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9 The Swedish Wage Structure: The Rise and Fall of Solidarity Wage Policy?

Per-Anders Edin and Bertil Holmlund

Wage inequality in Sweden declined precipitously during the 1960s and the 1970s. There was a sharp reduction in overall wage dispersion and in the relative earnings advantage of highly educated workers, a marked narrowing of wage differences between men and women, and a trend increase in youth relative wages. There was also a substantial narrowing of wage differentials among workers within broad occupation and education groups.

The trend decline in wage inequality was broken in the 1980s. Wage differentials have widened along several dimensions from the mid-1980s to the early 1990s. There has been a modest rise in overall wage inequality and some increase in educational wage differentials, and the trend increase in youth relative wages has been reversed. Wage inequality within manual as well as nonmanual occupations has widened.

The pattern of decreasing wage differentials during the 1970s and expanding differentials during the 1980s is not a feature that is unique to the Swedish labor market. Wage differentials by education and occupation declined during the 1970s in a number of countries, whereas the 1980s have seen rising inequality, notably in Britain and the United States (see, e.g., Bound and Johnson

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1992; Davis 1992; and Katz, Loveman, and Blanchflower, chap. 1 in this volume).

Much of the Swedish discussion has taken it for granted that the pay compression has been driven by the egalitarian ambitions of strong and coordinated trade unions. Indeed, the period of narrowing wage differentials coincides with the heydays of the "solidarity wage policy," the deliberate attempt by the main union confederations to reduce wage dispersion. The years of widening wage differentials coincide with a period when centralized bargaining loses its edge. A conclusion that movements in wage inequality can be traced to institutional forces lies therefore close at hand. Our analysis of the Swedish wage structure suggests that institutions are only part of the story. We show that conventional demand and supply factors can go a substantial way toward explaining some key relative wage movements in Sweden.

The plan of the paper is as follows. We begin in section 9.1 with a brief overview of the institutional background. Section 9.2 turns to a comprehensive documentation of the changes in the Swedish wage structure that took place from the 1960s on. By means of estimated wage equations for several different years we decompose the changes in wage dispersion into changes in individual characteristics and in returns to these characteristics and into residual changes. Section 9.3 discusses alternative explanations of the observed patterns. To what extent have sectoral shifts affected the relative demand for skilled labor? Are the movements in the wage dispersion driven by changes in the relative supply of skilled labor? Is there any evidence that changing institutional conditions in the labor market, in particular the breakdown of centralized wage bargaining, have influenced wage behavior? Section 9.4 examines whether pay compression has resulted in a deterioration of the labor market for youths, and section 9.5 looks at the relations between the returns to schooling and the demand for higher education. Section 9.6 concludes.

Our main findings can be summarized as follows:

1. The sharp pay compression that took place during the 1960s and the 1970s has been partly reversed during the 1980s. Wage compression was mainly due to narrowing age and education differentials as well as decreasing wage differentials between males and females. The recent widening of wage differentials is largely an increase in within-group dispersion.

2. The returns to higher education decreased sharply from the late 1960s and up to the mid-1980s, followed by a rebound during the second half of the 1980s. The main source of these fluctuations appears to be fluctuations in the relative supply of university-educated labor.

3. Youth relative wages increased continuously over the 1970s and up to the mid-1980s, with a slight trend reversal in the period thereafter. These movements are largely consistent with fluctuations in the relative supply of young and older workers.

4. Youth employment has shown substantial responsiveness with respect to

fluctuations in the size of the youth population. It is not obvious that pay compression has resulted in severe distortions in the youth labor market.

5. School enrollment among twenty- to twenty-four-year-olds has been highly responsive to the returns to university education. The demand for higher education declined as the university wage premium decreased. This led to a deceleration in the rate of growth of university-educated labor, which in turn resulted in a rebound of the university wage premium in the late 1980s.

