term contracts that amounts to roughly 50 percent. Measured relative to total wage and salary employment, the number of temporary workers rose from 10 percent to 16 percent; see figure 7.2. Note, however, the declining share of fixed-term contracts in the late 1980s and the late 1990s, periods with falling unemployment.[4]

The prevalence of fixed-term contracts is particularly visible among women, the young, and foreign-born residents. By the turn of the century, 18 percent of the female employees were on fixed-term contracts, a figure to be compared with 13 percent for the male employees. The trend rise in temporary work is striking for both men and women. Among young female workers aged sixteen to twenty-four, close to 60 percent were in temporary work by the end of the century; the corresponding share for young men was around 40 percent.

Temporary work has increased in every broad sector of the economy. Two sectors stand out. Financial and business services exhibit both the greatest increase in fixed-term contract rate and share of all fixed-term contracts, while health and care show the lowest growth rates in both these figures.

The most frequent form of fixed-term contracts involves replacement of

4. Fixed-term contracts account for a much higher share of the total flow of new hires than of the total stock of employment. Available data for the private sector reveal that fixed-term contracts accounted for roughly 50 percent of all new hires in the late 1980s. By the late 1990s, they accounted for some 70 percent.

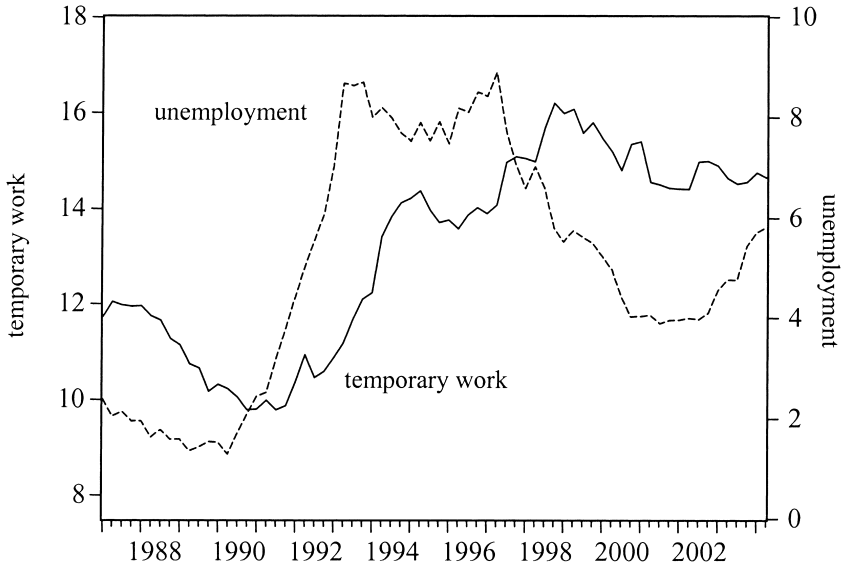


**Fig. 7.2 Temporary work (percent of total wage and salary employment) and unemployment (percent of the labor force), seasonally adjusted quarterly data 1987Q1 to 2004Q2**

*Source:* Labor force surveys, Statistics Sweden.

absent workers. Sweden has a generous allowance for many forms of leave, particularly parental leave and long statutory holidays. The incidence of leave replacements has, however, remained roughly constant at around 4 to 5 percent of total wage and salary employment. The entire rise in temporary work is accounted for by other categories, namely on-call contracts, project work, and probationary employment.

Why did fixed-term contracts exhibit such rapid growth during the 1990s? Holmlund and Storrie (2002) discuss this issue and conclude that legislative changes are unlikely to be crucial. Changes in the industrial structure of employment, or in the demographic composition of the labor force, have likewise negligible explanatory power. A more promising explanation focuses on the consequences of adverse macroeconomic conditions. A recession is associated with relatively more hirings on temporary contracts, reflecting weaker incentives on the part of firms to offer long-term contracts when workers are easier to find as well as an increased willingness on the part of workers to accept temporary work when job offers are in short supply. The Swedish experience as well as the developments of temporary work in the other Nordic countries lends support to this hypothesis. The share of temporary work has been relatively stable in Norway (with stable or falling unemployment) but increased sharply in Finland over the 1990s—that is, a period when Finnish unemployment skyrocketed.

The trend rise in temporary work over the 1990s may thus to a significant degree reflect changes in the macroeconomic environment and, in particular, the rise in unemployment from the exceptionally low (and unsustainable) levels in the late 1980s to the much higher (and presumably sustainable) levels prevailing in recent years. In addition, other, more "structural" forces may have tilted employers' preferences toward more flexible staffing arrangements, but it is difficult to pinpoint the exact causes. Hiring labor on a fixed-term contract can accommodate fluctuations in the workload associated with a volatile market environment, but evidence on *increased* volatility is hard to come by.[5]

## 7.3 Data

In order to study wage dispersion, wage changes, and mobility, we use a linked employer-employee database containing information on all workers and plants in both the private and public sectors. From the database, we derive measures of wage levels, wage changes, mobility, and tenure. Through the employer-employee link, we are able to derive plant aggregates of these measures as well as measures of wage dispersion at the plant level. In addition to these core measures, we also use information on observable characteristics (age, gender, immigrant status, and education) of the workers.

The basic data source is a version of a register database (RAMS) provided by Statistics Sweden. The RAMS database contains yearly plant-level data on all workers that were employed at a plant some time during each year, irrespectively of whether they were employed on a fixed-term or a permanent contract. The data include information on total annual earnings as well as the first and the last remunerated month for each employee. We construct monthly wage data by dividing total earnings during the year by the number of remunerated months, including only employment spells that cover November each year. Thus, we use the average monthly wage-bill paid to an employee by a single employer as our measure of the employee's wage.

The data are yearly and cover the period 1985 to 2000. The underlying population consists of all individuals aged sixteen to sixty-five who resided in Sweden anytime between 1990 and 2000. This implies that the oldest workers as well as workers who emigrated or died before 1990 are missing during the first five years. Thus, in effect, we have an age restriction of sixteen to sixty in 1985 and sixteen to sixty-four in 1989.

The data do not contain information on hours worked, so in order to focus on workers that are reasonably close to full-time employment, we consider a person to be full-time employed if and only if the wage for No-

5. Houseman (2001) reports from a survey of U.S. employers that flexible staffing arrangements are mainly used to accommodate fluctuations in workload or absences.

vember exceeds a minimum wage.[6] Furthermore, an individual is only counted as employed by at most one plant each year, with priority given to the observation generating the highest wage.

The data set is based on information on total labor earnings collected for the purpose of calculating taxes. Thus, the data include the earnings of *all* employees, including top chief executive officers (CEOs), which implies that some of the observations are extreme outliers. It should be noted that there is great persistence over time in the recorded wages of these individuals, suggesting that the extreme values are not due to errors. As is evident from table 7.2, the wages of the top earners have a large impact on the standard deviation of monthly wages, while the mean hardly is affected at all (this pattern is, of course, even more noticeable when looking at wages in levels). It might be misleading if a very small number of workers influence the statistics in such a dramatic way, especially when comparing to other data sets where this group may be excluded by construction. On the other hand, wages of top earners within each plant are the focus of parts of this chapter. Considering this, we retain all but the top 0.5 percent in the wage distribution in the relevant years. In an effort to reduce the impact of measurement errors in changes, we also rank individuals according to their log wage change and drop the highest and lowest half-percentile each year.

Table 7.3 compares the constructed wage distribution to the "actual" wage distribution, calculated from the 3 percent random sample in the Longitudinal Individual Data Base (LINDA; see Edin and Fredriksson 2000). The constructed data correspond reasonably close to the actual data when looking at log wages but appear to contain some noise in the estimated dispersion of both wages and wage changes.

The individual identifiers are based on official personal identification numbers, which should be very accurate and consistent over time. However, plant identifiers may change over time for administrative reasons. In order not to misclassify the disappearance of administrative plant numbers as plant closings, we only include plants that existed in two consecutive years when studying changes (and, for comparability, throughout section 7.4). Thus, the calculated exit rates (i.e., the fraction of employees in a plant that leave within a year) does not include plant closings. Because our tenure variable is calculated within the sample, changes in administrative plant numbers will probably mean that we underestimate the fraction of long-tenured workers. When calculating wage changes for people who change plants, we only include people who changed between plants with at least twenty-five employees in both years in order to get consistency with the definition used elsewhere in this analysis.

6. The minimum wage is defined as 75 percent of the mean wage of janitors employed by local municipalities, according to Statistics Sweden's information on monthly wages; the cutoffs are available upon request.

**Table 7.2** The importance of extreme values (2000)

| | Log of nominal monthly wage in 2000 | | |
|---|---|---|---|
| Highest included percentile | Mean | Standard deviation | Max. |
| 95 | 9.820 | 0.283 | 10.54 |
| 99 | 9.855 | 0.328 | 10.98 |
| 99.5 | 9.862 | 0.338 | 11.19 |
| 99.9 | 9.868 | 0.351 | 11.75 |
| All | 9.870 | 0.359 | 15.07 |

*Note:* Total sample size is 3,040,555 individuals.

**Table 7.3** Actual and constructed nominal monthly wages (2000)

| | Log (wages) | | Changes in log wage (from 1999) | |
|---|---|---|---|---|
| | Constructed | Actual | Constructed | Actual |
| Mean | 9.860 | 9.876 | 0.051 | 0.054 |
| Standard deviation | 0.336 | 0.283 | 0.149 | 0.116 |
| 10th percentile | 9.453 | 9.585 | –0.093 | –0.022 |
| Median | 9.821 | 9.818 | 0.042 | 0.037 |
| 90th percentile | 10.309 | 10.258 | 0.216 | 0.165 |
| *N* | 2,999,065 | 105,633 | 2,602,351 | 88,864 |

*Note:* The observations with the largest (and smallest for the actual data) 0.5 percent of wages as well as the largest and smallest 0.5 percent of log wage changes are excluded from the data.

Our analysis is focused on the corporate sector,[7] and in order to get a meaningful description of the wage dispersion within establishments, we include only plants with at least twenty-five employees. Table 7.4 displays the relative size of the corporate sector for the years 1985 and 2000.[8] We include both a measure where we use the entire corporate sector and one where we restrict the analysis to the private corporations. It is shown that the size of the corporate sector, as measured in number of employees, increased slightly between 1985 and 2000 (from 63 to 66 percent).

Table 7.4 also shows the share of workers in each sector who worked in plants with at least twenty-five employees. It is shown that 59 percent of individuals employed in the corporate sector in 2000 worked in 25+ sized plants; the corresponding number for 1985 was 57 percent. Figure 7.3

7. The main reason is to get comparability with other studies in the volume.

8. The sector definitions are based on Statistics Sweden (SCB; 2001) and SCB (2002) and comply with European Union (EU)-standard classifications.

**Table 7.4 Sector and size**

| | Relative size of sector (no. of employees) | | Share of all employees in sector working in size 25+ plants |
|---|---|---|---|
| | All plants and employees | Employees in size 25+ plants only | |
| 1985 | | | |
| All corporate | 0.63 | 0.62 | 0.59 |
| Private | 0.52 | 0.48 | 0.55 |
| Public and nonprofit | 0.37 | 0.38 | 0.63 |
| 2000 | | | |
| All corporate | 0.66 | 0.62 | 0.57 |
| Private | 0.60 | 0.54 | 0.55 |
| Public and nonprofit | 0.34 | 0.38 | 0.68 |

*Note:* Size is the total number of employees each year.

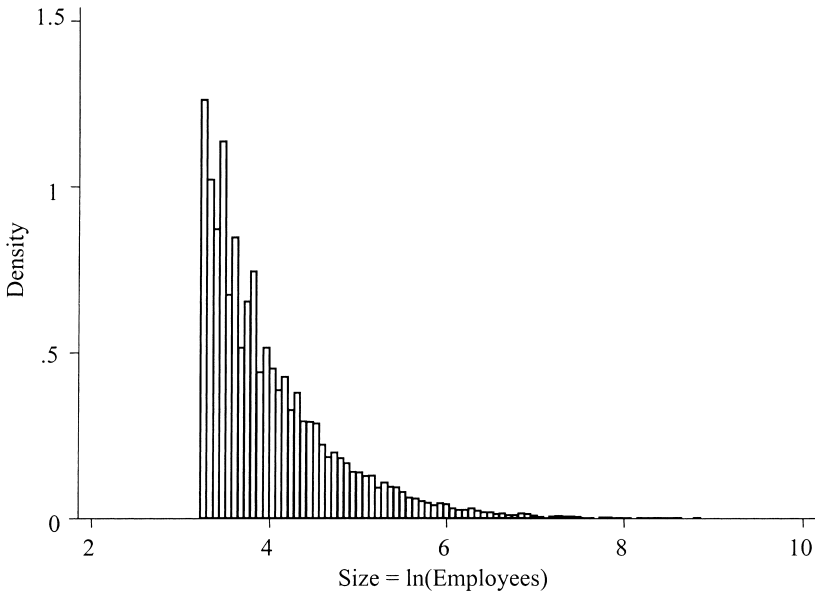


**Fig. 7.3 Plant size distribution for 2000: Corporate sector**

shows the log plant-size distribution for 2000. It is obvious that most 25+ sized plants have close to twenty-five employees, and, as a consequence, a significant fraction of plants move around the twenty-five limit between years. However, as noted in the preceding, we will condition on plants having at least twenty-five employees in both years whenever we calculate changes.

