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WAGE DISPERSION BETWEEN AND WITHIN PLANTS: SWEDEN 1985-2000

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ABSTRACT

The paper describes the Swedish wage distribution and how it correlates with worker mobility and plant-specific factors. It is well known that wage inequality has increased in Sweden since the mid-1980s. However, little evidence has so far been available as to whether this development reflects increased dispersion between plants, between individuals in the same plant, or both. We use a new linked employer-employee data set and discover that a trend rise in between-plant wage inequality account for the entire increase in wage dispersion. This pattern, which remains when we control for observable individual human capital characteristics, may reflect increased sorting of workers by skill levels and/or increased scope for rent sharing in local wage negotiations. Our discussion suggests that both factors may have become more important.

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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 young 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 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, 2004).

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 paper 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 paper 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 wellknown 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 pro-cyclical; and smaller plants experience higher mobility.

The plan of the paper is as follows. We begin in section 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 analysis of wages and mobility later in the paper. Section 3 describes the data, section 4 provides snapshots of plant wages and mobility and section 5 portrays in some detail the evolution of the wage structure. Section 6 provides a discussion and section 7 concludes.

2 Background[1]

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 valid reason and the employer's assessment of whether there is lack of work can not be disputed in court. Layoffs have to be notified to workers several months ahead of their implementation and 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

[1] This section draws on various sources, in particular Holmlund (2006) and Holmlund and Storrie (2002).

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 labour 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 18 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 neither very stringent, not very liberal. The OECD-comparisons concerning ”employment flexibility” rank Sweden as number 18 among 26 countries. By this ranking Sweden would be less flexible than, for example, the Netherlands, Denmark and the United Kingdom, but more flexible than France and Germany (see OECD, 1999).

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 non-union workers. The trend decline of union density visible in many countries has been conspicuously absent in Sweden. 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 co-determination 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 et al, 2001).

Post-war 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 LO (the Swedish trade union confederation) and SAF (Swedish employers' federation). 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 towards 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 1991-93. 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 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 Industrial Agreement 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. 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 towards more informal coordination in wage bargaining. Perhaps paradoxically, the move towards informal macro-coordination in wage bargaining has taken place simultaneously with a clear shift towards 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.

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 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 working age population (see Table 1). The level of 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.

Table 1 Macroeconomic conditions.

Year	Unemployment[A]	Employment[B]	Economic growth[C]		
			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

Notes: [A]Share of labour force.[B]Share of working aged (16-64) population.[C] Change in real GDP. Numbers in bold refer to the years studied in section 4.

Why did Swedish unemployment rise so sharply in the early 1990s? It can 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 1990-91, 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 towards 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 onwards, 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 1990s was not sustainable. Over the 1990s, several reforms may have facilitated to 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.

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 pro-cyclical, 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 1968-1988, to be compared with an average annual layoff rate of only 2 percent.[2] 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 which have grown relentlessly during the 1990s. As shown in Figure 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. 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 2. Note, however, the declining share of fixed-term contracts in the late 1980s and the late 1990s, periods with falling unemployment.[3]

[2] 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).

[3] 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.

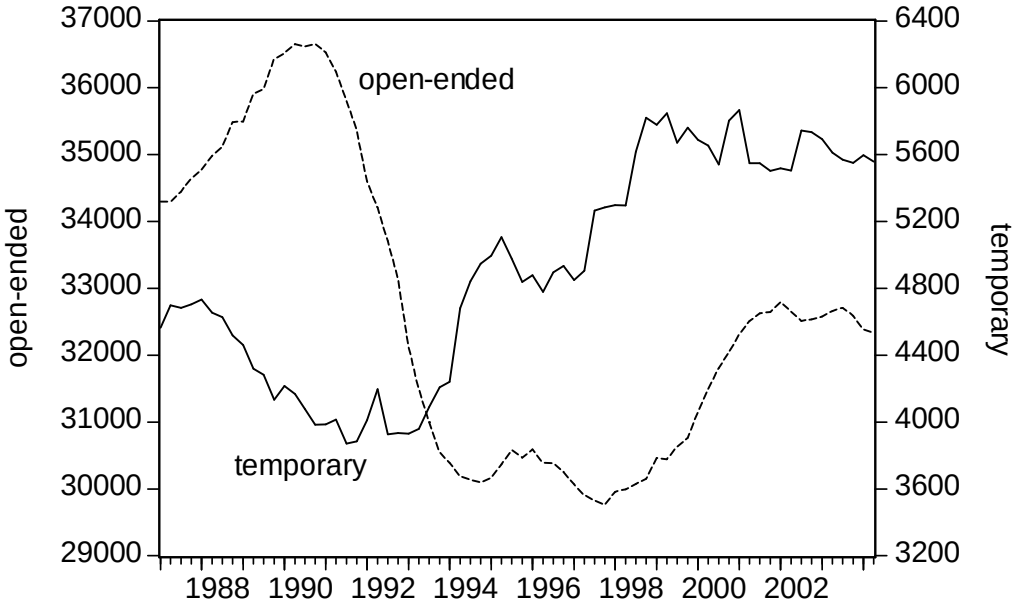

Figure 1 Wage and salary employment (100s) by type of contract, seasonally adjusted quarterly data 1987Q1 – 2004Q2. (*Source*: Labor force surveys, Statistics Sweden.)

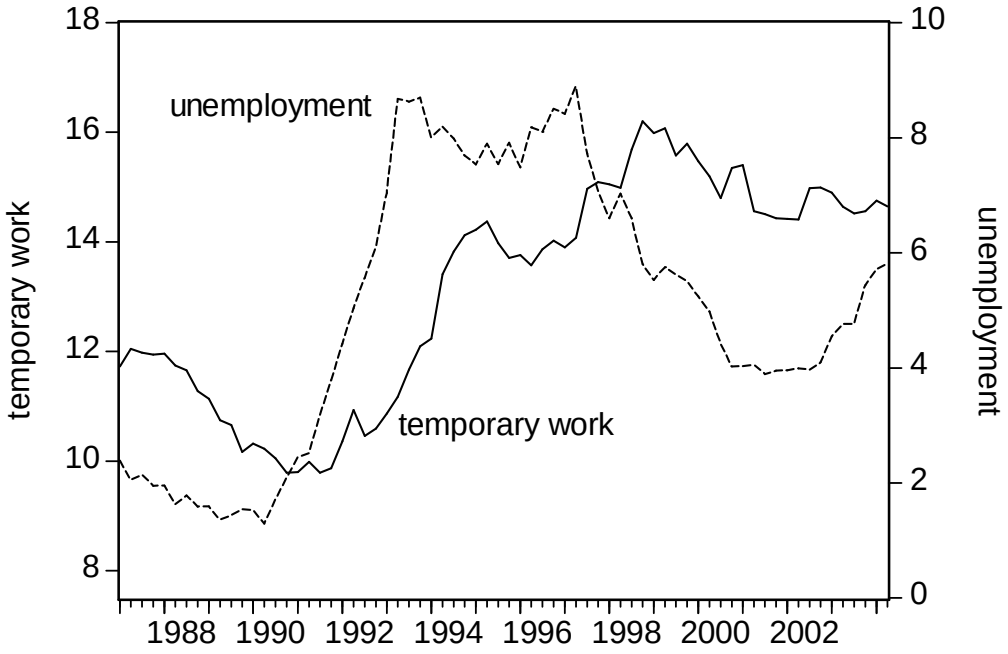

Figure 2 Temporary work (percent of total wage and salary employment) and unemployment (percent of the labor force), seasonally adjusted quarterly data 1987Q1 – 2004Q2. (*Source*: Labor force surveys, Statistics Sweden.)

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 16-24, 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 absent workers. Sweden has 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 4-5 percent of total wage and salary employment. The entire rise in temporary work is accounted for by other categories, viz. 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 part of firms to offer long-term contracts when workers are easier to find as well as an increased willingness on 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, i.e., 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 towards 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.[4]

[4] Houseman (2001) reports from a survey of US employers that flexible staffing arrangements are mainly used to accommodate fluctuations in workload or absences.