9.1 The Institutional Setting

9.1.1 Industrial Relations in Sweden

Sweden has a reputation for peaceful labor relations.[1] This reputation is based on Sweden's experience after World War II, where labor conflicts have been rare events. Labor relations in previous decades were much less peaceful, however. The number of annual workdays lost owing to conflicts typically amounted to one or several millions during the interwar period; the corresponding figures during the 1950s and the 1960s were typically fewer than 100,000 days.

An important turning point is the "Basic Agreement" from 1938 between LO (the Swedish trade union confederation) and SAF (the Swedish employers' federation). This agreement—commonly referred to as *Saltsjöbadsavtalet*—defined a set of rules for conflict resolutions, which together with previously introduced legislation formed a basis for more peaceful labor relations. The legislation included a law on collective agreements from 1928, which made conflicts illegal after a contract had been signed. A labor court was also introduced in 1928 to handle disputes over contracts.

LO was founded in 1898 and is still the largest union confederation, with a membership over 2.2 million and twenty-three affiliated unions. LO organizes blue-collar workers in both the private and the public sectors. White-collar union confederations were formed just after World War II, and their membership figures have been gradually increasing during the postwar period. TCO—the central organization for salaried employees—is the largest white-collar confederation with over 1.2 million members among twenty affiliated unions. The third major organization is SACO—the Swedish confederation of professional associations—with 330,000 members and twenty-five unions. SACO is almost exclusively an organization for employees with a university education.

By international standards, a very high share of the Swedish workforce is unionized. According to the labor force surveys, 81 percent of employees were union members in 1991, and unionization rates show negligible variations

1. The section draws primarily on Calmfors and Forslund (1991), Elvander (1988), Hibbs (1990), Meidner (1974), Nilsson (1993), and Ullenhag (1971).

across broad education and occupation groups. For example, employees with a university education have union membership rates close to the average. Union membership rates are higher in the public sector than in the private; in 1990, the figures were 90 and 74 percent, respectively (Statistics Sweden 1992).

Union density has fallen sharply in many countries over the past decade. Sweden has so far experienced very little of this decline, although the number of union members fell in 1987 for the first time since the 1930s. There has been a slight decrease in unionization rates since 1987, mainly due to decreasing membership rates among young workers.

The growth of the public sector, in conjunction with increasing union membership rates among white-collar workers, has gradually eroded LO's dominant position among the union confederations. LO accounted for 80 percent of the total union membership in 1950 but less than 60 percent in 1990. Public-sector unions increased their share of the total number of union members from 26 to 42 percent during the same period.

The growth of public-sector and white-collar unions has reduced the relative importance of LO and SAF in the wage rounds. LO and SAF were the two key players in the heydays of "the Swedish model," when their wage agreements for the private sector worked as guideposts for the rest of the labor market. This has become an increasingly less accurate description of the Swedish wage negotiation system. A new private-sector player was formed in the early 1970s, a negotiation cartel (PTK) comprising private-sector employees from primarily TCO and SACO. (TCO and SACO do not as central organizations take direct part in the wage negotiations.) SAF and PTK struck several central agreements during the 1970s and the 1980s.

In 1965, public-sector employees were given the right to bargain over wages, including the right to strike. Employer organizations for the central and local governments have since then regularly negotiated with public-sector unions, with substantial coordination on both sides of the bargaining table. Private-sector wage agreements have in general been struck before public-sector agreements. Statistical studies of intersectoral wage linkages confirm this pattern; wage increases in the private sector have typically preceded ("Granger caused") public-sector wage increases (Holmlund and Ohlsson 1992).

9.1.2 Coordination and Solidarity: Theory and Practice

The term *solidarity wage policy* was coined in the late 1930s, but egalitarian ideas have a long history in LO. Demands for wage equalization among different groups within LO were regularly voiced during the LO congresses, typically closely related to demands for a more centralized bargaining structure within LO. LO had in fact little influence over its constituent unions during its early history. For example, no central negotiations between LO and SAF took place during the period 1909–36.