## 7.4 Snapshots of Plant Wages and Mobility

This section provides detailed descriptive evidence of wages, wage changes, and mobility at the plant level in the Swedish private corporate sector for the years 1986, 1990, 1995, and 2000. The purpose of the analysis is to provide an overview of the role of plants in shaping wages, wage changes, and labor mobility in Sweden since the 1980s, in order to facilitate comparisons with other countries and depict the most important changes that have occurred during the period under study.

The analysis is based only on plants in *privately owned* firms in the corporate sector. It is worth noting that the period under study was characterized by a steady increase in the share of workers in private plants within the corporate sector: in 1986, only 77 percent of workers worked in plants owned by private firms, whereas the corresponding share was 87 percent in 2000 (see table 7.4).

Because the focus of this section is on describing the pattern and changes in wages and turnover at the plant level, most statistics are calculated with one plant as one observation, implying that all included plants have an equal weight. Thus, small plants are up-weighted compared to an analysis based on individuals.

### 7.4.1 Wage Levels

Figure 7.4 shows the log real wage distribution for the four years studied (wages are deflated by the consumer price index). The figure reveals a steady increase in real wages, but also an increase in dispersion. This is also shown by the first panel of table 7.5, where the standard deviation of log wages increases from 0.307 to 0.340 between 1986 and 2000. This reproduces what is a well-known fact from several previous studies, namely that the wage dispersion in Sweden started to increase in the mid-1980s after several decades of wage compression.[9]

The second panel of table 7.5 shows that the *between*-plant dispersion, measured as the standard deviation of plant average wages, increased over time. As a contrast, the third panel shows that the *within*-plant dispersion, measured as the mean of the within-plant standard deviation of wages, remained relatively constant over time. This impression also holds in the fourth panel showing statistics for the coefficient of variation within plants. Thus, it appears as though the prime source of increased dispersion is between, rather than within, plants. We will return to this issue at length in section 7.5 of the paper.

The fifth panel of table 7.5 reveals a positive correlation between the wage *level* in a plant and the wage *dispersion* within the plant. This result is

9. See, for example, Le Grand, Szulkin, and Thålin (2000), Edin and Holmlund (1995), and Gustavsson (2004).

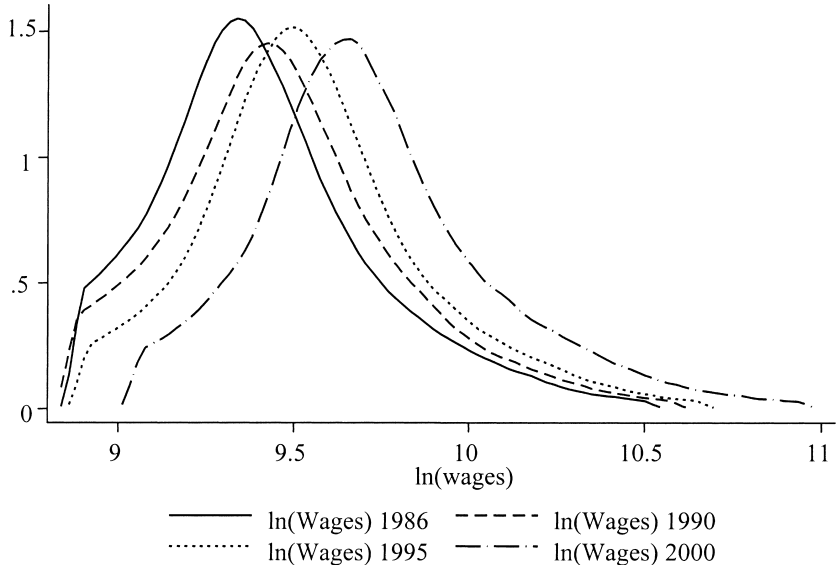


**Fig. 7.4 The distribution of log real wages**
*Note:* Deflated by CPI to 1990:SEK.

probably, at least partly, driven by the skewness of the wage distribution (see figure 7.4). The wage dispersion among high-paid people is larger even in relative terms.[10]

The last two panels of table 7.5 show the evolution of wage dispersion for young (twenty-five to thirty) and old (forty-five to fifty) workers. The results show that the increase in wage dispersion was larger for young workers than for prime-aged workers. However, if we compare the log wages for youths to the average log wages displayed in the top panel, we see that youth wages appear to have remained relatively stable at approximately 90 percent of the average wage over the period.

### 7.4.2 Wage Changes

In this subsection, we study wage changes within and between plants. In doing so, we only look at changes for workers that are employed by plants in the sample (i.e., by plants with at least twenty-five employees in the private corporate sector) in two consecutive years. Figure 7.5 shows the distribution of wage changes for the four years studied. It can be noted that many workers experienced a real wage decline between 1989 and 1990.

10. Some caution is warranted when comparing these numbers to other data sources because the used data are rather unique in including the earnings of all people receiving remuneration from each plant, including top CEOs. Note, however, that we, as explained in section 7.3, excluded the top 0.5 percent of wages each year.

**Table 7.5** **Structure of wages within and between plants**

| | Wages (1990-SEK)[a] | | | | Log wages (1990-SEK)[a] | | | |
|---|---|---|---|---|---|---|---|---|
| | 1986[b] | 1990 | 1995 | 2000 | 1986 | 1990 | 1995 | 2000 |
| 1. Average wage | 12,976 | 13,797 | 14,865 | 17,843 | 9.420 | 9.477 | 9.553 | 9.727 |
| SD | 4,572 | 4,996 | 5,346 | 7,040 | 0.307 | 0.322 | 0.318 | 0.340 |
| 90 percentile | 18,832 | 20,069 | 21,606 | 26,716 | 9.843 | 9.907 | 9.981 | 10.193 |
| 75 percentile | 14,544 | 15,649 | 16,711 | 20,055 | 9.585 | 9.658 | 9.724 | 9.906 |
| Median | 11,848 | 12,696 | 13,668 | 16,070 | 9.380 | 9.449 | 9.523 | 9.685 |
| 25 percentile | 9,992 | 10,525 | 11,462 | 13,437 | 9.210 | 9.262 | 9.347 | 9.506 |
| 10 percentile | 8,519 | 8,728 | 9,570 | 11,208 | 9.050 | 9.074 | 9.166 | 9.324 |
| No. of workers | 692,870 | 800,332 | 739,378 | 860,581 | 692,870 | 800,332 | 739,378 | 860,581 |
| 2. Plant average wage | 12,678 | 13,490 | 14,432 | 17,245 | 9.396 | 9.455 | 9.521 | 9.692 |
| SD | 2,088 | 2,266 | 2,679 | 3,663 | 0.145 | 0.152 | 0.169 | 0.188 |
| 90 percentile | 15,699 | 16,680 | 18,143 | 22,497 | 9.603 | 9.664 | 9.751 | 9.959 |
| 75 percentile | 13,664 | 14,586 | 15,855 | 19,008 | 9.478 | 9.541 | 9.624 | 9.801 |
| Median | 12,228 | 13,076 | 13,935 | 16,397 | 9.376 | 9.440 | 9.505 | 9.665 |
| 25 percentile | 11,239 | 11,953 | 12,554 | 14,698 | 9.297 | 9.353 | 9.407 | 9.561 |
| 10 percentile | 10,448 | 11,003 | 11,501 | 13,413 | 9.227 | 9.272 | 9.318 | 9.472 |
| No. of plants | 7,047 | 8,306 | 7,526 | 9,067 | 7,047 | 8,306 | 7,526 | 9,067 |
| 3. Plant SD of wages | 3,820 | 4,168 | 4,404 | 5,484 | 0.266 | 0.279 | 0.273 | 0.279 |
| SD | 1,387 | 1,416 | 1,626 | 2,222 | 0.064 | 0.060 | 0.066 | 0.069 |
| 90 percentile | 5,830 | 6,219 | 6,678 | 8,635 | 0.355 | 0.361 | 0.361 | 0.371 |
| 75 percentile | 4,702 | 5,029 | 5,459 | 6,917 | 0.308 | 0.317 | 0.317 | 0.326 |
| Median | 3,595 | 3,924 | 4,151 | 5,047 | 0.260 | 0.274 | 0.267 | 0.272 |
| 25 percentile | 2,775 | 3,119 | 3,159 | 3,794 | 0.220 | 0.238 | 0.226 | 0.228 |
| 10 percentile | 2,206 | 2,546 | 2,474 | 2,936 | 0.186 | 0.207 | 0.192 | 0.195 |
| No. of plants | 7,047 | 8,306 | 7,526 | 9,067 | 7,047 | 8,306 | 7,526 | 9,067 |
| Plant CV of wages | 0.296 | 0.305 | 0.300 | 0.312 | 0.028 | 0.030 | 0.029 | 0.029 |
| SD | 0.076 | 0.072 | 0.080 | 0.088 | 0.007 | 0.006 | 0.007 | 0.007 |
| 90 percentile | 0.392 | 0.399 | 0.406 | 0.429 | 0.037 | 0.038 | 0.037 | 0.038 |
| 75 percentile | 0.349 | 0.356 | 0.356 | 0.371 | 0.033 | 0.033 | 0.033 | 0.033 |
| Median | 0.294 | 0.302 | 0.298 | 0.306 | 0.028 | 0.029 | 0.028 | 0.028 |
| 25 percentile | 0.240 | 0.253 | 0.242 | 0.247 | 0.024 | 0.025 | 0.024 | 0.024 |
| 10 percentile | 0.197 | 0.212 | 0.196 | 0.200 | 0.020 | 0.022 | 0.020 | 0.020 |
| No. of plants | 7,047 | 8,306 | 7,526 | 9,067 | 7,047 | 8,306 | 7,526 | 9,067 |
| 4. Correlation (average wage, SD of wage) | 0.782 | 0.758 | 0.742 | 0.768 | 0.591 | 0.499 | 0.480 | 0.499 |
| 5. Wages for workers aged 25–30 | 11,910 | 12,716 | 13,318 | 16,258 | 9.358 | 9.419 | 9.467 | 9.657 |
| SD | 2,950 | 3,321 | 3,456 | 4,929 | 0.230 | 0.249 | 0.243 | 0.276 |
| 90 percentile | 15,521 | 16,772 | 17,305 | 22,121 | 9.650 | 9.727 | 9.759 | 10.004 |
| 75 percentile | 13,293 | 14,381 | 14,994 | 18,364 | 9.495 | 9.574 | 9.615 | 9.818 |
| Median | 11,466 | 12,335 | 12,922 | 15,469 | 9.347 | 9.420 | 9.467 | 9.647 |
| 25 percentile | 9,961 | 10,508 | 11,086 | 13,073 | 9.206 | 9.260 | 9.313 | 9.478 |
| 10 percentile | 8,649 | 8,861 | 9,449 | 11,009 | 9.065 | 9.089 | 9.154 | 9.306 |
| No. of workers | 103,277 | 125,836 | 127,035 | 138,219 | 103,277 | 125,836 | 127,035 | 138,219 |
| 6. Wages for workers aged 45–50 | 14,251 | 15,453 | 16,255 | 19,169 | 9.508 | 9.585 | 9.638 | 9.795 |
| SD | 5,236 | 5,770 | 6,002 | 7,772 | 0.327 | 0.339 | 0.332 | 0.351 |
| 90 percentile | 21,462 | 23,417 | 24,497 | 29,579 | 9.974 | 10.061 | 10.106 | 10.295 |

**Table 7.5** (continued)

| | Wages (1990-SEK)[a] | | | | Log wages (1990-SEK)[a] | | | |
|---|---|---|---|---|---|---|---|---|
| | 1986[b] | 1990 | 1995 | 2000 | 1986 | 1990 | 1995 | 2000 |
| 75 percentile | 16,254 | 17,854 | 18,562 | 21,767 | 9.696 | 9.790 | 9.829 | 9.988 |
| Median | 12,820 | 13,974 | 14,680 | 16,948 | 9.459 | 9.545 | 9.594 | 9.738 |
| 25 percentile | 10,773 | 11,600 | 12,304 | 14,193 | 9.285 | 9.359 | 9.418 | 9.561 |
| 10 percentile | 9,162 | 9,690 | 10,455 | 12,108 | 9.123 | 9.179 | 9.255 | 9.402 |
| No. of workers | 91,500 | 120,626 | 121,496 | 116,080 | 91,500 | 120,626 | 121,496 | 116,080 |

*Notes:* SD = standard deviation; CV = coefficient of variation.