3 Data

In order to study wage dispersion, wage changes and mobility, we use a linked employer-employee data base containing information on all workers and plants in both the private and public sectors. From the data base 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 data base (RAMS) provided by Statistics Sweden. RAMS contains yearly plant-level data on all workers that were employed at a plant some time during each year, irrespectively of whether 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 is yearly and cover the period 1985-2000. The underlying population consists of all individuals aged 16-65 who resided in Sweden anytime between 1990 and 2000. This implies that the oldest workers as well as workers that emigrated or died before 1990 are missing during the first five years. Thus, in effect, we have an age restriction of 16-60 in 1985 and 16-64 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 November exceeds a minimum wage.[5] 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.

[5] 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 cut-offs are available upon request.

Table 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.

The dataset 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 CEO's, 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 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 in the focus of parts of the paper. 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 3 compares the constructed wage distribution to the "actual" wage distribution calculated from the 3 percent random sample in the LINDA-database (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.

Table 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
10^{th} percentile	9.453	9.585	-0.093	-0.022
Median	9.821	9.818	0.042	0.037
90^{th} 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 % of wages as well as the largest and smallest 0.5 % of log wage changes are excluded from the data.

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 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. Since 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 that change plants, we only include people that changed between plants with at least 25 employees in both years in order to get consistency with the definition used elsewhere in this analysis.

Table 4 Sector and size.

	Relative size of sector (# Employees)		
1985	All plants and employees	Employees in size 25+ plants only	Share of all employees in sector working in size 25+ plants
All corporate	0.63	0.62	0.59
Private corporate	*0.52*	*0.48*	0.55
Public and non-profit	0.37	0.38	0.63
2000			
All corporate	0.66	0.62	0.57
Private corporate	*0.60*	*0.54*	0.55
Public and non-profit	0.34	0.38	0.68

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

Our analysis is focused on the corporate sector, and in order to get a meaningful description of the wage dispersion within establishments we include only plants with at least 25 employees.[6] Table 4 displays the relative size of the corporate sector for the years 1985 and 2000.[7] 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 4 also shows the share of workers in each sector that worked in plants with at least 25 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 3 shows the log plant-size distribution for 2000. It is obvious that most 25+ sized plants have close to 25 employees, and as a consequence, a significant fraction of plants move around the 25 limit

[6] The main reason is to get comparability with other studies in the volume for which this text is intended.

[7] The sector definitions are based on SCB (2001) and SCB (2002) and comply with EU-standard classifications.

between years. However, as noted above, we will condition on plants having at least 25 employees in both years whenever we calculate changes.

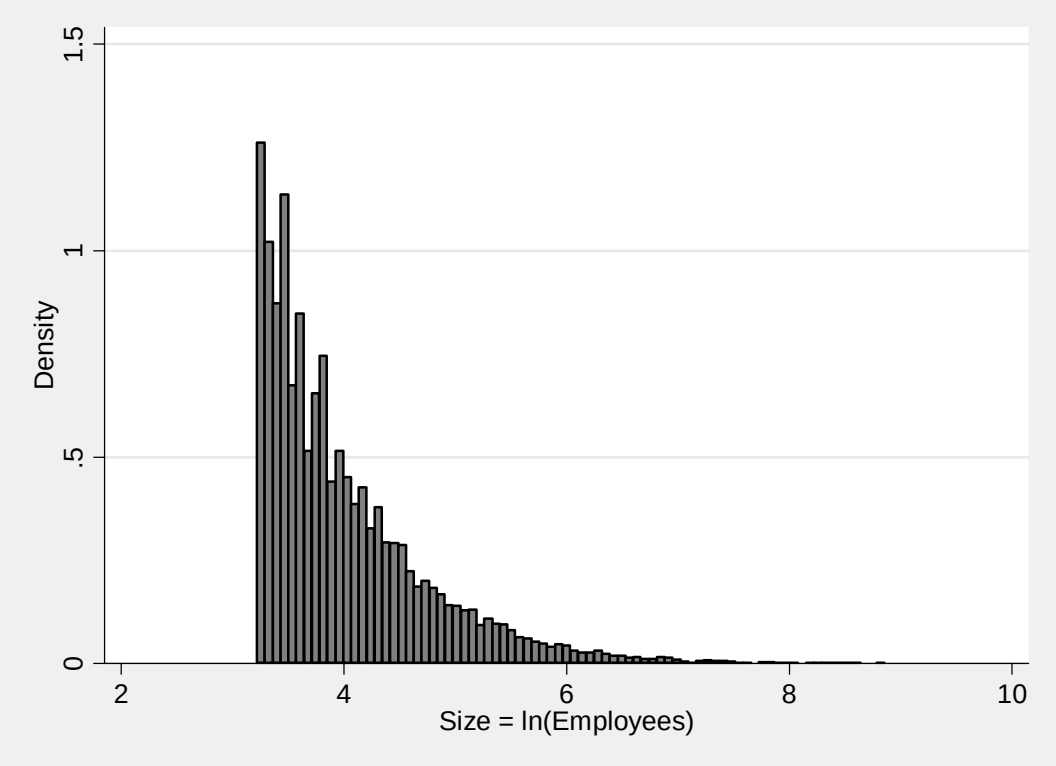

Figure 3 Plant size distribution for 2000 – corporate sector.

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 4).

Since 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.

4.1 Wage levels

Figure 4 shows the log real wage distribution for the four years (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 5, where the standard deviation of log wages increases from 0.307 to o.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.[8]

[8] See e.g. Le Grand et al (2000), Edin and Holmlund (1995) and Gustavsson (2006).

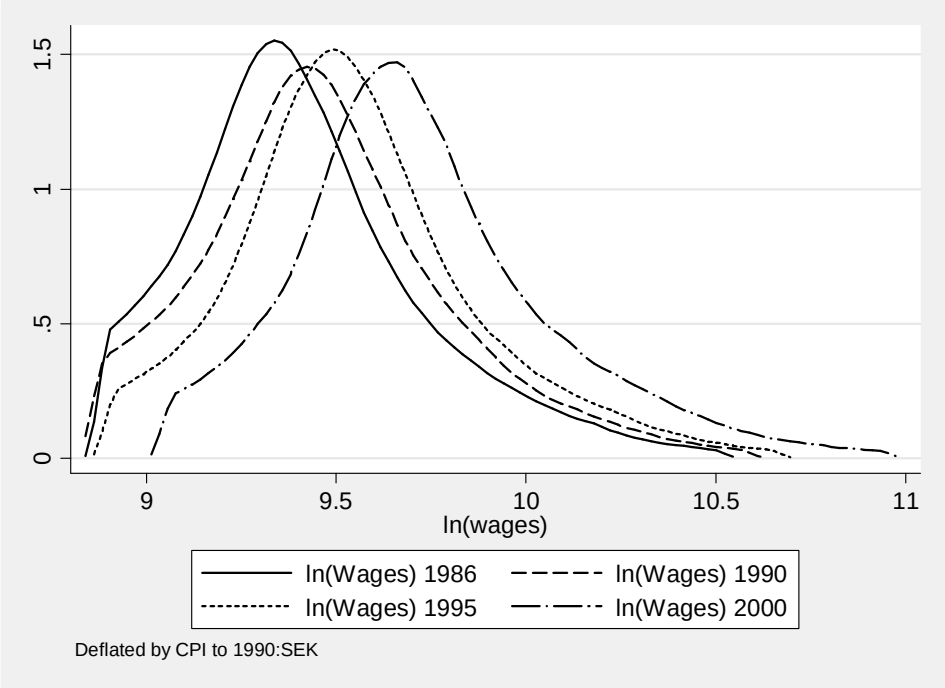

Figure 4 The distribution of log real wages.

The second panel of Table 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 the prime source of increased dispersion is between, rather than within, plants. We will return to this issue at length in section 5 of the paper.

The fifth panel of Table 5 reveals a positive correlation between the wage *level* in a plant and the wage *dispersion* within the plant. This result is probably, at least partly, driven by the skewness of the wage distribution (see Figure 4

above). The wage dispersion among high-paid people is larger even in relative terms.[9]

The last two panels of Table 5 show the evolution of wage dispersion for young (25-30) and old (45-50) 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 of young wages to the average log wages displayed in the top panel we see that youth wages appears to have remained relatively stable at approximately 90 percent of the average wage over the period.