The year 1936 seems to have been one of takeoff for the solidarity wage policy. In that year the metalworkers' union placed a motion before the LO

congress recommending a "socialist wage policy, with the emphasis on solidarity." The motion recognized, however, that LO had limited possibilities of pursuing such a policy in practice. The idea that *coordination* was a necessary prerequisite for *solidarity* was developed and refined in a number of articles and LO reports during the following decade. Of particular importance in this regard were the writings of the LO economists Gösta Rehn and Rudolf Meidner. (For an account of this discussion, see Turvey [1952].)

Rehn and Meidner argued that coordination should be seen not only as a device to achieve a wage policy of solidarity but also as a means to promote growth and structural change in the economy. The guiding principle should be "equal pay for equal work," irrespective of the ability to pay among particular firms or industries. The principle might be viewed as an attempt to use the centralized union's visible hand to achieve a wage structure that would appear in a competitive labor market. The Rehn-Meidner program did not rule out wage differences among workers with different skills or working conditions, only differences based on firms' profitability. The program did recognize, however, that a wage policy of this kind might put pressure on weak firms and ultimately cause unemployment in certain industries or regions. The solidarity wage policy should therefore be combined with an *active labor market policy* to facilitate the relocation of workers made redundant in less efficient firms.

A solidarity wage policy and an active labor market policy—two basic ingredients of what has been referred to as "the Swedish model"—were gradually initiated in practice during the 1950s. The first centralized wage round between LO and SAF took place in 1952, but coordination did not become a permanent feature of such negotiations until 1956. In fact, LO participated in the 1952 wage round reluctantly, SAF this time being the eager supporter of coordination. This SAF policy seems to have originated in the view that centralization might be conducive to wage moderation by preventing excessive leapfrogging.

Recent econometric work suggests that wage differentials in Sweden reflect industry rents to a much smaller extent than wages in the United States do (Holmlund and Zetterberg 1991; Edin and Zetterberg 1992). This finding is clearly consistent with the objectives of the solidarity wage policy. Equal pay for equal work is only one facet of solidarity wage policy, however. Another, based on strong ideological convictions among the union leaders and the membership at large, is *wage equalization.* There has always been a tension between these two facets of the solidarity wage policy. To some extent pay compression could be justified as establishing equal pay for equal work; an example is wage hikes for female workers and the abolition of special female wage scales. In other cases it was not at all clear what the operational content of equal pay for equal work really was. Attempts to achieve some consensus on wage differentials through elaborate job evaluation schemes have not been very successful. Solidarity wage policy from the late 1960s up to 1983 has therefore to a large extent been equivalent to pay compression.

The wage-bargaining process during the period 1956–83 took place at three levels: a central framework agreement between LO and SAF (or PTK and SAF), a number of national industry negotiations, followed by local negotiations at the plant level. There have been sixteen central LO-SAF agreements between 1956 and 1983, with contract lengths of one, two, or three years. Despite this centralized bargaining structure, "wage drift" has been a pervasive phenomenon. For example, wage drift among private-sector blue-collar workers—conventionally measured as the difference between actual wage increases and wage increases agreed on at the industry level—has on average accounted for close to 50 percent of total wage increases.

The egalitarian ambitions of the wage policy were manifested in the central LO-SAF agreements, but similar egalitarian ambitions seem to have dominated among white-collar unions within TCO. The frame agreements typically included a common wage increase specified in absolute terms (Swedish öre) rather than as a percentage. Other ingredients were special low-wage provisions, wage-drift guarantees to compensate workers without wage drift, and cost-of-living adjustments. It was possible to implement deviations from the frame agreement's distribution profile at the industry-level negotiations, but only if the parties could agree. The distribution rules in the frame agreement became binding if the parties at the industry level failed to agree on other distribution plans.