Data only include employees of plants with 25+ employees in year $t$ and $t-1$.

[a]Deflation by CPI to 1990-SEK.

[b]Data for 1986 do not include workers older than sixty-two or workers that emigrated or died before 1990.

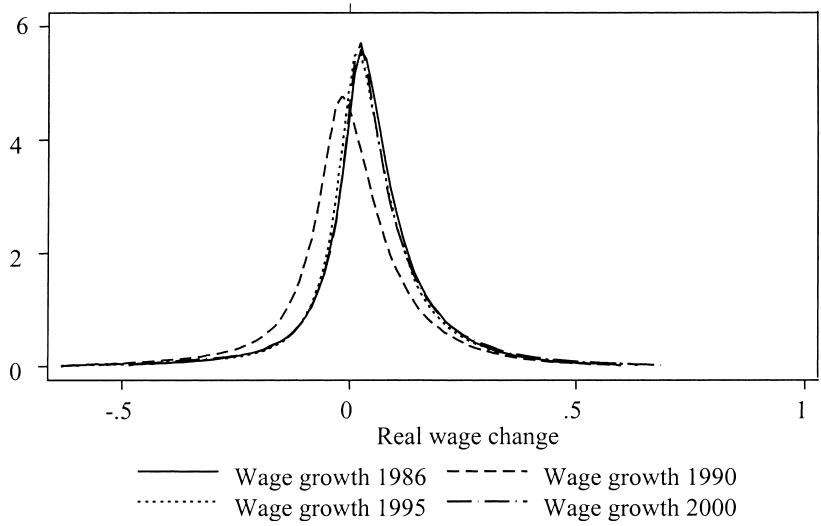


**Fig. 7.5 Distribution of log real wage changes**

*Note:* Deflated by CPI to 1990:SEK.

Table 7.6 looks at wage changes. The top panel shows the mean and distribution of individual wage changes: the average real wage change was between 4 and 5 percent, except in 1990 when it was close to zero. As for the dispersion, there appears to be some variation over time, but not much to indicate a trend.

Figure 7.6 and the second panel of table 7.6 show the distribution of plant average wage changes using information on the workers that remained in the plant for two consecutive years (from $t-1$ to $t$). We see that

**Table 7.6** **Wage changes**

| | Δ Wages (1990 SEK:s)[a] | | | | Δ ln(Wages) (1990 SEK:s)[a] | | | |
|---|---|---|---|---|---|---|---|---|
| | 1986[b] | 1990 | 1995 | 2000 | 1986[b] | 1990 | 1995 | 2000 |
| 1. Change in wages | 610 | 46 | 638 | 898 | 0.048 | 0.004 | 0.045 | 0.048 |
| SD | 1,559 | 1,890 | 2,018 | 2,633 | 0.124 | 0.140 | 0.134 | 0.142 |
| 90 percentile | 2,356 | 2,174 | 2,803 | 3,668 | 0.191 | 0.164 | 0.193 | 0.207 |
| 75 percentile | 1,283 | 922 | 1,428 | 1,826 | 0.103 | 0.068 | 0.098 | 0.105 |
| Median | 503 | –27 | 476 | 626 | 0.040 | –0.002 | 0.034 | 0.038 |
| 25 percentile | –108 | –830 | –195 | –177 | –0.009 | –0.059 | –0.014 | –0.011 |
| 10 percentile | –956 | –1,920 | –1,160 | –1,434 | –0.078 | –0.139 | –0.079 | –0.085 |
| No. of workers | 586,057 | 665,982 | 623,679 | 704,360 | 586,057 | 665,982 | 623,679 | 704,360 |
| 2. Plant wage change[c] | 666 | 122 | 565 | 948 | 0.054 | 0.010 | 0.041 | 0.053 |
| SD | 541 | 680 | 799 | 1,141 | 0.042 | 0.049 | 0.053 | 0.059 |
| 90 percentile | 1,255 | 860 | 1,366 | 2,088 | 0.099 | 0.063 | 0.094 | 0.114 |
| 75 percentile | 914 | 440 | 878 | 1,292 | 0.073 | 0.033 | 0.063 | 0.076 |
| Median | 617 | 90 | 484 | 763 | 0.052 | 0.008 | 0.037 | 0.047 |
| 25 percentile | 368 | –232 | 162 | 384 | 0.032 | –0.016 | 0.014 | 0.024 |
| 10 percentile | 138 | –549 | –148 | 30 | 0.013 | –0.039 | –0.008 | 0.001 |
| No. of plants | 7,037 | 8,296 | 7,521 | 9,063 | 7,037 | 8,296 | 7,521 | 9,063 |
| 3. Within plant SD | 1,402 | 1,713 | 1,738 | 2,197 | 0.113 | 0.128 | 0.120 | 0.126 |
| SD | 483 | 553 | 690 | 980 | 0.029 | 0.033 | 0.035 | 0.039 |
| 90 percentile | 2,008 | 2,393 | 2,614 | 3,417 | 0.151 | 0.170 | 0.164 | 0.176 |
| 75 percentile | 1,627 | 1,986 | 2,059 | 2,605 | 0.130 | 0.147 | 0.140 | 0.147 |
| Median | 1,322 | 1,632 | 1,615 | 1,975 | 0.111 | 0.127 | 0.117 | 0.122 |
| 25 percentile | 1,078 | 1,346 | 1,275 | 1,553 | 0.093 | 0.107 | 0.096 | 0.100 |
| 10 percentile | 890 | 1,112 | 1,000 | 1,231 | 0.078 | 0.089 | 0.078 | 0.082 |
| No. of plants | 7,035 | 8,294 | 7,519 | 9,054 | 7,035 | 8,294 | 7,519 | 9,054 |
| 4. Wage change if changed plant | 524 | –129 | 742 | 1,069 | 0.037 | –0.015 | 0.047 | 0.053 |
| SD | 2,302 | 2,671 | 3,179 | 4,026 | 0.174 | 0.194 | 0.197 | 0.213 |
| 90 percentile | 3,243 | 2,979 | 4,382 | 5,727 | 0.254 | 0.221 | 0.292 | 0.319 |
| 75 percentile | 1,703 | 1,358 | 2,347 | 3,133 | 0.135 | 0.099 | 0.155 | 0.175 |
| Median | 452 | –110 | 664 | 913 | 0.035 | –0.008 | –0.044 | 0.051 |
| 25 percentile | –700 | –1,595 | –789 | –1,049 | –0.055 | –0.122 | –0.053 | –0.063 |
| 10 percentile | –2,168 | –3,348 | –2,771 | –3,525 | –0.184 | –0.269 | –0.195 | –0.218 |
| No. of workers | 23,659 | 28,824 | 21,477 | 40,217 | 23,659 | 28,824 | 21,477 | 40,217 |
| 5. Wage change if tenure 1–3 years | | 444 | 1,073 | 1,542 | | 0.037 | 0.083 | 0.089 |
| SD | | 1,984 | 2,316 | 2,965 | | 0.155 | 0.163 | 0.164 |
| 90 percentile | | 2,769 | 3,765 | 4,837 | | 0.228 | 0.292 | 0.292 |
| 75 percentile | | 1,460 | 2,186 | 2,793 | | 0.118 | 0.165 | 0.170 |
| Median | | 336 | 845 | 1,178 | | 0.027 | 0.063 | 0.073 |
| 25 percentile | | –569 | –30 | 108 | | –0.044 | –0.002 | 0.007 |
| 10 percentile | | –1,659 | –1,046 | –1,151 | | –0.128 | –0.075 | –0.071 |
| No. of workers | | 230,789 | 172,967 | 224,083 | | 230,789 | 172,967 | 224,083 |
| 6. Wage change if tenure ≥3 years | | –168 | 458 | 555 | | –0.013 | 0.029 | 0.027 |
| SD | | 1,726 | 1,773 | 2,192 | | 0.121 | 0.113 | 0.115 |
| 90 percentile | | 1,635 | 2,213 | 2,637 | | 0.113 | 0.142 | 0.141 |
| 75 percentile | | 603 | 1,150 | 1,312 | | 0.043 | 0.078 | 0.075 |

**Table 7.6** **Wage changes**

| | Δ Wages (1990 SEK:s)[a] | | | | Δ ln(Wages) (1990 SEK:s)[a] | | | |
|---|---|---|---|---|---|---|---|---|
| | 1986[b] | 1990 | 1995 | 2000 | 1986[b] | 1990 | 1995 | 2000 |
| Median | –175 | | 378 | 446 | | –0.013 | 0.027 | 0.027 |
| 25 percentile | | –915 | –233 | –252 | | –0.064 | –0.016 | –0.015 |
| 10 percentile | | –1,950 | –1,131 | –1,387 | | –0.136 | –0.077 | –0.081 |
| No. of workers | | 403,369 | 429,235 | 440,060 | | 406,369 | 429,235 | 440,060 |

*Notes:* See table 7.5 notes.

[a]Deflation by CPI to 1990-SEK.

[b]Data for 1986 do not include workers older than sixty-two or workers that emigrated or died before 1990.

[c]Average change in wage (or log wage) for workers that worked in the plant in both $t$ and $t-1$.

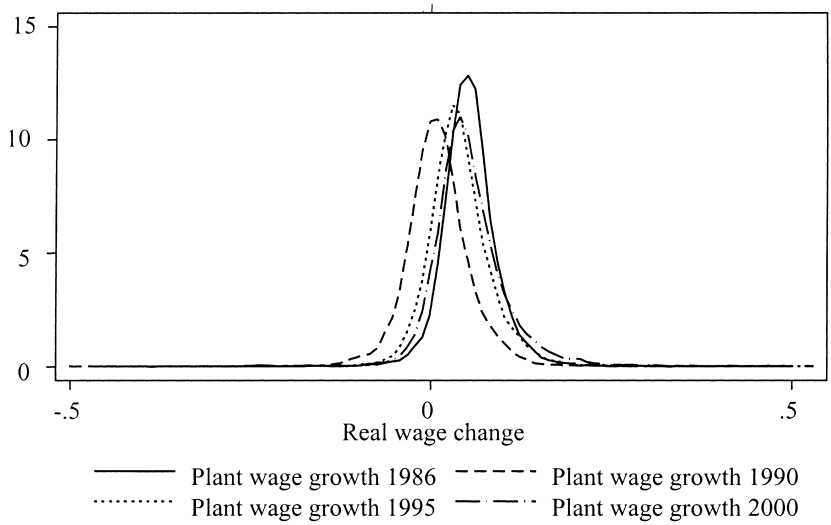


**Fig. 7.6 Distribution of plant average log wages for workers who remain in the same plant**

*Note:* Deflated by CPI to 1990:SEK.

the dispersion of wage changes *between* plants, as measured by the standard deviation of plant wage changes, increased over time. As a contrast, it is shown in the third panel that the dispersion of wage changes *within* plants (the mean of the standard deviation of wage changes within a plant) was relatively stable. Thus, the results suggest that the rate of real wage changes increasingly varies between plants, but that the variation of wage changes has remained stable within plants.

The bottom three panels of table 7.6 show the distribution of wage

changes separately for different tenure groups: (1) for those that changed plants (from one plant in the sample to another), (2) for those with short (one to three years) tenure, and (3) for long-tenured (> three years) workers. The tables show, as expected, that wage increases are smaller for workers with long tenure than for workers with shorter tenure. The wage increases for workers that change plants are smaller than average at the start of the period, but larger at the end of the period. This observation seems consistent with the observed increase in the importance of plant effects. However, it should also be noted that the dispersion of wage changes is much larger for those that change plants, suggesting important differences between voluntary and involuntary worker separations. It is important to keep in mind that the analysis is based on raw differences and that the probability of changing plants may be correlated with other characteristics that may affect the rate of wage growth, such as age or education.

### 7.4.3 Mobility

We now take a look at worker mobility at the plant level. The *entry rate* is defined as the share of workers in a plant in year $t$ that did not work in the plant in $t-1$. Correspondingly, the *exit rate* is defined as the share of workers in a plant in year $t-1$ that did not remain in the same plant in year $t$.

The top panels of table 7.7 shows some background statistics. We see an increase in the number of plants over time (top panel) and some decrease in the average number of employees per plant (the second panel) consistent with the declining average plant size we described in section 7.3. The third panel shows the employment growth rates of the plants and by comparing the left part of the table (all 25+ sized plants) with the right side (only 100+ sized plants) it is clear the smaller plants had higher growth rates than larger plants during this period.

Comparing the exit rates depending on the size of the plant in the fourth and fifth panels, we see that there are fewer exits in the largest plants; presumably this is because they can provide more career opportunities than smaller organizations.