[9] Some caution is warranted when comparing these numbers to other data sources since the used data are rather unique in including the earnings of all people receiving remuneration from each plant, including top CEO's. Note however that we, as explained in Section 3, excluded the top 0.5 percent of wages each year.

Table 5 Structure of wages within and between plants.

	Wages (1990-SEK)[1]				Log wages (1990-SEK)[1]			
	1986[2]	1990	1995	2000	1986	1990	1995	2000
1, Average Wage	12976	13797	14865	17843	9.420	9.477	9.553	9.727
(s.d.)	4572	4996	5346	7040	0.307	0.322	0.318	0.340
90%-ile	18832	20069	21606	26716	9.843	9.907	9.981	10.193
75%-ile	14544	15649	16711	20055	9.585	9.658	9.724	9.906
Median	11848	12696	13668	16070	9.380	9.449	9.523	9.685
25%-ile	9992	10525	11462	13437	9.210	9.262	9.347	9.506
10%-ile	8519	8728	9570	11208	9.050	9.074	9.166	9.324
[N – workers]	692870	800332	739378	860581	692870	800332	739378	860581
2, Plant average wage	12678	13490	14432	17245	9.396	9.455	9.521	9.692
(s.d.)	2088	2266	2679	3663	0.145	0.152	0.169	0.188
90%-ile	15699	16680	18143	22497	9.603	9.664	9.751	9.959
75%-ile	13664	14586	15855	19008	9.478	9.541	9.624	9.801
Median	12228	13076	13935	16397	9.376	9.440	9.505	9.665
25%-ile	11239	11953	12554	14698	9.297	9.353	9.407	9.561
10%-ile	10448	11003	11501	13413	9.227	9.272	9.318	9.472
[N – plants]	7047	8306	7526	9067	7047	8306	7526	9067
3, Plant s.d. of wages	3820	4168	4404	5484	0.266	0.279	0.273	0.279
(s.d.)	1387	1416	1626	2222	0.064	0.060	0.066	0.069
90%-ile	5830	6219	6678	8635	0.355	0.361	0.361	0.371
75%-ile	4702	5029	5459	6917	0.308	0.317	0.317	0.326
Median	3595	3924	4151	5047	0.260	0.274	0.267	0.272
25%-ile	2775	3119	3159	3794	0.220	0.238	0.226	0.228
10%-ile	2206	2546	2474	2936	0.186	0.207	0.192	0.195
[N – plants]	7047	8306	7526	9067	7047	8306	7526	9067
Plant CV of wages	0.296	0.305	0.300	0.312	0.028	0.030	0.029	0.029
(s.d.)	0.076	0.072	0.080	0.088	0.007	0.006	0.007	0.007
90%-ile	0.392	0.399	0.406	0.429	0.037	0.038	0.037	0.038
75%-ile	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%-ile	0.240	0.253	0.242	0.247	0.024	0.025	0.024	0.024
10%-ile	0.197	0.212	0.196	0.200	0.020	0.022	0.020	0.020
[N – plants]	7047	8306	7526	9067	7047	8306	7526	9067

Table 5 Structure of wages within and between plants (continued).

	Wages (1990-SEK)[1]				Log wages (1990-SEK)[1]			
	1986[2]	1990	1995	2000	1986	1990	1995	2000
4, Correlation(average wage, s.d. 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	11910	12716	13318	16258	9.358	9.419	9.467	9.657
(s.d.)	2950	3321	3456	4929	0.230	0.249	0.243	0.276
90%-ile	15521	16772	17305	22121	9.650	9.727	9.759	10.004
75%-ile	13293	14381	14994	18364	9.495	9.574	9.615	9.818
Median	11466	12335	12922	15469	9.347	9.420	9.467	9.647
25%-ile	9961	10508	11086	13073	9.206	9.260	9.313	9.478
10%-ile	8649	8861	9449	11009	9.065	9.089	9.154	9.306
[N – workers]	103277	125836	127035	138219	103277	125836	127035	138219
6, Wages for workers aged 45 - 50	14251	15453	16255	19169	9.508	9.585	9.638	9.795
(s.d.)	5236	5770	6002	7772	0.327	0.339	0.332	0.351
90%-ile	21462	23417	24497	29579	9.974	10.061	10.106	10.295
75%-ile	16254	17854	18562	21767	9.696	9.790	9.829	9.988
Median	12820	13974	14680	16948	9.459	9.545	9.594	9.738
25%-ile	10773	11600	12304	14193	9.285	9.359	9.418	9.561
10%-ile	9162	9690	10455	12108	9.123	9.179	9.255	9.402
[N – workers]	91500	120626	121496	116080	91500	120626	121496	116080

Note: Data only include employees of plants with 25+ employees in year *t* and *t*-1. [1]Deflation by CPI to 1990-SEK. [2]Data for 1986 do not include workers older than 62 or workers that emigrated or died before 1990.

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 25 employees in the private corporate sector) in two consecutive years. Figure 5 shows the distribution of wage changes for the four years. It can be noted that many workers experienced a real wage decline between 1989 and 1990.

Table 6 looks at wage changes. The top panel shows the mean and distribution of individual wage changes: the average real wage change was between four and five 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.

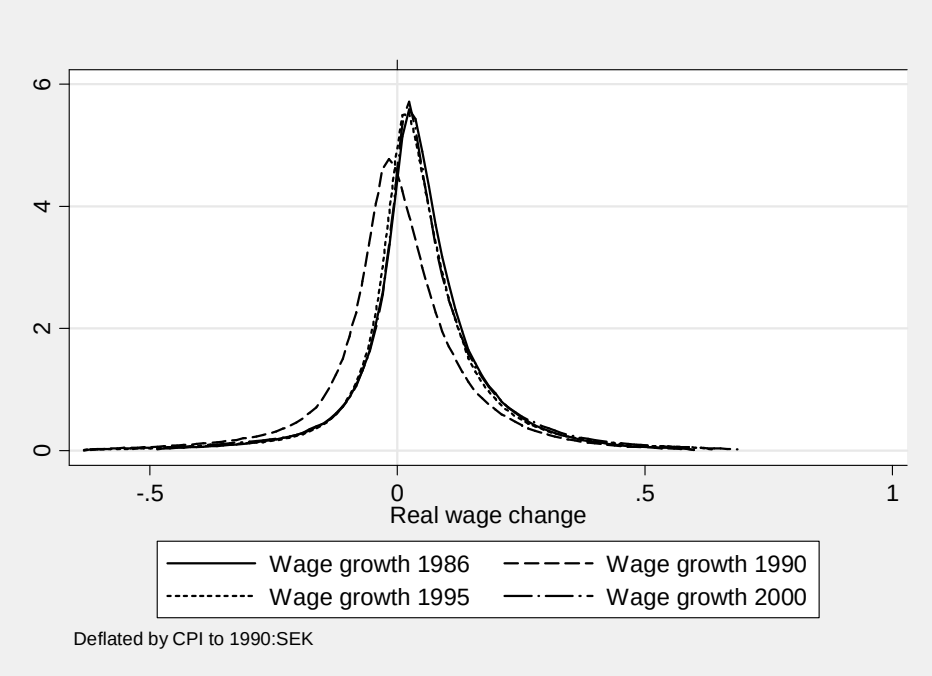

Figure 5. Distribution of log real wage changes.

Figure 6 and the second panel of Table 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 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.