The pay compression face of solidarity wage policy has been caricatured as equivalent to "equal pay for all work." This is certainly an exaggeration, but the radical egalitarianism of the wage policy is one factor that has been put forward to explain the ultimate breakdown of centralized wage bargaining in Sweden. The employers' organization in the engineering industry (Verkstadsföreningen) had for years been critical of the central negotiations, arguing that the frame agreements allowed too little flexibility at the industry and local levels. Verkstadsföreningen and other critics of wage equalization argued in favor of pay systems that would allow higher remuneration of skilled workers. The turning point came in 1983, when Verkstadsföreningen was able to sidestep LO and SAF and negotiate a separate agreement with the metalworkers' union. The wage negotiations after 1983 have primarily involved industry-level rather than national bargaining, although three notional central frame agreements were struck during the second half of the 1980s.

The period 1991–93 is a special case, entailing government-promoted voluntary incomes policies in conjunction with a sharp disinflation policy. Despite all the noise that SAF had made about the costs of central negotiations, the organization was quite anxious to follow suit when the government called for coordinated national efforts to achieve deceleration of wage inflation. The degree of coordination in the wage rounds of the early 1990s has been extreme, involving virtually all employer organizations and most of the unions.

There is a common presumption that the period 1991–93 is an interlude that will be followed by something similar to the industry-level negotiations that

took place in the wake of the breakdown of centralization in 1983. The exact shape of Sweden's future wage-bargaining system is, however, very much an open question. SAF seems to have ambitions to prevent any return to the old system of nationwide coordination, and some employer representatives argue in favor of decentralization all the way down to the firm and plant levels. On the union side, there are signs of emerging cooperation between blue-collar and white-collar workers, a development that may be unavoidable as the sharp borderlines between traditional blue- and white-collar jobs begin to disappear.

9.2 Changes in the Swedish Wage Structure

9.2.1 Basic Facts

Sweden has experienced dramatic changes in its wage structure over the past three decades. Data from a variety of sources indicate that substantial pay compression took place from the mid-1960s to the early 1980s. As in many other countries, this trend was reversed from around 1980–85 on; the data at hand show a modest increase in the dispersion of wages and salaries during the second half of the 1980s and up to the early 1990s.[2]

Table 9.1 displays the standard deviation of log hourly earnings from two representative samples of the Swedish population (see Eriksson and Åberg 1987; and Klevmarken and Olofsson 1993). For 1968, 1974, and 1981, we have data from the Level of Living Survey (LNU); for 1984, 1986, 1988, and 1991, we use the Household Market and Nonmarket Activities Survey (HUS). We have restricted the samples to eighteen- to sixty-five-year-old employees (excluding the self-employed). The three LNU samples and HUS 1984 are constructed in an identical fashion. The later HUS samples are somewhat different. This is due to the household panel construction of HUS.[3] The earnings data from LNU and HUS are comparable in the sense that they are measured in essentially the same way. Respondents are asked to report, among other things, current (before-tax) wage or salary as well as normal hours of work; hourly earnings for those who are not paid on an hourly basis are calculated as the ratio between weekly (monthly) pay and hours worked. These two surveys are our main data sources for the analysis in this section.

2. The trend decline in wage dispersion has been discussed by, among others, Björklund (1986, 1987), Jonsson and Siven (1986), and Hibbs (1990). The development during the late 1980s is less well documented, an exception being Hibbs (1990).

3. The 1984 sample was reinterviewed in the later surveys. New individuals have been added to the sample through an additional sample in 1986 and through interviews with young individuals leaving their parents and new adult members of existing households in 1986 and 1991. For these new individuals we construct the independent variables in the same way as above. For the panel samples of HUS 1986, 1988, and 1991, however, we have information only on events taking place between the surveys. Since we did not have access to spells of employment for the 1991 sample or to changes in educational attainment as formulated above, we constructed these variables in a different way. For experience we used the initial values and assumed that the individual had been working until the survey in question. For education we used the initial level of education.