In the following panels (6 and following), we show exit and entry rates for different parts of the plant wage distribution. It is clear that most of the mobility takes place in the lower part of a plant's wage distribution, both in terms of exit and entry. Exit rates in the top quartile are in the order of 13 to 18 percent, whereas exit rates in the bottom quartiles are between 26 and 36 percent. The corresponding numbers for entry rates are 10 to 14 percent in the top quartile and 40 to 44 percent in the bottom quartile. Thus, there is relatively more entry than exits at the lower part of the plant wage distribution and relatively more exits than entry at the higher part of the wage distribution, suggesting that workers to some extent enter at lower wage levels and get promoted to higher wage levels before leaving the plant.

**Table 7.7** **Mobility, all jobs**

| | All Plants | | | | Plants with 100+ employees | | | |
|---|---|---|---|---|---|---|---|---|
| | 1986 | 1990 | 1995 | 2000 | 1986 | 1990 | 1995 | 2000 |
| 1. No. of plants | 7,047 | 8,306 | 7,526 | 9,067 | 1,341 | 1,566 | 1,420 | 1,650 |
| 2. Employees/plant | 98.3 | 96.4 | 98.4 | 95.2 | 311.5 | 303.1 | 315.3 | 301.6 |
| | (232.1) | (222.6) | (219.1) | (206.7) | (474.3) | (456.0) | (441.2) | (424.4) |
| 3. Employment growth/plant | 0.015 | 0.028 | 0.056 | 0.059 | 0.001 | –0.006 | 0.051 | 0.040 |
| | (0.241) | (0.245) | (0.228) | (0.319) | (0.172) | (0.160) | (0.193) | (0.249) |
| | *By individual—a person is one observation* | | | | | | | |
| 4. Exit rate | 0.199 | 0.217 | 0.151 | 0.204 | 0.182 | 0.208 | 0.132 | 0.186 |
| If wage >90 percentile | 0.165 | 0.176 | 0.174 | 0.231 | 0.153 | 0.167 | 0.155 | 0.222 |
| If wage in 45–55 percentile | 0.135 | 0.159 | 0.099 | 0.142 | 0.120 | 0.151 | 0.081 | 0.123 |
| If wage <10 percentile | 0.475 | 0.457 | 0.336 | 0.422 | 0.462 | 0.454 | 0.314 | 0.403 |
| | *By plant—a plant is one observation* | | | | | | | |
| 5. Exit rate | 0.202 | 0.216 | 0.159 | 0.212 | 0.183 | 0.204 | 0.136 | 0.191 |
| | (0.124) | (0.124) | (0.120) | (0.141) | (0.107) | (0.107) | (0.100) | (0.124) |
| 6. Exit rate, top quartile of plant wages | 0.131 | 0.148 | 0.127 | 0.174 | 0.116 | 0.139 | 0.110 | 0.164 |
| | (0.147) | (0.154) | (0.148) | (0.174) | (0.116) | (0.121) | (0.111) | (0.141) |
| 7. Exit rate, bottom quartile of plant wages | 0.355 | 0.353 | 0.259 | 0.316 | 0.338 | 0.349 | 0.230 | 0.288 |
| | (0.190) | (0.184) | (0.180) | (0.194) | (0.138) | (0.135) | (0.131) | (0.147) |
| 8. Exit rate, top decile of plant wages | 0.143 | 0.160 | 0.148 | 0.191 | 0.133 | 0.154 | 0.137 | 0.188 |
| | (0.192) | (0.201) | (0.197) | (0.224) | (0.144) | (0.144) | (0.142) | (0.169) |
| 9. Exit rate 45–55 percentile, of plant wages | 0.156 | 0.179 | 0.127 | 0.178 | 0.130 | 0.159 | 0.100 | 0.153 |
| | (0.201) | (0.212) | (0.190) | (0.218) | (0.134) | (0.137) | (0.121) | (0.153) |
| 10. Exit rate, bottom decile of plant wages | 0.454 | 0.432 | 0.340 | 0.396 | 0.444 | 0.437 | 0.314 | 0.376 |
| | (0.272) | (0.270) | (0.268) | (0.278) | (0.161) | (0.159) | (0.164) | (0.173) |

(*continued*)

**Table 7.7 Mobility, all jobs**

| | All Plants | | | | Plants with 100+ employees | | | |
|---|---|---|---|---|---|---|---|---|
| | 1986 | 1990 | 1995 | 2000 | 1986 | 1990 | 1995 | 2000 |
| | *By plant—a plant is one observation* | | | | | | | |
| 11. Entry rate | 0.198 | 0.221 | 0.191 | 0.234 | 0.176 | 0.191 | 0.169 | 0.209 |
| | (0.126) | (0.129) | (0.127) | (0.153) | (0.105) | (0.102) | (0.110) | (0.135) |
| 12. Entry rate, top quartile of plant wages | 0.103 | 0.116 | 0.105 | 0.144 | 0.090 | 0.100 | 0.096 | 0.134 |
| | (0.134) | (0.140) | (0.136) | (0.164) | (0.102) | (0.108) | (0.111) | (0.137) |
| 13. Entry rate, bottom quartile of plant wages | 0.398 | 0.432 | 0.392 | 0.438 | 0.366 | 0.388 | 0.353 | 0.399 |
| | (0.212) | (0.212) | (0.227) | (0.235) | (0.169) | (0.165) | (0.177) | (0.199) |
| 14. Entry rate, top decile of plant wages | 0.112 | 0.127 | 0.118 | 0.159 | 0.103 | 0.115 | 0.115 | 0.155 |
| | (0.170) | (0.182) | (0.176) | (0.206) | (0.121) | (0.135) | (0.133) | (0.161) |
| 15. Entry rate 45–55 percentile of plant wages | 0.135 | 0.156 | 0.127 | 0.168 | 0.112 | 0.125 | 0.106 | 0.142 |
| | (0.193) | (0.207) | (0.189) | (0.224) | (0.124) | (0.125) | (0.129) | (0.160) |
| 16. Entry rate, bottom decile of plant wages | 0.500 | 0.528 | 0.502 | 0.541 | 0.461 | 0.478 | 0.463 | 0.504 |
| | (0.288) | (0.282) | (0.294) | (0.295) | (0.195) | (0.189) | (0.198) | (0.215) |
| 17. percent of workers with 5+ years of tenure | | 0.316 | 0.414 | 0.364 | | 0.351 | 0.459 | 0.423 |
| | | (0.218) | (0.262) | (0.249) | | (0.225) | (0.257) | (0.258) |
| 18. Correlation (size, average tenure)[a] | | 0.072 | 0.052 | 0.045 | | 0.092 | 0.032 | 0.022 |
| 19. Correlation (size, average age) | –0.004 | 0.014 | –0.004 | –0.011 | –0.063 | –0.038 | –0.064 | –0.035 |
| 20. Correlation (exit rate, average wage) | –0.184 | –0.166 | –0.034 | –0.019 | –0.136 | –0.128 | 0.037 | 0.084 |
| 21. Correlation (exit rate, average wage change) | 0.050 | –0.002 | 0.040 | 0.181 | 0.098 | –0.028 | 0.079 | 0.272 |
| 22. Correlation (exit rate, SD of wage) | 0.054 | 0.097 | 0.177 | 0.215 | 0.110 | 0.114 | 0.299 | 0.340 |
| 23. Correlation (entry rate, average wage), | –0.100 | –0.118 | –0.051 | 0.026 | –0.107 | –0.051 | 0.021 | 0.054 |
| 24. Correlation (entry rate, average wage change) | 0.249 | 0.206 | 0.249 | 0.362 | 0.383 | 0.199 | 0.330 | 0.414 |
| 25. Correlation (entry rate, SD of wage), | 0.110 | 0.135 | 0.181 | 0.239 | 0.192 | 0.251 | 0.248 | 0.310 |

*Notes:* Numbers in parentheses are standard deviations (SD). All statistics are at the plant level with one plant as one observation except as otherwise noted. Separate tables for high and low level jobs can be found in appendix A. Correlations are with average log wages in plants, average log wage changes for workers remaining in the plant, and standard deviation of log wages within plants.

[a]Note that tenure is calculated from 1985 onward, and thus truncated at different values for different years.

The most important development over time seems to be some procyclicality, in terms of entry rates and exit rates. In both the (relative) slump years of 1986 and 1995, we see that exits as well as entries were relatively uncommon (panels 5 to 16) and the fraction of high-tenured workers was relatively large in 1995 (panel 17).

The six bottom panels (18 to 25) of table 7.7 show correlations between entry and exit rates and different aspects of the plants wage distributions. In calculating these correlations we use the log wages, the standard deviation of log wages, and the log wage changes (for those remaining in the plant between year $t$ and $t-1$). The purpose is to describe the relationship between wage levels and wage structures on one side and mobility on the other side.

The correlations between average wage and exit rates are negative in the first years, but they grew over time, and for the large plant sample, they are positive for the last two years. The correlation between average wage change and exit rates fluctuates substantially between the years and even change signs. Exit rates are in all cases positively correlated with the standard deviation of wages, and this correlation appears to be growing over time.

As for the entry rates, the correlation with the average wage is similar to that for exit rates; it starts out negative but is positive at the end of the period. High entry rates also appear to be positively correlated with wage growth as well as with within-plant wage dispersion, and at least in the case of dispersion, increasingly so over time.

Appendix A shows tables that depict high- and low-level jobs separately. *High-level jobs* are defined as jobs paying more than the 80th percentile of the wage distribution in the data and *low-level jobs* are defined as the jobs paying less than the 20th percentile of the distribution. The story told by these numbers is essentially the same as in table 7.7: both entry and exits are more common for low-level jobs and less common for high-level jobs, with a more pronounced pattern for entries. The main difference seems to be that the correlation between mobility and the plant wages, wage changes, and wage dispersion all are more positive for high-level jobs.

This concludes the snapshots of wages and mobility. The most noteworthy observation is the rise in between-plant wage dispersion, whereas the within dispersion has remained largely constant. The next section takes a closer look at this development.

## 7.5 The Evolution of the Wage Structure

Figure 7.7 shows the overall log wage variance throughout the time period for the entire economy, for the corporate sector, for the private corporate sector, and for manufacturing. The figure clearly shows that the wage dispersion has increased quite consistently for all of these except for manufacturing, where the dispersion has been relatively stable.

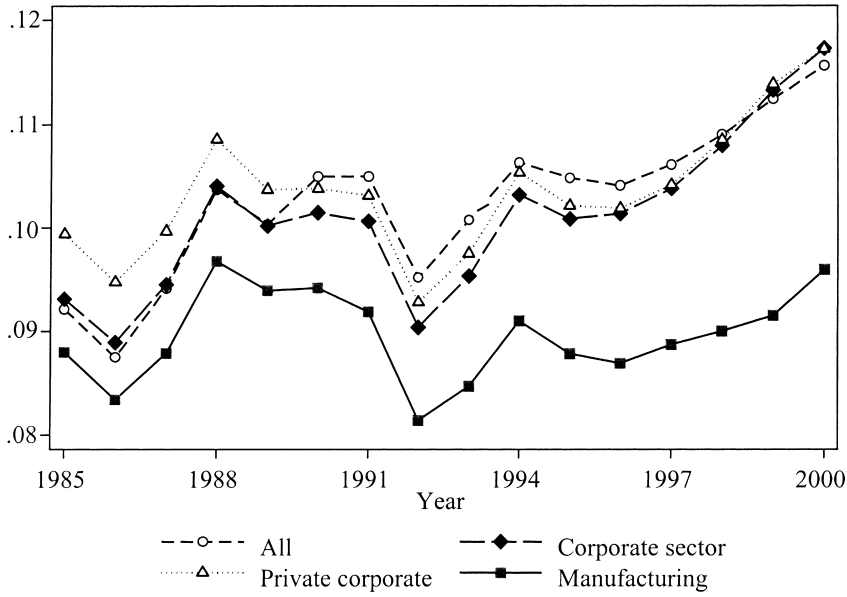


**Fig. 7.7 Overall log (wage) variance**

The description in the previous section suggested that differences between plants may play an important role in explaining the growing wage dispersion in Sweden since the mid-1980s. The purpose of this section is to study in some detail the changing role that plants have played in explaining the growing wage dispersion between workers in the Swedish economy.

### 7.5.1 Within- and between-Plant Components

We start by looking at how the share of log wage variance that can be attributed to plant-specific factors has changed over time. Figure 7.8 shows that the between-plant variance as a share of overall variance has increased steadily throughout the period. The development is equally visible when studying the entire economy as when studying only the corporate sector. There is also a steady increase in the importance of plant effects when focusing only on the manufacturing sector, even though the increase is less pronounced in that sector. Throughout the rest of this section, we will focus on plants in the corporate sector. However, we will include the entire corporate sector regardless of ownership (see the discussion in the beginning of the previous section).

Interestingly, it is the increase in between-plant variance that makes up the entire increase in wage dispersion over the period. Figure 7.9 shows the evolution of within-plant variance, which contains a slightly cyclical pattern, but has no trend.