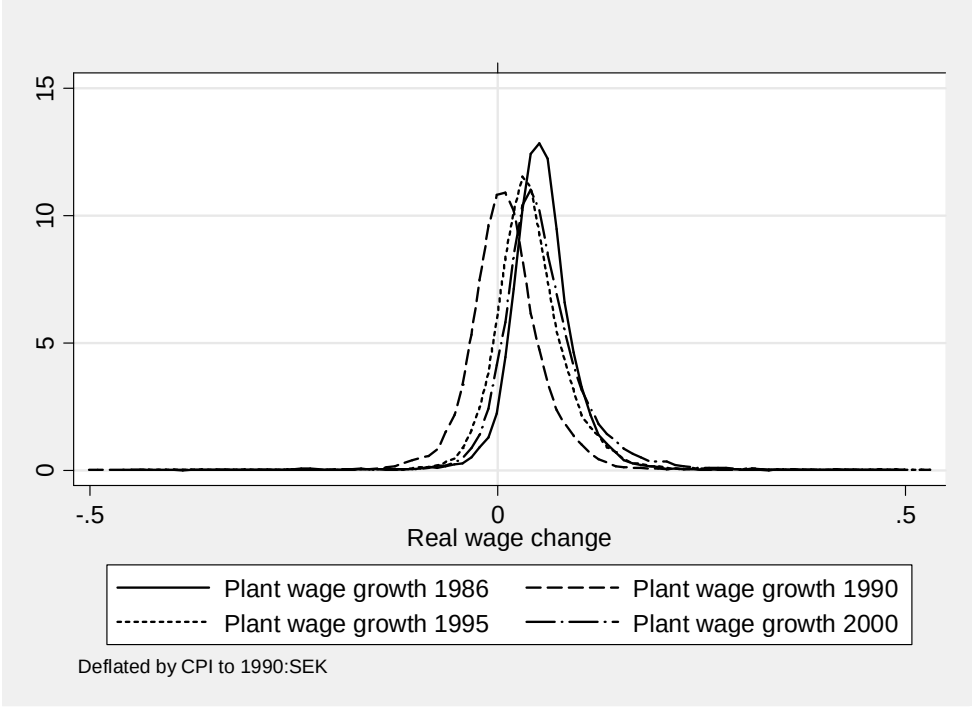

Figure 6 Distribution of plant average log wage changes for workers who remain in the same plant.

The bottom three panels of Table 6 show the distribution of wage changes separately for different tenure groups: (i) for those that changed plants (from one plant in the sample to another), (ii) for those with short (1-3 years) tenure, and (iii) for long tenured (> 3 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.

Table 6 Wage changes.

	Δ Wages (1990 SEK:s)[1]				Δ ln(Wages) (1990 SEK:s)[1]			
	1986[2]	1990	1995	2000	1986[2]	1990	1995	2000
1, Change in wages	610	46	638	898	0.048	0.004	0.045	0.048
(s.d.)	1559	1890	2018	2633	0.124	0.140	0.134	0.142
90%-ile	2356	2174	2803	3668	0.191	0.164	0.193	0.207
75%-ile	1283	922	1428	1826	0.103	0.068	0.098	0.105
Median	503	-27	476	626	0.040	-0.002	0.034	0.038
25%-ile	-108	-830	-195	-177	-0.009	-0.059	-0.014	-0.011
10%-ile	-956	-1920	-1160	-1434	-0.078	-0.139	-0.079	-0.085
[N – workers]	586057	665982	623679	704360	586057	665982	623679	704360
2, Plant wage change[3]	666	122	565	948	0.054	0.010	0.041	0.053
(s.d.)	541	680	799	1141	0.042	0.049	0.053	0.059
90%-ile	1255	860	1366	2088	0.099	0.063	0.094	0.114
75%-ile	914	440	878	1292	0.073	0.033	0.063	0.076
Median	617	90	484	763	0.052	0.008	0.037	0.047
25%-ile	368	-232	162	384	0.032	-0.016	0.014	0.024
10%-ile	138	-549	-148	30	0.013	-0.039	-0.008	0.001
[N – plants]	7037	8296	7521	9063	7037	8296	7521	9063
3, Within plant s.d.	1402	1713	1738	2197	0.113	0.128	0.120	0.126
(s.d.)	483	553	690	980	0.029	0.033	0.035	0.039
90%-ile	2008	2393	2614	3417	0.151	0.170	0.164	0.176
75%-ile	1627	1986	2059	2605	0.130	0.147	0.140	0.147
Median	1322	1632	1615	1975	0.111	0.127	0.117	0.122
25%-ile	1078	1346	1275	1553	0.093	0.107	0.096	0.100
10%-ile	890	1112	1000	1231	0.078	0.089	0.078	0.082
[N – plants]	7035	8294	7519	9054	7035	8294	7519	9054

Table 6 Wage changes (continued).

	Δ Wages (1990 SEK:s)[1]				Δ ln(Wages) (1990 SEK:s)[1]			
	1986[2]	1990	1995	2000	1986[2]	1990	1995	2000
4, Wage change if								
changed plant	524	-129	742	1069	0.037	-0.015	0.047	0.053
(s.d.)	2302	2671	3179	4026	0.174	0.194	0.197	0.213
90%-ile	3243	2979	4382	5727	0.254	0.221	0.292	0.319
75%-ile	1703	1358	2347	3133	0.135	0.099	0.155	0.175
Median	452	-110	664	913	0.035	-0.008	0.044	0.051
25%-ile	-700	-1595	-789	-1049	-0.055	-0.122	-0.053	-0.063
10%-ile	-2168	-3348	-2771	-3525	-0.184	-0.269	-0.195	-0.218
[N – workers]	23659	28824	21477	40217	23659	28824	21477	40217
5, Wage change if								
tenure 1-3 years		444	1073	1542		0.037	0.083	0.089
(s.d.)		1984	2316	2965		0.155	0.163	0.164
90%-ile		2769	3765	4837		0.228	0.292	0.292
75%-ile		1460	2186	2793		0.118	0.165	0.170
Median		336	845	1178		0.027	0.063	0.073
25%-ile		-569	-30	108		-0.044	-0.002	0.007
10%-ile		-1659	-1046	-1151		-0.128	-0.075	-0.071
[N – workers]		230789	172967	224083		230789	172967	224083
6, Wage change if								
tenure $\geq$ 3 years		-168	458	555		-0.013	0.029	0.027
(s.d.)		1726	1773	2192		0.121	0.113	0.115
90%-ile		1635	2213	2637		0.113	0.142	0.141
75%-ile		603	1150	1312		0.043	0.078	0.075
Median		-175	378	446		-0.013	0.027	0.027
25%-ile		-915	-233	-252		-0.064	-0.016	-0.015
10%-ile		-1950	-1131	-1387		-0.136	-0.077	-0.081
[N – workers]		406369	429235	440060		406369	429235	440060

Note: Data only include employees of plants with 25+ employees in year *t* and *t*-1. [1]Deflation by CPI to 1990-SEK. [2]Data for 1986 do not include workers older than 62 or workers that emigrated or died before 1990. [3] Average change in wage (or log wage) for workers that worked in the plant in both *t* and *t* – 1.

4.3 Mobility

We now take a look at worker mobility 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 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 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 panel 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 below) 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.

The most important development over time seems to be some pro-cyclicality, 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).

Table 7 Mobility, all jobs.

	All Plants				Plants with 100+ employees			
	1986	1990	1995	2000	1986	1990	1995	2000
1, Number of plants	7047	8306	7526	9067	1341	1566	1420	1650
2, Employees/plant	98.3	96.4	98.4	95.2	311.5	303.1	315.3	301.6
(s.d.)	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
(s.d.)	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%-ile	0.165	0.176	0.174	0.231	0.153	0.167	0.155	0.222
If wage in 45-55 %-ile	0.135	0.159	0.099	0.142	0.120	0.151	0.081	0.123
If wage < 10%-ile	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
(s.d.)	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
(s.d.)	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
(s.d.)	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
(s.d.)	0.192	0.201	0.197	0.224	0.144	0.144	0.142	0.169
9, Exit rate 45-55 %-ile, of plant wages	0.156	0.179	0.127	0.178	0.130	0.159	0.100	0.153
(s.d.)	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
(s.d.)	0.272	0.270	0.268	0.278	0.161	0.159	0.164	0.173

Table 7 Mobility, all jobs (continued).

	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
(s.d.)	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
(s.d.)	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
(s.d.)	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
(s.d.)	0.170	0.182	0.176	0.206	0.121	0.135	0.133	0.161
15, Entry rate 45-55 %-ile, of plant wages	0.135	0.156	0.127	0.168	0.112	0.125	0.106	0.142
(s.d.)	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
(s.d.)	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
(s.d.)		0.218	0.262	0.249		0.225	0.257	0.258

Table 7 Mobility, all jobs (continued).

	All Plants				Plants with 100+ employees			
	1986	1990	1995	2000	1986	1990	1995	2000
18, Correlation (size, average tenure)[1]		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, s.d. 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, s.d. of wage),	0.110	0.135	0.181	0.239	0.192	0.251	0.248	0.310

Note: All statistics are at the plant level with one plant as one observation except 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.1 Note that tenure is calculated from 1985 onwards, and thus truncated at different values for different years.

The six bottom panels (18 to 25) of Table 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 depicts 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 are essentially the same as in Table 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.

5 The evolution of the wage structure

Figure 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.

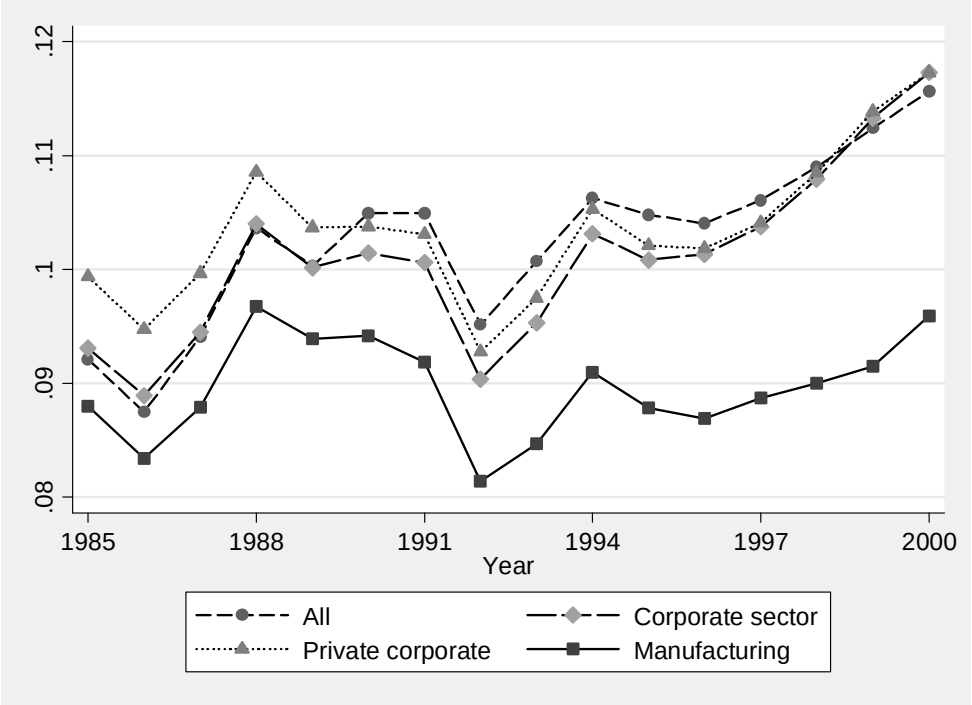

Figure 7 Overall log(wage) variance.

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.

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 8 shows that the between plant variance as a share of overall variance has increase steadily throughout the period. The development is equally visible when studying the entire economy as when studying only the corporate sector. There is a steady increase in the importance of plant effects also 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).

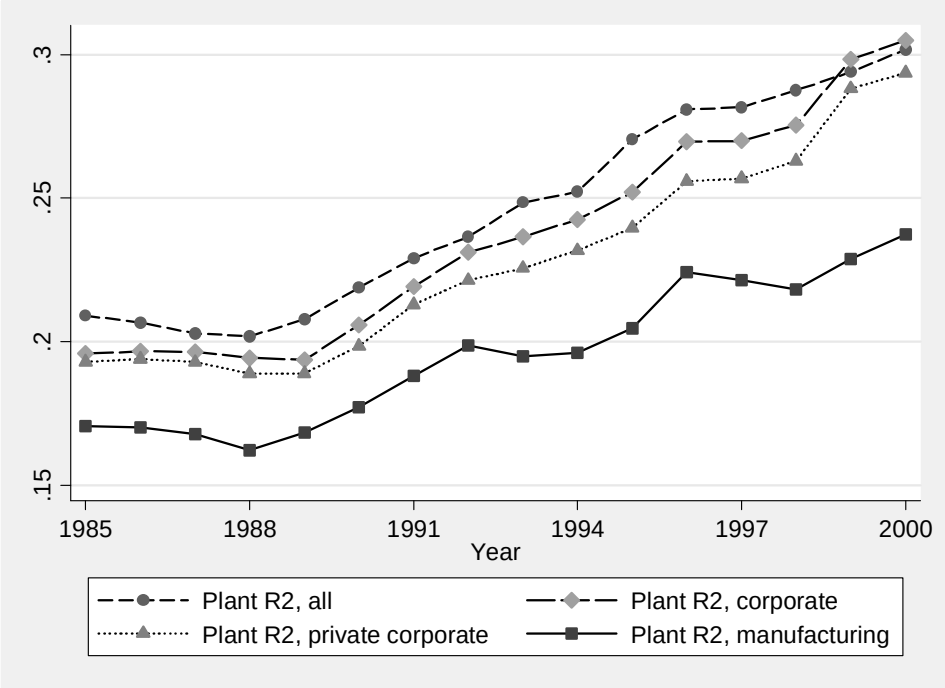

Figure 8 Fraction of total variance explained by plant effects.

Interestingly, it is the increase in between plant variance that makes up the entire increase in wage dispersion over the period. Figure 9 shows the evolution of within plant variance which contains a slightly cyclical pattern, but has no trend.

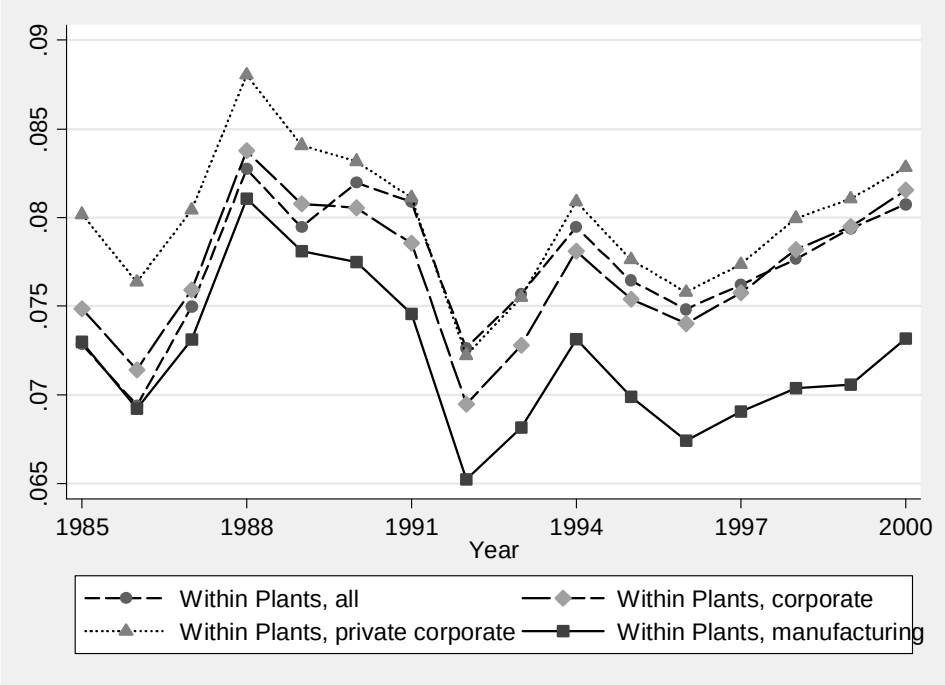

Figure 9 Within plant variance.

It is possible that the increase in between plant variance is due to changes in the industry composition. Thus, in Figure 10 we decompose the between plant variance in two parts, between plants within the same 2-digit industry and between 2-digit industries.[10] 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 (since 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 1-digit industries. The results (not displayed) showed that all industries had

[10] We use "reduced" 2-digit industry codes that are the lowest level at which it is possible to get consistent industry classifications throughout the period (new codes where issued in 1992). Thus, the corporate sector is divided into 39 industries.

positive trends in between plant variances, while only three industries had trends in within-plant variance. To further asses the role of structural change we have looked separately at all plants that existed in 1985 and/or 2000, as well as dividing 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.