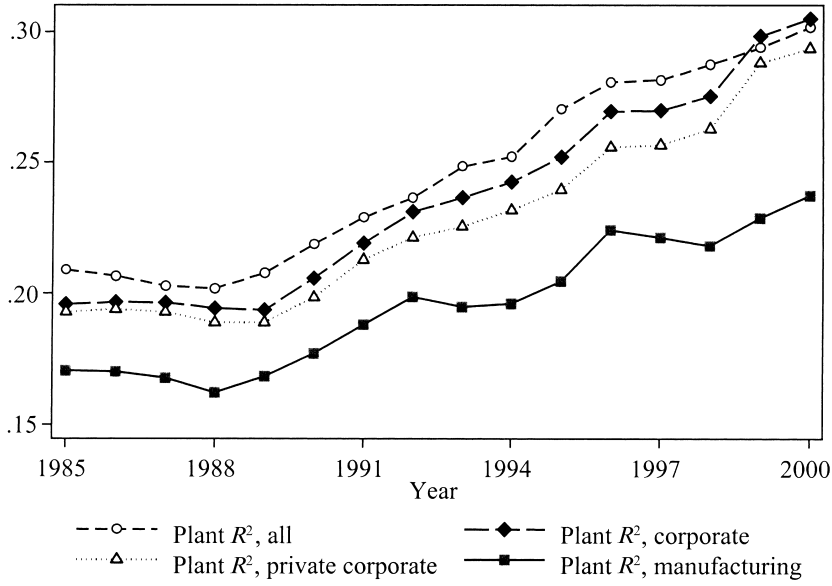


**Fig. 7.8 Fraction of total variance explained by plant effects**

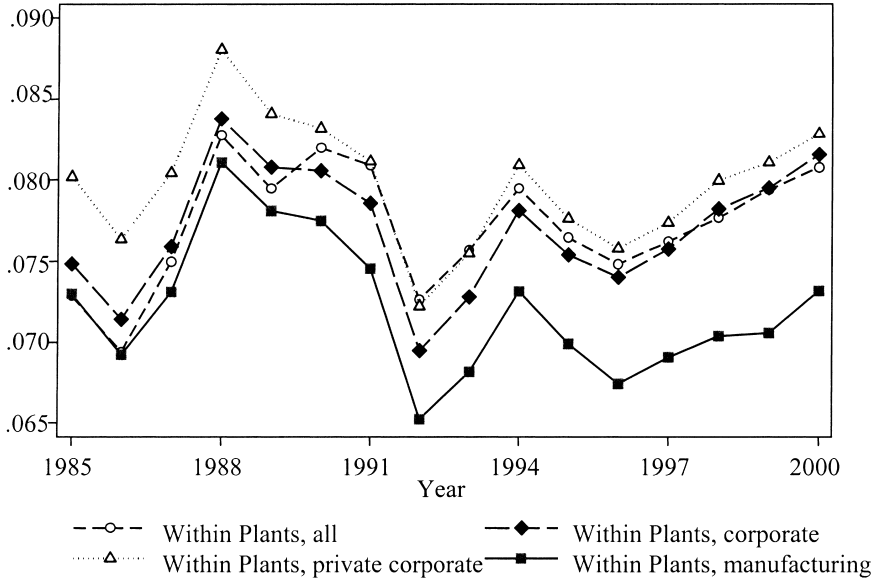


**Fig. 7.9 Within-plant variance**

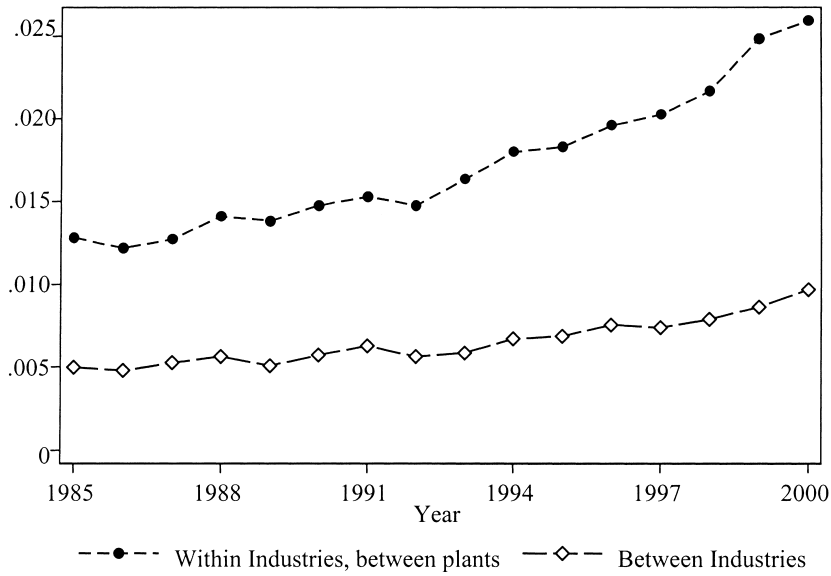


**Fig. 7.10 Between-plant components: Corporate sector**

It is possible that the increase in between-plant variance is due to changes in the industry composition. Thus, in figure 7.10 we decompose the between-plant variance in two parts, between plants within the same two-digit industry and between two-digit industries.[11] The figure clearly shows an increase in both the wage variances between plants in the same industry and between industries. We have also looked at the variance between plants within the same firm; this variance is small (because many firms just have one plant) but increasing.

As a (very) rough formal analysis of time trends for different industries, we estimated time trend estimates for the entire economy as well as separately for all one-digit industries. The results (not displayed) showed that all industries had positive trends in between-plant variances, while only three industries had trends in within-plant variances. To further assess the role of structural change, we have looked separately at all plants that existed in 1985 or 2000, as well as divided these plants by employment growth rates. All the results from these experiments suggested that the growing difference between plants is driven by increased differences between plants in the wages they pay, rather than by changes in the composition of plants in the economy.

11. We use "reduced" two-digit industry codes that are the lowest level at which it is possible to get consistent industry classifications throughout the period (new codes were issued in 1992). Thus, the corporate sector is divided into thirty-nine industries.

### 7.5.2 The Role of Sorting and Observed Human Capital Attributes

The increased between-plant wage inequality may have occurred for two very different reasons. First, it may be due to increased sorting of workers by observed and unobserved skills so that high-skilled and low-skilled workers to an increasing degree are found in different plants. Another possibility is increased importance of "true" plant effects, such as effects operating via rent sharing at the plant level. For example, between-plant wage dispersion is likely to rise if wages at the plant level become more responsive to plant-specific price and productivity conditions.

To get a first look at the importance of sorting according to skill, we will include traditional observable human capital variables (age, age squared, education, gender, and immigration status) in a Mincer-type regression. The results from the regressions can be found in appendix B. As has already been shown in, for example, Gustavsson (2006), the explanatory power of observable characteristics has declined over time.

We proceed by including plant-fixed effects in the Mincer equation and calculate the fixed effects $R^2$ (explanatory power), defined as the fraction of total residual variance attributed to the plant effects. This fraction captures the additional explanatory power of plant effects after controlling for observable characteristics.[12] The results displayed in figure 7.11 show that the plants play an increasingly important role after controlling for observable skills: there is a trend increase in the fraction of residual variance attributed to plant effects. We also calculate the correlation between the fixed effects and the prediction from observables and take this as a measure of the degree of sorting on observables in order to answer the question: to what extent do individuals with high earnings potential work in plants with large plant effects? Figure 7.11 reveals an increase in the degree of sorting: workers with favorable observed human capital attributes show an increasing tendency to work in high paying plants.

How should these patterns be interpreted? There is clearly evidence of increased sorting on observed skills, and there is a presumption that this also is associated with more sorting on unobserved skills. Conclusions about the development of true plant effects are more problematic, however, because such conclusions would require that the observed human capital characteristics capture all skill differences between individuals, which seems like a rather strong assumption.[13]

12. The fraction is formally equivalent to what Kremer and Maskin (1996) refer to as an index of segregation (or correlation) by worker skill.

13. Figure 7.11 also shows that observed human capital variables can explain less of the within-plant variance over time. However, using the within-estimated coefficients to calculate the between $R^2$, we see no evidence of a trend, suggesting that the between-plant variance of observables has increased relative to the within-plant variance. We interpret this as further support to the notion of increased sorting.

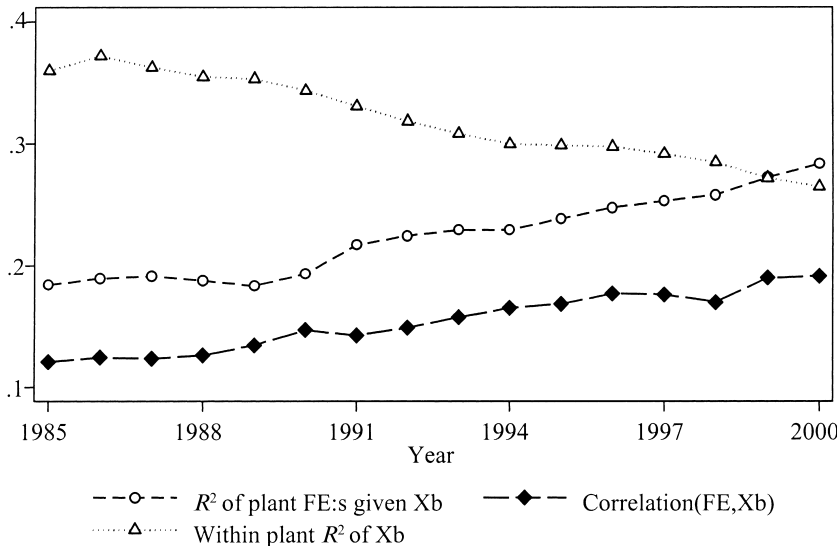


**Fig. 7.11 Plant effects when controlling for observables**

*Notes:* The estimated (year-specific) model is $\ln W(i,j,t) = X(i,t)\, b(t) + \mathrm{FE}(j,t) + e(i,j,t)$, where $X$ is education (six dummies), age, age squared, gender, and immigration status. FE is a plant fixed effect and $e$ the error term. For estimates, see appendix C.

### 7.5.3 Plant Effects and Skill Levels

We noted already in section 7.4 that the variance of log wages within a plant is correlated with the average log wage of that plant and that this may reflect the skewness of the log wage distribution. Thus, we may be interested in the changing role of plants in different parts of the skill distribution. We study this by dividing the sample of individuals into quartiles of predicted wages from the estimated ordinary least squares (OLS) Mincer equations. Figure 7.12 shows an interesting pattern; the plant effects become increasingly important for all quartiles except the top predicted quartile.[14] Thus, it appears that the increasing importance of plant effects is a feature of all parts of the skill distribution *except* at the most highly skilled quartile. Plant effects were clearly most important for the highest-skilled workers at the beginning of the time period; but at the end of the period, there were little or no differences between different parts of the skill distribution. This suggests that changes in bargaining institutions may have been a factor of importance. For white-collar workers in the top of the earnings distribution, there has typically been considerable scope for indi-

14. It should be noted that the pattern of increased plant effect $R^2$s can be replicated using only males. Thus, it is not likely that the differences between predicted wage quartiles are driven by different time patterns for men and women.

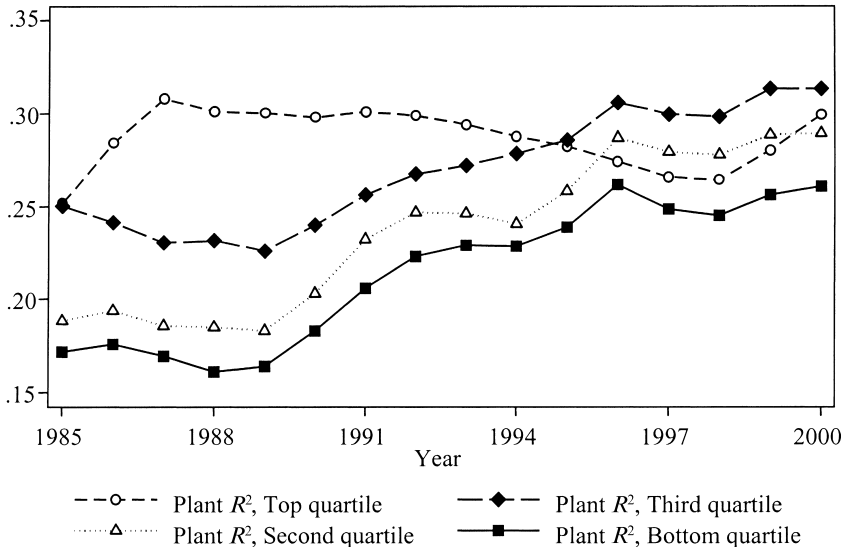


**Fig. 7.12 Fraction of variance explained by plant effects by predicted wage quartile in the corporate sector**

*Note:* Quartiles of predicted wages from regressions on education (six dummies), age, age squared, immigration status, and gender.

vidual bargaining with the employer, and the national wage agreements have been less relevant for those workers than for other groups. A speculative interpretation of figure 7.12 would be that a gradual erosion of the bite of national wage agreements has made wage-setting processes more similar across skill groups, with a tendency to emulate practices among the workers with the highest pay.