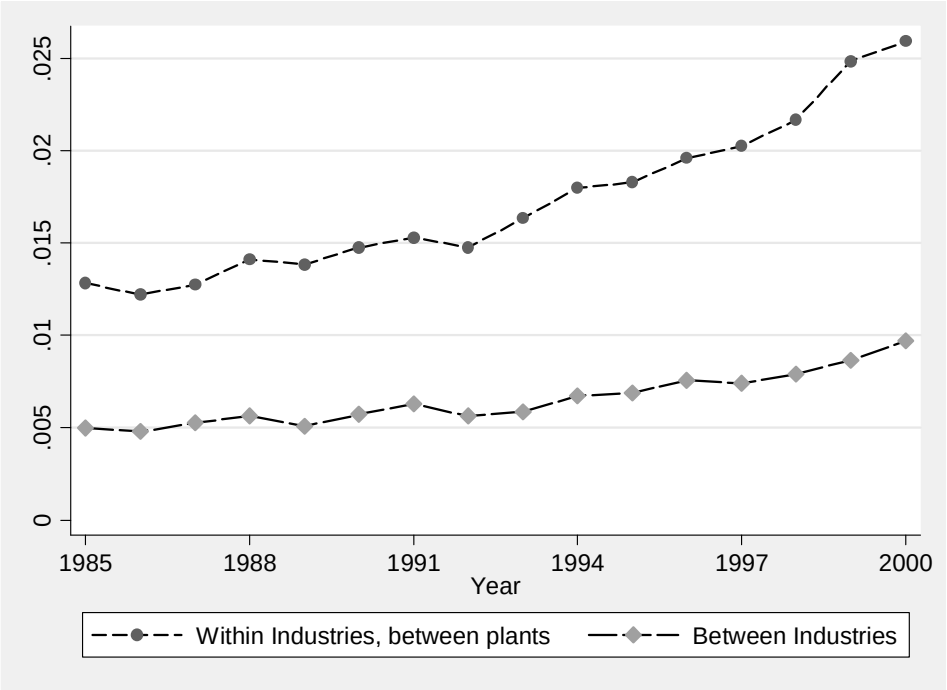

Figure 10 Between plant components, corporate sector.

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 immigrant) in a "Mincer-type" regression. The results from the regressions can be found in Appendix B. As already has been shown in e.g. 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 R2, 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 11 show that the plants play an increasingly important role also 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 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.

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

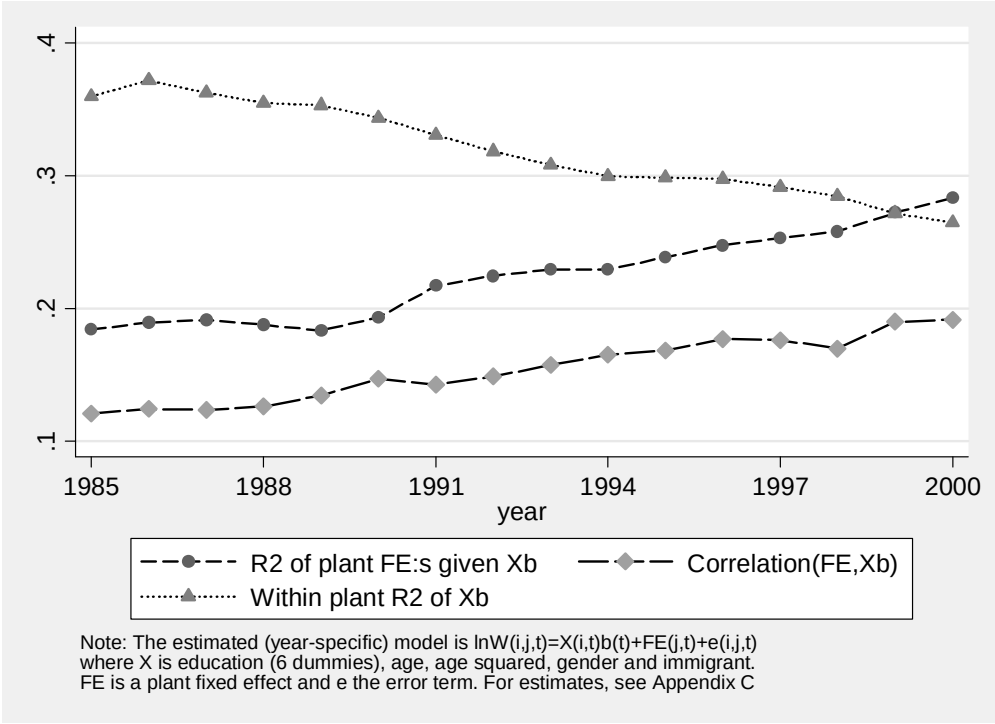

Figure 11 Plant effects when controlling for observables.

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, since such conclusion would require that the observed human capital characteristics capture all skill differences between individuals, which seem like a rather strong assumption.[13]

[13] Figure 11 also show 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 R2 we see no evidence of a trend, suggesting that the between plant variance of observables have

5.3 Plant effects and skill levels

We noted already in Section 4 that the variance of log wages within a plant is correlated with the average log wage of that plant and that this may be 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 OLS-Mincer equations. Figure 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 individual 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 12 would be that a gradual erosion of the bite of national wage agreements have made wage setting processes more similar across skill groups, with a tendency to emulate practices among the workers with the highest pay.

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increased relative to the within plant variance. We interpret this as further support to the notion of increased sorting.

[14] It should be noted that the pattern of increased plant effect R2: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.

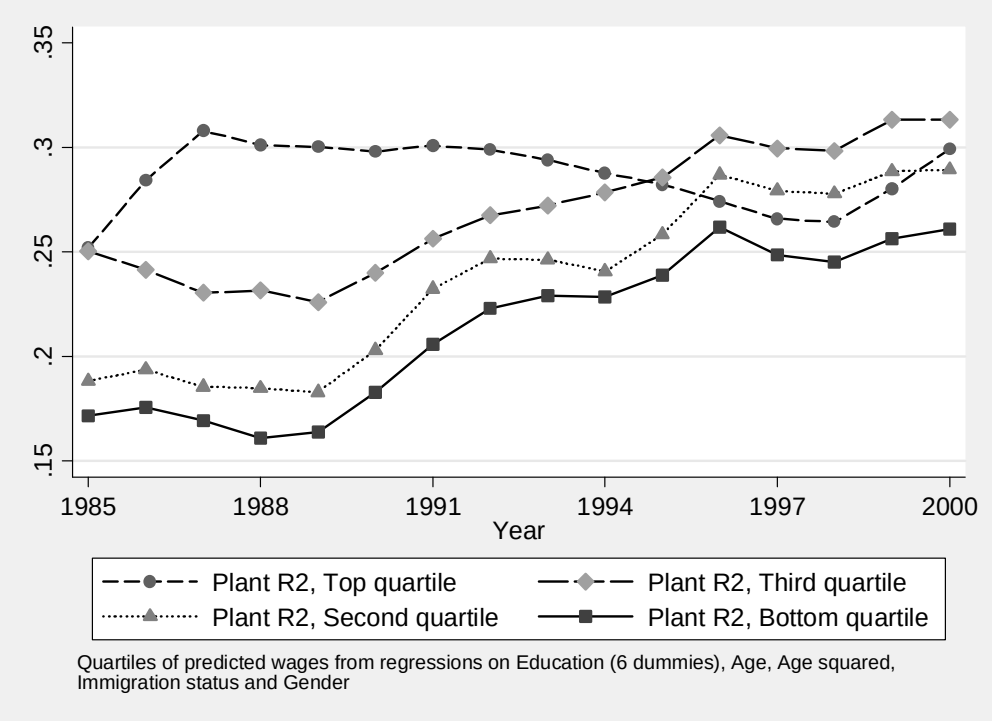
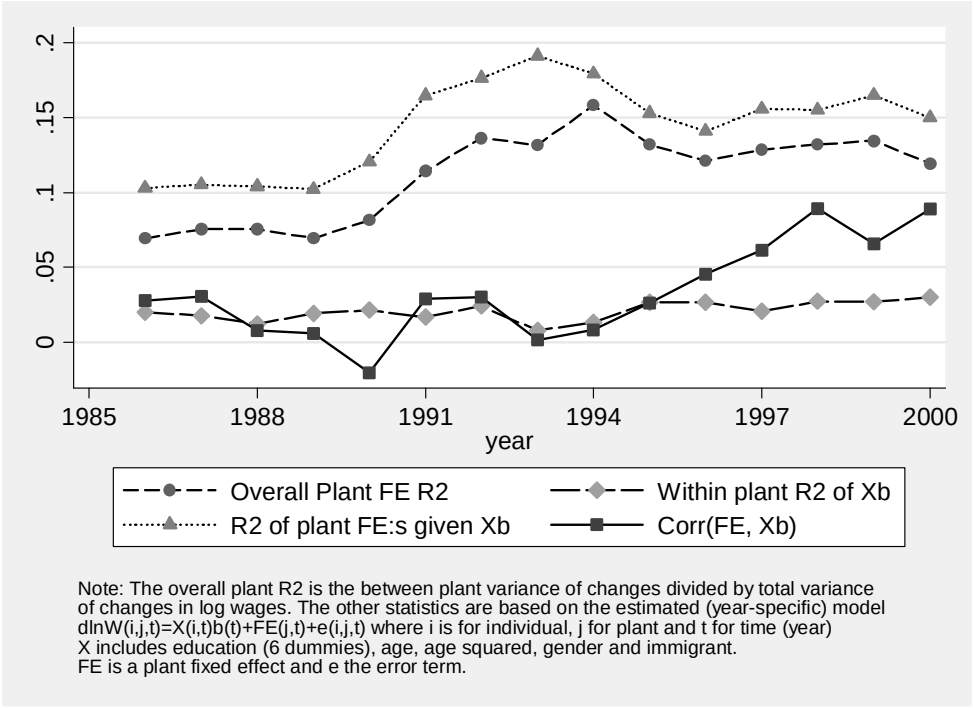