### 7.5.4 Wage Changes and Mobility

So far this section has focused entirely on wage levels. However, changes in the variance between plants in wages may have implications for both wage changes and mobility. In figure 7.13 we study the fraction of wage growth variance that can be attributed to plant effects for the different years (using only workers who remain in the same plant). The pattern is less obvious than when studying wage levels, but there is a marked shift in plant-specific wage growth in the beginning of the 1990s. This pattern also remains after controlling for observables. The strongest pattern emerging from the figure is, however, an increased sorting on observables (measured as the correlation between observed human capital and plant-fixed effects) starting in the mid-1990s, where workers with high predicted wage growth rates (e.g., young workers) increasingly sort themselves to plants with high residual wage growth rates. However, it should be noted that, as is evident

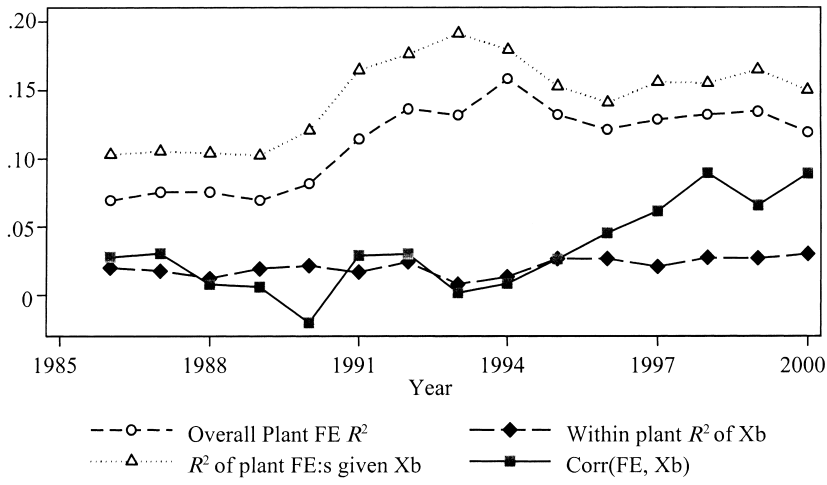


**Fig. 7.13 Real wage growth and plant effects**

*Notes:* The overall plant $R^2$ is the between-plant variance of changes divided by total variance of changes in log wages. The other statistics are based on the estimated (year-specific) model $d \ln W(i,j,t) = X(i,t)\, b(t) + \mathrm{FE}(j,t) + e(i,j,t)$, where $i$ is for individual, $j$ for plant, and $t$ for time (year). $X$ includes education (six dummies), age, age squared, gender, and immigration status. FE is a plant-fixed effect and $e$ the error term.

from figure 7.13, the within-plant predictive power of the observables is quite small (in the order of 1 to 3 percent).

In section 7.4, we noted what appeared to be increased wage changes for those who changed plants relative to the average wage change. However, when studying the time pattern throughout the period, it is apparent that the difference is highly volatile, with little evidence of a trend (in most cases, the differences are insignificant), a picture that also remains after controlling for observable characteristics. What appears to be a robust pattern, however, is a procyclicality of the fraction of workers observed in the data in two consecutive years who have changed plants between the years (see figure 7.14). The fraction of workers changing jobs in 1993 is roughly half that in 1988 and 2000.

### 7.5.5 The Dynamics of Plant Wages

It appears clear that wages have become more dispersed between plants in the cross-section. In this subsection, we study whether the same is true for the time dimension—that is, does the apparent increase in cross-sectional flexibility also mean that average plant wages are more volatile over time?

We have computed the year-by-year correlations of plant log wages. The correlations are displayed in figure 7.15 and vary between 0.92 and 0.96 with a marked procyclical pattern—the four years with the lowest correlations are 1991 to 1994—but with no trend. Thus, plant-specific wages do

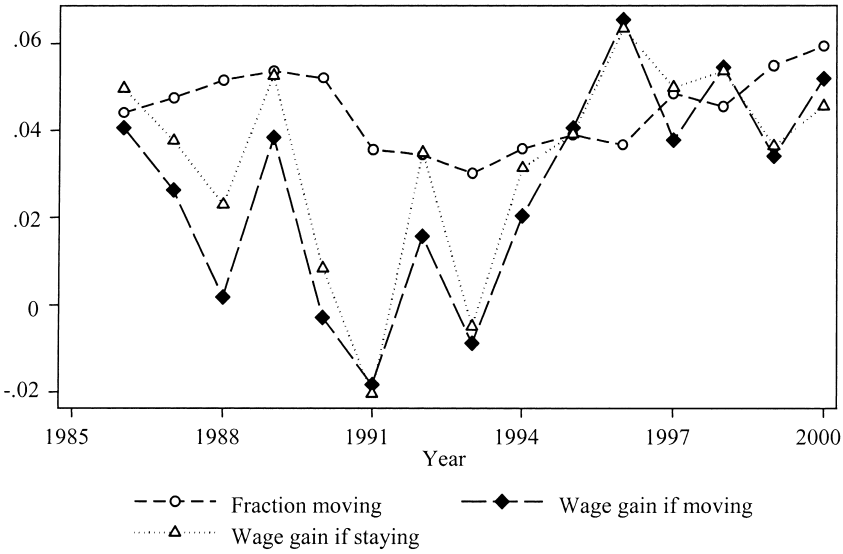


**Fig. 7.14 Mobility and wage gains**

*Notes:* Data include only workers in plants with 25+ employees in year $t$ and $t-1$. "Fraction moving" is fraction of included workers that changed plant between $t$ and $t-1$.

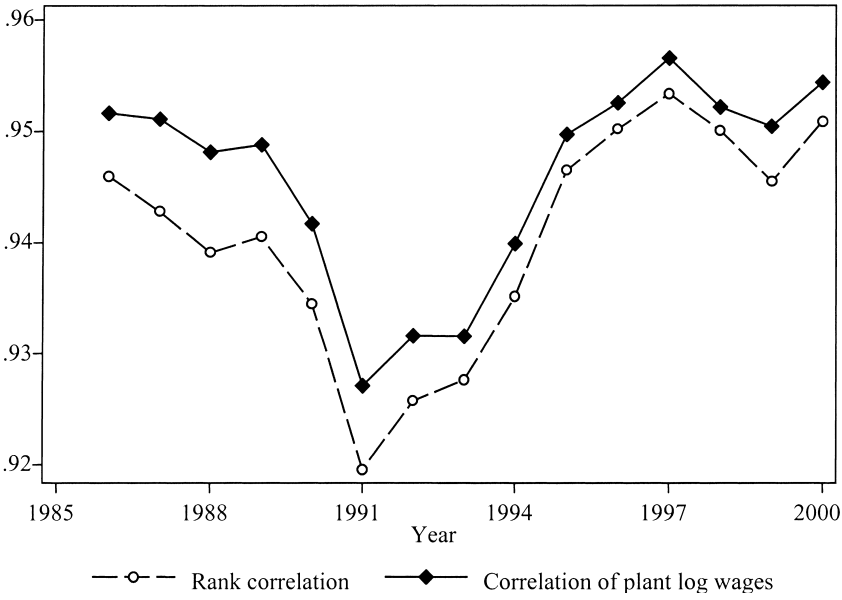


**Fig. 7.15 Year-to-year correlations of plant log wages**

not *fluctuate* more in 2000 than they did in 1985, even though wages are more dispersed in the cross section.

A main drawback of our data is the lack of information on productivity at the plant level. It is not possible, therefore, to examine how plant wages respond to changes in value productivity. However, because our results show that wages do not fluctuate more, but are more dispersed in the cross-section, it is suggested that either wages do not follow productivity more closely now (on a year-by-year basis at least), *or* wages follow productivity more, but the time variability in productivity has been reduced.

## 7.6 Discussion

We have documented a continuous increase in between-plant wage inequality since the mid-1980s. This increase holds in the raw data but also after controls for observable human capital attributes. It holds within industries as well as between plants in different industries. It is also interesting to note that the development is visible in all parts of the (observed) skill distribution except for the most highly skilled workers.

How can this development be explained? One possibility is increased sorting of workers by skill. Other possibilities revolve around rent sharing and what we have referred to as true plant effects. Suppose that wage negotiations have gradually become more decentralized, with increased bargaining power for local unions. This could cause an increase in wage dispersion as wages adjust to plant-level productivity, recognizing that plant productivity levels typically are much more dispersed than wages. Another twist on the rent-sharing theme is that the dispersion of plant productivity has increased, something that would translate into more wage dispersion to the extent that there is some scope for rent sharing at the plant level. We discuss these possibilities in turn.

### 7.6.1 Sorting by Skill

The segregation by skill theory of Kremer and Maskin (1996) is concerned with the idea that a rise in the overall (mean) skill levels may be accompanied by a rise in wage inequality as well as a rise in segregation across plants of workers of different skills. Key assumptions are that workers of different skills are imperfect substitutes, different tasks within a plant are complementary, and different tasks differ in their sensitivity to skill. The distribution of worker skills is exogenous, and the competitive economy operates under constant returns. The equilibrium wage distribution depends on skill distribution, but also on how workers of different skills are matched with one another. The model predicts that a rise in the dispersion of the skill distribution will cause increased segregation of workers. Moreover, a rise in the mean of the skill distribution increases wage inequality across plants when the skill distribution is sufficiently dispersed.

Kremer and Maskin (1996) provide empirical evidence that suggests that segregation by skill has become increasingly prevalent in the United States, the United Kingdom, and France over the 1980s and the 1990s. There is, furthermore, some evidence from data on U.S. states that segregation by skill is amplified by increased variance of skills, consistent with the theory.

The level of education has increased substantially in Sweden in recent decades. Between 1970 and 2000, the fraction of the population with upper-secondary education increased from 30 to 50 percent, and the fraction with tertiary education from 7 to 30 percent (Björklund et al. 2005). Has there also been an increase in the dispersion of education? If so, the Kremer and Maskin (1996) theory would predict increased segregation by skill, consistent with what we observe in the Swedish data.

We have transformed our data on education levels into years of schooling and computed the variance of schooling using all individuals in the data. The results are displayed in figure 7.16 and reveal a marked increase in the variance of schooling from the early 1990s and onward (but a slight decline in the late 1980s). Although this pattern is broadly consistent with the Kremer and Maskin (1996) theory, the exercise certainly does not demonstrate a causal relationship between the dispersion of education and segregation of workers by observed and unobserved skill, or between the

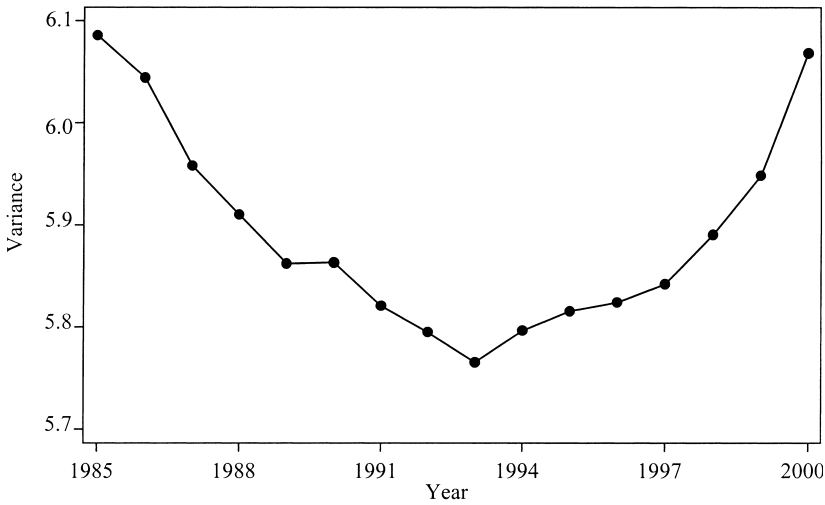


**Fig. 7.16 Variance in years of schooling**

*Notes:* Years of schooling calculated as less than compulsory, eight years; compulsory, nine years; two-year high school, eleven years; three-year high school, twelve years; some university, thirteen years; university, fifteen years; graduate studies, nineteen years. Data is for the entire Swedish population aged sixteen to sixty-five each year.

dispersion of skills and between-plant wage inequality. At the very least, the results suggest that future work on the sources of increased wage inequality in Sweden should explore how changes in the level and dispersion of schooling have affected employers' incentives to match workers of different skills in the same plants.

### 7.6.2 Decentralization of Wage Bargaining

In a standard bargaining framework, the bargained wage is determined by "inside" and "outside" factors. The former include measures of the plant's ability to pay, the latter overall labor market conditions. Imagine a plant-level wage negotiation between an employer and a local union. The stronger the local union is, the more responsive would the bargained wage be with respect to the plant's ability to pay. The power of the local union will be constrained not only by a strong bargaining position of the employer but also by a central union that is able to strike wage agreements at the national or industry level. The more centralized the wage bargaining system, the weaker the links between plant-specific productivity factors and wage agreements at the local level. And, conversely, the less centralized the bargaining system, the more scope for local rent sharing.