Figure 12 Fraction of variance explained by plant effects by predicted wage quartile in the corporate sector.

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 13 we study the fraction of wage growth variance that can be attributed to plant effects for the different years (using only workers that 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 from Figure 13, the within plant predictive power of the observables is quite small (in the order of 1-3 percent).



Note: The overall plant R2 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 dlnW(i,j,t)=X(i,t)b(t)+FE(j,t)+e(i,j,t) where i is for individual, j for plant and t for time (year)
X includes education (6 dummies), age, age squared, gender and immigrant.
FE is a plant fixed effect and e the error term.

Figure 13 Real wage growth and plant effects.

In Section 4 we noted what appeared to be increased wage changes for those that 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 worker observed in the data in two consecutive years that have changed plants between the years (see Figure 14). The fraction changing jobs in 1993 is roughly half that in 1988 and 2000.

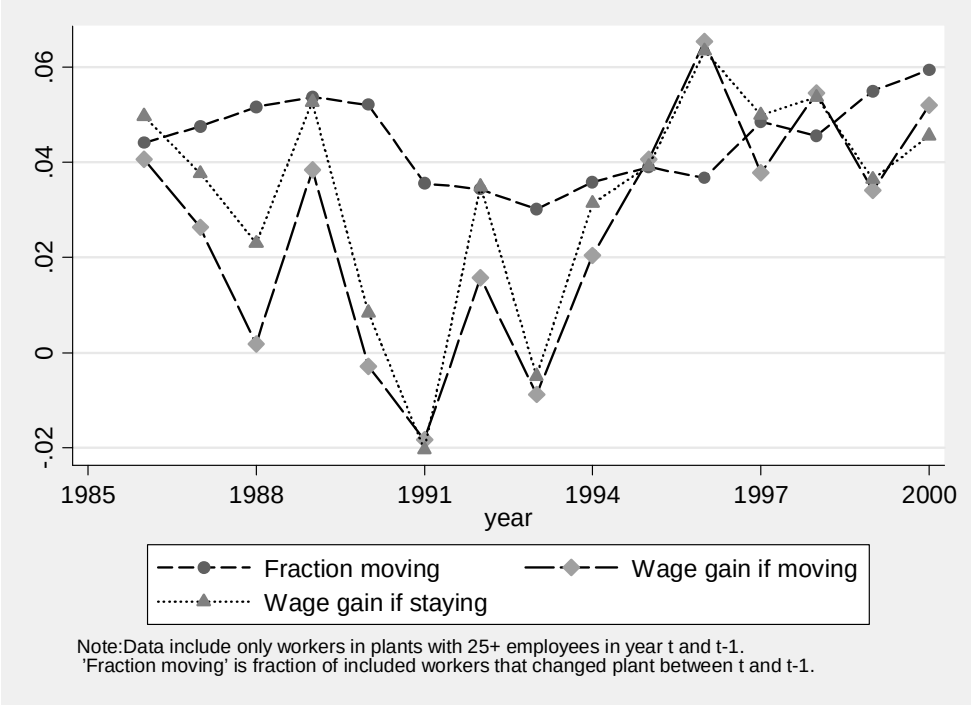


Figure 14 Mobility and wage gains.

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 15 and vary between 0.92 and 0.96 with a marked pro-cyclical pattern – the four years with the lowest correlations are 1991-94 – but with no trend. Thus, plant specific wages do 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, since 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.

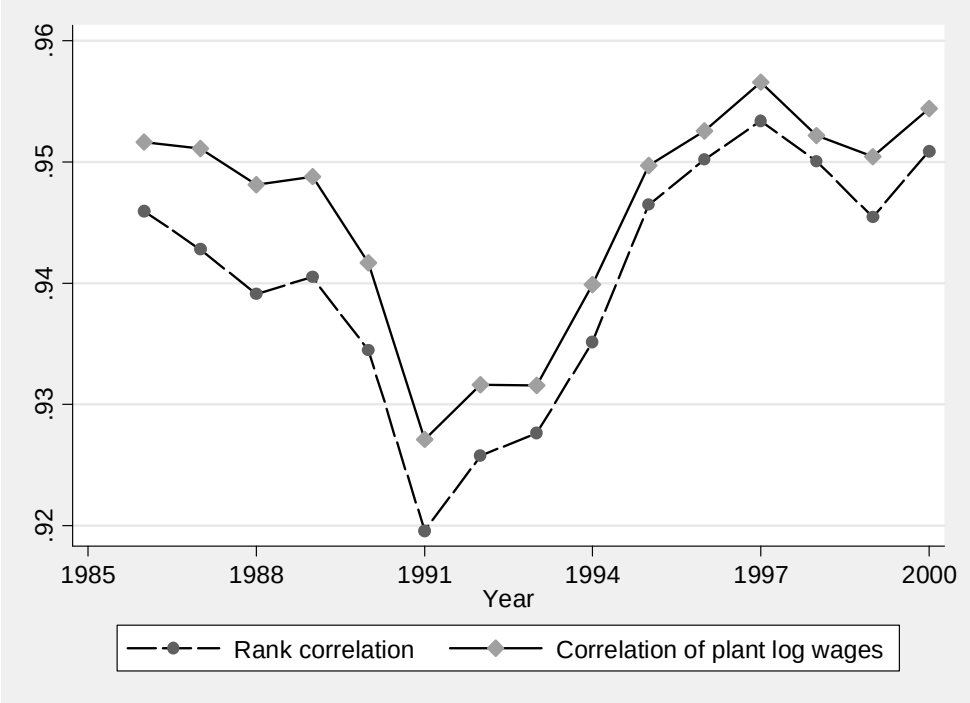


Figure 15 Year to year correlations of plant log wages.

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.

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 the 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 provide empirical evidence that suggests that segregation by skill has become increasingly prevalent in the US, the UK and France over the 1980s and the 1990s. There is furthermore some evidence, from data on US 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 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 16 and reveal a marked increase in the variance of schooling from the early 1990s and onwards (but a slight decline in the late 1980s). Although this pattern is broadly consistent with the Kremer and Maskin theory, the exercise does certainly not demonstrate a causal relationship between the dispersion of education and segregation of workers by observed and unobserved skill, or between the 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.