A number of studies have examined this hypothesis using data on plants or industries.[15] By and large, most studies find that rent sharing has been of limited importance in Sweden. There is so far little hard evidence that increasingly decentralized wage negotiations have changed this pattern. Forslund and Lindh (2004) used plant data for Swedish mining and manufacturing and looked at the cross-sectional relationship between plant wages and plant productivity, measured as the nominal value added per employee. In regressions for each year for the period 1970 to 1996, they related log wages to log productivity. The estimated coefficient on productivity was closely centered on 0.05. The mean of the estimates was 0.055 for the period 1970 to 1982 and 0.051 for the period 1983 to 1996. The authors report that panel data regressions produce similar estimates. There is no indication in this study that wages have become more responsive to plant-level productivity despite the fact that wage negotiations arguably have become more decentralized since the mid-1980s. Unfortunately, because our data do not include any plant-level productivity measures, it is not possible to shed new light on this hypothesis.

### 7.6.3 Product Markets and Ability to Pay

An increase in the productivity dispersion across plants may cause an increase in between-plant wage inequality as long as there is some scope for local rent sharing. The recent paper by Dunne et al. (2004) brings new ev-

15. Holmlund and Zetterberg (1991) exploit industry data, whereas firm data are used by Arai (2003), Forslund (1994), and Forslund and Lindh (2004).

idence on this issue in a study of wage and productivity dispersion in U.S. manufacturing. The study exploits establishment data over the 1975 to 1992 period and finds that almost all of the increase in hourly wage dispersion is accounted for by an increase in the between-plant component. Interestingly, the study also documents an increase in the between-plant distribution of productivity over the same period. Moreover, wages and productivity at the plant level are strongly positively correlated, both in levels and changes. The paper also finds that an important source of the rise in wage and productivity dispersion between plants is accounted for by changes in the distribution of computer investment across plants.

Data on the evolution of the productivity dispersion across Swedish plants are rare. Some information is offered by Forslund and Lindh (2004), who computed a productivity measure (the standard deviation of log value productivity) for mining and manufacturing. Interestingly, there is a trend rise in productivity dispersion, especially from the early 1980s and onward. To the extent that this development holds for the private sector as a whole, it may help explain the rise in between-plant wage inequality.

## 7.7 Concluding Remarks

This chapter has provided new evidence on the evolution of wage dispersion in Sweden, with particular focus on dispersion within and between plants. We use linked employer-employee data and find a striking trend increase in between-plant wage inequality since the mid-1980s. Interestingly, this trend in between-plant variance makes up the entire increase in wage dispersion over the period.

The increase in wage dispersion between plants is not only present in the raw data, but also when we control for workers' human capital characteristics. Thus, sorting by observed characteristics can only explain part of the increase. We find that the basic pattern holds within industries as well as between plants in different industries. Also, increasing between-plant wage dispersion has been substantial throughout the individual wage distribution, except for individuals at the top of the distribution. Overall, our results suggest that the growing difference between plants is driven by increased differences between plants in the wages they pay, rather than by changes in the composition of plants in the economy.

It lies close at hand to suspect that a gradual evolution toward more decentralized wage-bargaining practices is a factor of importance. Our data are, however, not rich enough to test alternative hypotheses concerning the mechanisms behind the rise in wage inequality between plants. It is premature, therefore, to identify the causes of the rise in between-plant wage inequality. To make progress on this front, we need more information on plant characteristics and, in particular, measures of (value) productivity at the plant level.

# Appendix A

## *Mobility of High- and Low-Level Jobs*

**Table 7A.1** **Mobility: High-level jobs**

| | All plants | | | | Plants with 100+ employees | | | |
|---|---|---|---|---|---|---|---|---|
| | 1986 | 1990 | 1995 | 2000 | 1986 | 1990 | 1995 | 2000 |
| No. of plants | 6783 | 8025 | 7137 | 8475 | 1338 | 1560 | 1418 | 1640 |
| Employees | 100.6 | 98.4 | 101.7 | 99.1 | 311.6 | 303.8 | 315.4 | 302.6 |
| | (236.1) | (226.1) | (224.5) | (213.2) | (474.7) | (456.8) | (441.5) | (425.5) |
| Employment growth | 0.016 | 0.029 | 0.057 | 0.062 | 0.002 | –0.005 | 0.051 | 0.040 |
| | (0.243) | (0.247) | (0.230) | (0.327) | (0.171) | (0.160) | (0.193) | (0.249) |
| Exit rate, observ = person | 0.136 | 0.149 | 0.136 | 0.182 | 0.133 | 0.153 | 0.131 | 0.197 |
| Exit rate | 0.141 | 0.158 | 0.144 | 0.190 | 0.125 | 0.152 | 0.130 | 0.191 |
| | (0.202) | (0.210) | (0.206) | (0.237) | (0.140) | (0.150) | (0.139) | (0.179) |
| Top quartile of firm wages | 0.167 | 0.183 | 0.179 | 0.220 | 0.161 | 0.190 | 0.182 | 0.239 |
| | (0.285) | (0.293) | (0.293) | (0.320) | (0.201) | (0.213) | (0.213) | (0.259) |
| Bottom quartile of firm wages | 0.128 | 0.147 | 0.128 | 0.177 | 0.113 | 0.128 | 0.105 | 0.159 |
| | (0.249) | (0.266) | (0.252) | (0.282) | (0.185) | (0.188) | (0.184) | (0.217) |
| Top decile of firm wages | 0.186 | 0.204 | 0.208 | 0.239 | 0.188 | 0.229 | 0.236 | 0.279 |
| | (0.339) | (0.352) | (0.353) | (0.375) | (0.263) | (0.288) | (0.291) | (0.333) |
| Bottom decile of firm wages | 0.141 | 0.156 | 0.122 | 0.192 | 0.115 | 0.130 | 0.095 | 0.170 |
| | (0.289) | (0.301) | (0.267) | (0.323) | (0.233) | (0.233) | (0.196) | (0.269) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Entry rate | 0.116 | 0.129 | 0.128 | 0.169 | 0.107 | 0.114 | 0.118 | 0.167 |
| | (0.183) | (0.191) | (0.197) | (0.227) | (0.133) | (0.136) | (0.138) | (0.181) |
| Top quartile of firm wages | 0.130 | 0.147 | 0.146 | 0.181 | 0.126 | 0.148 | 0.151 | 0.191 |
| | (0.253) | (0.268) | (0.271) | (0.300) | (0.182) | (0.202) | (0.208) | (0.243) |
| Bottom quartile of firm wages | 0.117 | 0.125 | 0.122 | 0.179 | 0.102 | 0.096 | 0.105 | 0.149 |
| | (0.241) | (0.244) | (0.242) | (0.289) | (0.182) | (0.163) | (0.182) | (0.221) |
| Top decile of firm wages | 0.144 | 0.160 | 0.159 | 0.194 | 0.152 | 0.171 | 0.180 | 0.222 |
| | (0.304) | (0.320) | (0.321) | (0.347) | (0.243) | (0.260) | (0.273) | (0.311) |
| Bottom decile of firm wages | 0.128 | 0.141 | 0.139 | 0.200 | 0.094 | 0.095 | 0.111 | 0.154 |
| | (0.279) | (0.289) | (0.285) | (0.330) | (0.201) | (0.201) | (0.209) | (0.254) |
| % of workers with 5+ years of tenure | | 0.452 | 0.485 | 0.447 | | 0.472 | 0.529 | 0.468 |
| | | (0.344) | (0.355) | (0.347) | | (0.310) | (0.308) | (0.299) |
| Correlation (exit rate, average wage), | 0.105 | 0.106 | 0.134 | 0.158 | 0.174 | 0.117 | 0.196 | 0.193 |
| Correlation (exit rate, average wage change) | 0.045 | 0.047 | 0.072 | 0.131 | 0.074 | 0.084 | 0.121 | 0.141 |
| Correlation (exit rate, SD of wage) | 0.072 | 0.109 | 0.120 | 0.161 | 0.096 | 0.074 | 0.146 | 0.117 |
| Correlation (entry rate, average wage) | 0.103 | 0.129 | 0.150 | 0.165 | 0.088 | 0.165 | 0.229 | 0.182 |
| Correlation (entry rate, average wage change) | 0.027 | 0.044 | 0.056 | 0.090 | 0.084 | 0.085 | 0.069 | 0.083 |
| Correlation (entry rate, SD of wage) | 0.087 | 0.128 | 0.117 | 0.129 | 0.037 | 0.141 | 0.118 | 0.122 |

*Notes:* High-level jobs are jobs with wages above the 80th percentile of the sample wage distribution. All statistics are at the plant level with one plant as one observation except as otherwise noted. Tables for all jobs can be found in the text. Correlations are with average log wages in plants, average log wage changes for workers remaining in the plant, and standard deviation (SD) of log wages within plants. Numbers in parentheses are standard deviations.

**Table 7A.2** **Mobility: Low-level jobs**

| | All plants | | | | Plants with 100+ employees | | | |
|---|---|---|---|---|---|---|---|---|
| | 1986 | 1990 | 1995 | 2000 | 1986 | 1990 | 1995 | 2000 |
| No. of plants | 6964 | 8195 | 7415 | 8868 | 1340 | 1565 | 1420 | 1650 |
| Employees | 99.1 | 97.2 | 99.4 | 96.4 | 311.6 | 303.2 | 315.3 | 301.6 |
| | (233.3) | (223.9) | (220.6) | (208.8) | (474.4) | (456.1) | (441.2) | (424.4) |
| Employment growth | 0.016 | 0.028 | 0.057 | 0.060 | 0.001 | –0.006 | 0.051 | 0.040 |
| | (0.242) | (0.246) | (0.228) | (0.320) | (0.172) | (0.160) | (0.193) | (0.249) |
| Exit rate, observ = person | 0.394 | 0.395 | 0.270 | 0.346 | 0.376 | 0.387 | 0.246 | 0.319 |
| Exit rate | 0.387 | 0.382 | 0.286 | 0.345 | 0.369 | 0.377 | 0.258 | 0.321 |
| | (0.212) | (0.216) | (0.219) | (0.233) | (0.135) | (0.138) | (0.146) | (0.160) |
| Top quartile of firm wages | 0.303 | 0.318 | 0.217 | 0.276 | 0.257 | 0.290 | 0.168 | 0.230 |
| | (0.314) | (0.316) | (0.296) | (0.318) | (0.189) | (0.191) | (0.181) | (0.207) |
| Bottom quartile of firm wages | 0.521 | 0.485 | 0.393 | 0.456 | 0.525 | 0.496 | 0.385 | 0.460 |
| | (0.353) | (0.352) | (0.349) | (0.352) | (0.209) | (0.214) | (0.231) | (0.245) |
| Top decile of firm wages | 0.291 | 0.306 | 0.208 | 0.272 | 0.249 | 0.274 | 0.159 | 0.226 |
| | (0.385) | (0.387) | (0.352) | (0.380) | (0.247) | (0.255) | (0.224) | (0.267) |
| Bottom decile of firm wages | 0.579 | 0.537 | 0.443 | 0.517 | 0.584 | 0.545 | 0.451 | 0.518 |
| | (0.409) | (0.413) | (0.411) | (0.415) | (0.312) | (0.313) | (0.320) | (0.321) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Entry rate | 0.428 | 0.463 | 0.417 | 0.463 | 0.393 | 0.414 | 0.378 | 0.424 |
| | (0.239) | (0.239) | (0.256) | (0.264) | (0.167) | (0.162) | (0.181) | (0.201) |
| Top quartile of firm wages | 0.333 | 0.375 | 0.320 | 0.361 | 0.280 | 0.319 | 0.273 | 0.309 |
| | (0.336) | (0.345) | (0.347) | (0.359) | (0.210) | (0.216) | (0.237) | (0.262) |
| Bottom quartile of firm wages | 0.544 | 0.568 | 0.541 | 0.583 | 0.510 | 0.515 | 0.500 | 0.538 |
| | (0.357) | (0.355) | (0.358) | (0.356) | (0.234) | (0.230) | (0.238) | (0.263) |
| Top decile of firm wages | 0.318 | 0.364 | 0.305 | 0.347 | 0.262 | 0.300 | 0.259 | 0.285 |
| | (0.400) | (0.414) | (0.402) | (0.417) | (0.264) | (0.276) | (0.282) | (0.306) |
| Bottom decile of firm wages | 0.570 | 0.604 | 0.585 | 0.618 | 0.523 | 0.538 | 0.546 | 0.567 |
| | (0.413) | (0.407) | (0.409) | (0.405) | (0.328) | (0.323) | (0.322) | (0.332) |
| % of workers with 5+ years of tenure | | 0.137 | 0.235 | 0.203 | | 0.170 | 0.278 | 0.262 |
| | | (0.169) | (0.232) | (0.222) | | (0.147) | (0.196) | (0.210) |
| Correlation (exit rate, average wage), | –0.175 | –0.139 | –0.186 | –0.217 | –0.123 | –0.069 | –0.229 | –0.249 |
| Correlation (exit rate, average wage change) | –0.015 | –0.048 | –0.024 | –0.020 | –0.044 | –0.084 | –0.014 | –0.073 |
| Correlation (exit rate, SD of wage) | 0.044 | 0.053 | 0.076 | 0.099 | 0.061 | –0.014 | 0.064 | 0.162 |
| Correlation (entry rate, average wage), | –0.153 | –0.116 | –0.122 | –0.148 | –0.177 | –0.058 | –0.069 | –0.168 |
| Correlation (entry rate, average wage change) | 0.110 | 0.083 | 0.132 | 0.130 | 0.225 | 0.215 | 0.252 | 0.139 |
| Correlation (entry rate, SD of wage) | 0.045 | 0.033 | 0.055 | 0.079 | –0.015 | –0.002 | –0.053 | 0.021 |

*Notes:* Low-level jobs are jobs with wages below the 20th percentile of the sample wage distribution. All statistics are at the plant level with one plant as one observation except as otherwise noted. Tables for all jobs can be found in the text. Correlations are with average log wages in plants, average log wage changes for workers remaining in the plant, and standard deviation (SD) of log ages within plants. Numbers in parentheses are standard deviations.

# Appendix B

## *Mincer Equation Estimates*

**Table 7B.1 OLS Mincer equation results for corporate sector workers in 25+ sized plants**

| | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2-year high school | 0.052 | 0.056 | 0.057 | 0.057 | 0.059 | 0.064 | 0.072 | 0.062 | 0.064 | 0.062 | 0.059 | 0.060 | 0.058 | 0.053 | 0.052 | 0.048 |
| 3-year high school | 0.159 | 0.163 | 0.164 | 0.158 | 0.160 | 0.166 | 0.173 | 0.161 | 0.165 | 0.163 | 0.154 | 0.159 | 0.157 | 0.156 | 0.161 | 0.161 |
| Some univ. | 0.210 | 0.216 | 0.222 | 0.223 | 0.225 | 0.233 | 0.241 | 0.230 | 0.235 | 0.235 | 0.232 | 0.246 | 0.252 | 0.257 | 0.271 | 0.277 |
| 3-year univ. | 0.403 | 0.421 | 0.425 | 0.430 | 0.421 | 0.429 | 0.441 | 0.431 | 0.429 | 0.435 | 0.427 | 0.437 | 0.438 | 0.441 | 0.452 | 0.458 |
| Post grad. | 0.561 | 0.578 | 0.578 | 0.598 | 0.582 | 0.588 | 0.592 | 0.584 | 0.576 | 0.556 | 0.565 | 0.552 | 0.549 | 0.552 | 0.565 | 0.617 |
| Age | 0.041 | 0.040 | 0.041 | 0.042 | 0.041 | 0.041 | 0.039 | 0.033 | 0.035 | 0.040 | 0.040 | 0.041 | 0.043 | 0.044 | 0.044 | 0.044 |
| Age$^2$ · 100 | –0.041 | –0.040 | –0.041 | –0.042 | –0.041 | –0.041 | –0.038 | –0.032 | –0.034 | –0.039 | –0.040 | –0.040 | –0.042 | –0.044 | –0.044 | –0.044 |
| Female | –0.206 | –0.192 | –0.201 | –0.216 | –0.211 | –0.213 | –0.215 | –0.206 | –0.214 | –0.219 | –0.219 | –0.215 | –0.211 | –0.207 | –0.199 | –0.197 |
| Immigrant | –0.051 | –0.056 | –0.062 | –0.070 | –0.076 | –0.082 | –0.073 | –0.058 | –0.057 | –0.058 | –0.061 | –0.064 | –0.069 | –0.074 | –0.090 | –0.097 |
| Constant | 8.158 | 8.238 | 8.287 | 8.323 | 8.439 | 8.526 | 8.640 | 8.810 | 8.801 | 8.735 | 8.769 | 8.809 | 8.804 | 8.815 | 8.825 | 8.865 |
| $R^2$ | 0.4 | 0.41 | 0.4 | 0.39 | 0.39 | 0.38 | 0.37 | 0.36 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.34 | 0.33 | 0.33 |

*Notes:* All estimates are significant at the 1 percent significance level (all standard errors are 0.003 or less). Reference for education is "less than high school."

**Table 7B.2** **Plant-fixed effects Mincer equation results for corporate sector workers in 25+ sized plants**

| | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2-year high school | 0.042 | 0.045 | 0.045 | 0.045 | 0.047 | 0.050 | 0.053 | 0.049 | 0.049 | 0.048 | 0.046 | 0.048 | 0.046 | 0.042 | 0.039 | 0.036 |
| 3-year high school | 0.122 | 0.125 | 0.124 | 0.119 | 0.121 | 0.123 | 0.126 | 0.119 | 0.119 | 0.117 | 0.110 | 0.115 | 0.113 | 0.112 | 0.112 | 0.111 |
| Some univ. | 0.154 | 0.160 | 0.163 | 0.165 | 0.167 | 0.172 | 0.176 | 0.168 | 0.169 | 0.169 | 0.164 | 0.172 | 0.176 | 0.177 | 0.182 | 0.184 |
| 3-year univ. | 0.326 | 0.343 | 0.342 | 0.347 | 0.338 | 0.339 | 0.347 | 0.339 | 0.335 | 0.340 | 0.329 | 0.334 | 0.331 | 0.328 | 0.325 | 0.321 |
| Post grad. | 0.490 | 0.507 | 0.503 | 0.523 | 0.505 | 0.507 | 0.513 | 0.508 | 0.500 | 0.505 | 0.489 | 0.493 | 0.485 | 0.482 | 0.483 | 0.490 |
| Age | 0.038 | 0.037 | 0.038 | 0.039 | 0.038 | 0.038 | 0.035 | 0.031 | 0.032 | 0.036 | 0.037 | 0.037 | 0.040 | 0.041 | 0.040 | 0.040 |
| Age$^2$ · 100 | –0.038 | –0.037 | –0.037 | –0.038 | –0.037 | –0.037 | –0.034 | –0.029 | –0.030 | –0.034 | –0.036 | –0.036 | –0.039 | –0.040 | –0.039 | –0.039 |
| Female | –0.216 | –0.205 | –0.214 | –0.224 | –0.218 | –0.220 | –0.221 | –0.211 | –0.219 | –0.219 | –0.215 | –0.210 | –0.207 | –0.203 | –0.197 | –0.194 |
| Immigrant | –0.056 | –0.059 | –0.064 | –0.070 | –0.077 | –0.078 | –0.068 | –0.056 | –0.052 | –0.052 | –0.055 | –0.057 | –0.059 | –0.064 | –0.068 | –0.073 |
| Constant | 8.222 | 8.311 | 8.366 | 8.400 | 8.517 | 8.623 | 8.732 | 8.888 | 8.903 | 8.845 | 8.866 | 8.911 | 8.897 | 8.907 | 8.946 | 8.986 |
| No. of Plants | 8381 | 8680 | 9226 | 10109 | 10243 | 10552 | 10296 | 9431 | 9191 | 9816 | 10501 | 10720 | 10997 | 11575 | 12138 | 12820 |
| Within $R^2$ | 0.36 | 0.37 | 0.36 | 0.35 | 0.35 | 0.34 | 0.33 | 0.32 | 0.31 | 0.3 | 0.3 | 0.3 | 0.29 | 0.28 | 0.27 | 0.26 |
| Between $R^2$ | 0.505 | 0.523 | 0.508 | 0.518 | 0.513 | 0.536 | 0.500 | 0.502 | 0.514 | 0.523 | 0.524 | 0.522 | 0.511 | 0.490 | 0.491 | 0.469 |
| Variance-share of plant effect ($u$) | 0.184 | 0.189 | 0.191 | 0.188 | 0.183 | 0.193 | 0.217 | 0.225 | 0.229 | 0.229 | 0.239 | 0.248 | 0.253 | 0.258 | 0.272 | 0.283 |
| Corr ($Xb$, $u$) | 0.121 | 0.124 | 0.124 | 0.126 | 0.135 | 0.147 | 0.143 | 0.149 | 0.156 | 0.165 | 0.174 | 0.177 | 0.176 | 0.170 | 0.190 | 0.196 |

*Notes:* All estimates are significant at the 1 percent significance level (all standard errors are 0.005 or less). Reference for education is "less than high school." Estimated model is $\ln W = Xb + \theta + \epsilon$, where $\theta$ is the fixed-plant effect and $e$ is an error term. Between $R^2$ are based on squared correlations of actual and predicted plant averages (predictions are based on plant average $X$ and within-estimated parameters).

# Appendix C

## *Additional Tables*

**Table 7C.1 Means and standard deviations of wages and wage changes**

| | Log wages | | | | Log wage change | | | |
|---|---|---|---|---|---|---|---|---|
| | 1986 | 1990 | 1995 | 2000 | 1986 | 1990 | 1995 | 2000 |
| | *Plants by wage decile* | | | | *Plants by wage change decile* | | | |
| >90 percentile plants | | | | | | | | |
| Mean wage (or change) | 9.690 | 9.753 | 9.845 | 10.068 | 0.128 | 0.092 | 0.137 | 0.156 |
| Average within plants SD | 0.343 | 0.345 | 0.338 | 0.348 | 0.133 | 0.150 | 0.146 | 0.168 |
| 45th to 55th percentile plants | | | | | | | | |
| Mean wage (or change) | 9.376 | 9.440 | 9.505 | 9.666 | 0.051 | 0.006 | 0.036 | 0.046 |
| Average within plant SD | 0.255 | 0.270 | 0.263 | 0.264 | 0.111 | 0.128 | 0.116 | 0.121 |
| <10 percentile plants | | | | | | | | |
| Mean wage (or change) | 9.178 | 9.213 | 9.249 | 9.411 | –0.012 | –0.073 | –0.037 | –0.034 |
| Average within plant SD | 0.217 | 0.240 | 0.238 | 0.236 | 0.122 | 0.138 | 0.131 | 0.134 |
| | *Plants by distance to the plant with median wage* | | | | *Plants by distance to the plant with median wage change* | | | |
| Decile around 1 SD above median | | | | | | | | |
| Mean wage (or change) | 9.542 | 9.606 | 9.690 | 9.880 | 0.094 | 0.055 | 0.094 | 0.108 |
| Average within plant SD | 0.317 | 0.317 | 0.313 | 0.324 | 0.124 | 0.138 | 0.139 | 0.152 |
| Decile around 1 SD below median | | | | | | | | |
| Mean wage (or change) | 9.250 | 9.302 | 9.351 | 9.504 | 0.013 | –0.040 | –0.012 | –0.007 |
| Average within plant SD | 0.228 | 0.253 | 0.239 | 0.247 | 0.116 | 0.131 | 0.121 | 0.128 |
| No. of plants by decile | 704 | 831 | 753 | 906 | 704 | 831 | 753 | 906 |

*Notes:* All statistics are at the plant level with one plant as one observation and calculated for one decile in the distribution of plant wages (left-hand side) or in the distribution of wage changes (right-hand side). SD = standard deviation.

**Table 7C.2 Exit rates in plants with compressed and dispersed wages**

| | 1986 | 1990 | 1995 | 2000 |
|---|---|---|---|---|
| *Plants with compressed wages (90th/50th wage percentile ratio below average)* | | | | |
| Exit rate | 0.197 | 0.207 | 0.149 | 0.193 |
| | (0.123) | (0.121) | (0.114) | (0.132) |
| Exit rate in top within-plant decile | 0.127 | 0.142 | 0.123 | 0.158 |
| | (0.182) | (0.187) | (0.175) | (0.200) |
| Exit rate in bottom within-plant decile | 0.456 | 0.432 | 0.340 | 0.389 |
| | (0.272) | (0.269) | (0.267) | (0.273) |
| *Plants with dispersed wages (90th/50th wage percentile ratio above average)* | | | | |
| Exit rate | 0.209 | 0.228 | 0.174 | 0.238 |
| | (0.125) | (0.128) | (0.127) | (0.149) |
| Exit rate in top within-plant decile | 0.165 | 0.185 | 0.184 | 0.236 |
| | (0.204) | (0.215) | (0.220) | (0.245) |
| Exit rate in bottom within-plant decile | 0.452 | 0.431 | 0.341 | 0.406 |
| | (0.270) | (0.270) | (0.268) | (0.284) |

*Notes:* All statistics are at the plant level with one plant as one observation and calculated for one decile in the distribution of plant wages (first half) or in the distribution of wage changes (second half). Numbers in parentheses are standard deviations.

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