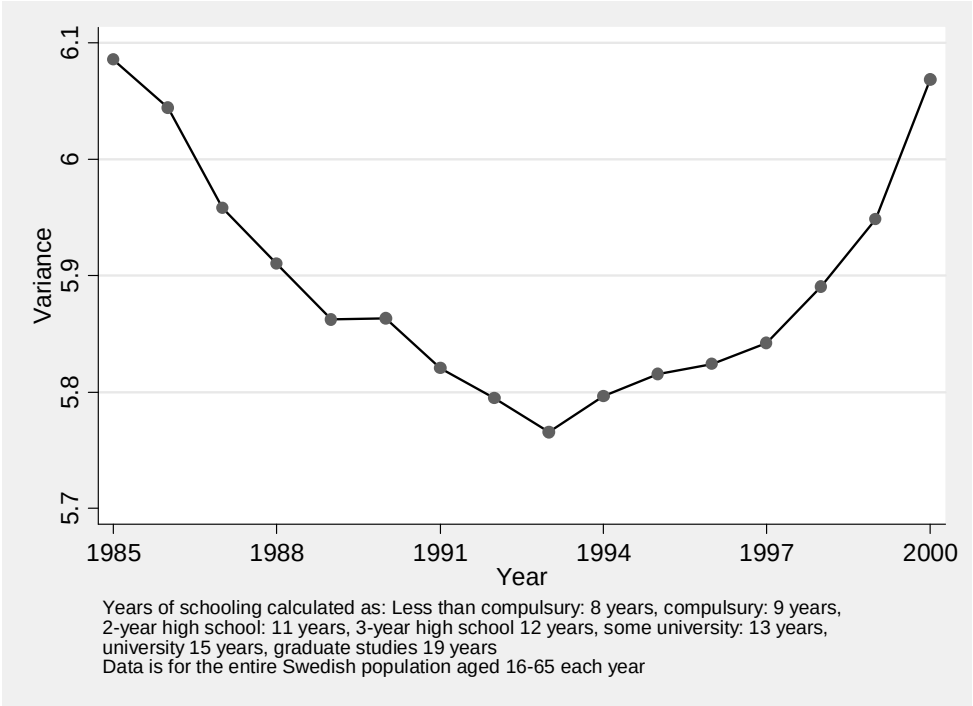


Figure 16 Variance in years of schooling.

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 1970-96 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 1970-82 and 0.051 for the period 1983-96. 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, since our data do not include any plant level productivity measures it is not possible to shed new light on this hypothesis.

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

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 evidence on this issue in a study of wage and productivity dispersion in US manufacturing. The study exploits establishment data over the 1975-92 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 in 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 onwards. 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 Concluding remarks

The paper 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 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 towards 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.

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Appendix A. Mobility of high and low level jobs

Table A1 Mobility, high level jobs (continues).

	All plants				Plants with 100+ employees			
	1986	1990	1995	2000	1986	1990	1995	2000
Number 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
(s.d.)	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
(s.d.)	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
(s.d.)	0.202	0.210	0.206	0.237	0.140	0.150	0.139	0.179
Exit rate, top quartile of plant wages	0.167	0.183	0.179	0.220	0.161	0.190	0.182	0.239
(s.d.)	0.285	0.293	0.293	0.320	0.201	0.213	0.213	0.259
Exit rate, bottom quartile of firm wages	0.128	0.147	0.128	0.177	0.113	0.128	0.105	0.159
(s.d.)	0.249	0.266	0.252	0.282	0.185	0.188	0.184	0.217
Exit rate, top decile of firm wages	0.186	0.204	0.208	0.239	0.188	0.229	0.236	0.279
(s.d.)	0.339	0.352	0.353	0.375	0.263	0.288	0.291	0.333
Exit rate, bottom decile of firm wages	0.141	0.156	0.122	0.192	0.115	0.130	0.095	0.170
(s.d.)	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
(s.d.)	0.183	0.191	0.197	0.227	0.133	0.136	0.138	0.181
Entry rate, top quartile of firm wages	0.130	0.147	0.146	0.181	0.126	0.148	0.151	0.191
(s.d.)	0.253	0.268	0.271	0.300	0.182	0.202	0.208	0.243
Entry rate, bottom quartile of firm wages	0.117	0.125	0.122	0.179	0.102	0.096	0.105	0.149
(s.d.)	0.241	0.244	0.242	0.289	0.182	0.163	0.182	0.221

Table A1 Mobility, high level jobs (continued).

	All plants				Plants with 100+ employees			
	1986	1990	1995	2000	1986	1990	1995	2000
Entry rate, top decile of firm wages	0.144	0.160	0.159	0.194	0.152	0.171	0.180	0.222
(s.d.)	0.304	0.320	0.321	0.347	0.243	0.260	0.273	0.311
Entry rate, bottom decile of firm wages	0.128	0.141	0.139	0.200	0.094	0.095	0.111	0.154
(s.d.)	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
(s.d.)		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, s.d. 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, s.d. of wage),	0.087	0.128	0.117	0.129	0.037	0.141	0.118	0.122

Note: 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 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 of log wages within plants.

Table A2 Mobility, low level jobs (continues).

	All Plants				Plants with 100+ employees			
	1986	1990	1995	2000	1986	1990	1995	2000
Number 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
(s.d.)	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
(s.d.)	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
(s.d.)	0.212	0.216	0.219	0.233	0.135	0.138	0.146	0.160
Exit rate, top quartile of firm wages	0.303	0.318	0.217	0.276	0.257	0.290	0.168	0.230
(s.d.)	0.314	0.316	0.296	0.318	0.189	0.191	0.181	0.207
Exit rate, bottom quartile of firm wages	0.521	0.485	0.393	0.456	0.525	0.496	0.385	0.460
(s.d.)	0.353	0.352	0.349	0.352	0.209	0.214	0.231	0.245
Exit rate, top decile of firm wages	0.291	0.306	0.208	0.272	0.249	0.274	0.159	0.226
(s.d.)	0.385	0.387	0.352	0.380	0.247	0.255	0.224	0.267
Exit rate, bottom decile of firm wages	0.579	0.537	0.443	0.517	0.584	0.545	0.451	0.518
(s.d.)	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
(s.d.)	0.239	0.239	0.256	0.264	0.167	0.162	0.181	0.201
Entry rate, top quartile of firm wages	0.333	0.375	0.320	0.361	0.280	0.319	0.273	0.309
(s.d.)	0.336	0.345	0.347	0.359	0.210	0.216	0.237	0.262
Entry rate, bottom quartile of firm wages	0.544	0.568	0.541	0.583	0.510	0.515	0.500	0.538
(s.d.)	0.357	0.355	0.358	0.356	0.234	0.230	0.238	0.263
Entry rate, top decile of firm wages	0.318	0.364	0.305	0.347	0.262	0.300	0.259	0.285
(s.d.)	0.400	0.414	0.402	0.417	0.264	0.276	0.282	0.306
Entry rate, bottom decile of firm wages	0.570	0.604	0.585	0.618	0.523	0.538	0.546	0.567
(s.d.)	0.413	0.407	0.409	0.405	0.328	0.323	0.322	0.332

Table A2 Mobility, low level jobs (continued).

	All Plants				Plants with 100+ employees			
	1986	1990	1995	2000	1986	1990	1995	2000
% of workers with 5+ years of tenure	--	0.137	0.235	0.203	--	0.170	0.278	0.262
(s.d.)		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, s.d. 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, s.d. of wage),	0.045	0.033	0.055	0.079	-0.015	-0.002	-0.053	0.021

Note: 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 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 of log ages within plants.

Appendix B Mincer equation estimates

Table B1 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-squared	**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**

Note: All estimates are significant at the 1 % significance level (all standard errors are 0.003 or less). Reference for education is “less than high school”.

Table B2 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
Number of Plants	8381	8680	9226	10109	10243	10552	10296	9431	9191	9816	10501	10720	10997	11575	12138	12820
Within R-squared	**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-squared	**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 (*X* b, *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**

Note: All estimates are significant at the 1 % significance level (all standard errors are 0.005 or less). Reference for education is "less than high school". Estimated model is $\ln W = X\mathbf{b} + u + e$ where u is the fixed plant effect and e is an error term. Between R-squared 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 C1 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 %-ile plants								
Mean wage (or change)	9.690	9.753	9.845	10.068	0.128	0.092	0.137	0.156
Average within plant sd	0.343	0.345	0.338	0.348	0.133	0.150	0.146	0.168
45^{th} to 55^{th} %-ile 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 %-ile 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
N: Plants by decile.	704	831	753	906	704	831	753	906

Note: 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).

Table C2 Exit rates in plants with compressed and dispersed wages.

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

Note: 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).