Table 9.1 **The Swedish Wage Dispersion, 1968–91 (standard deviation of log hourly earnings)**

	1968	1974	1981	1984	1986	1988	1991
LNU	.456	.359	.311	...	...	...	...
	(2,957)	(3,009)	(3,431)				
HUS	...	...	...	.305	.341	.368	.356
				(1,637)	(1,854)	(1,561)	(1,365)
HINK	...	...	.406	.343	.365	.391	.383[a]
			(1,000)	(1,004)	(1,889)	(1,779)	(1,746)

Note: The number of observations is given in parentheses. The samples cover 18–65-year-olds, excluding the self-employed. The HINK samples refer to individuals with no income from the public social insurance system (*Försäkringskassan*).

[a]Refers to 1990.

The picture that emerges from table 9.1 is quite striking. Between 1968 and 1981, we observe a decrease in the standard deviation of log hourly earnings of 32 percent (from .46 to .31). From 1984 to 1991, there is instead an increase in the dispersion by about 17 percent. Most of this increase seems to have occurred between 1984 and 1986. The dispersion in the early 1990s is of the same order of magnitude as the dispersion in the middle of the 1970s. This general pattern is confirmed by annual data from the Household Income Survey (HINK), 1981–90, reported in the bottom row of table 9.1. The earnings data in this survey are based on annual labor income, obtained from tax returns, divided by annual hours of work, as reported in a complementary survey.[4] These figures suggest that the drop in wage dispersion between 1981 and 1984 may be understated in the LNU-HUS comparison. The development after 1984 is very similar in the HINK and HUS samples, however.

Alternative measures of changes in wage dispersion are presented in figure 9.1 in terms of log wage differentials between different percentiles of the wage distribution. We report the log(P90/P10), where P_i is percentile i. The overall pattern of changes is the same as in table 9.1, with a substantial wage compression until the early 1980s and a tendency toward increasing wage dispersion thereafter. Decomposing the 90-10 differential into a 90-50 and a 50-10 differential illustrates that wage compression occurred at both the top and the bottom of the wage distribution. The wage dispersion is higher at the top, however. Furthermore, the 75-25 wage differential shows that the changes that we observe are not confined to the tails of the distribution.

The overall measures of wage dispersion reported here reveal that overall wage inequality in Sweden is small when viewed from an international perspective (see Davis 1992). Katz, Loveman, and Blanchflower (chap. 1 in this

4. Unfortunately, the earnings data also include sick pay and some other social insurance payments; it is possible to deduct these payments in a direct way only after 1985.

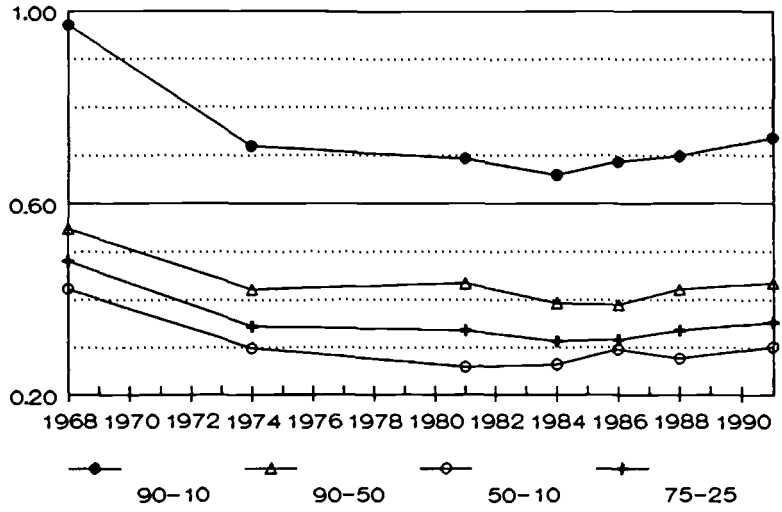

Fig. 9.1 Log wage differentials, 1968–91
Source: LNU and HUS.

volume) report that the 90–10 log wage differential for U.S. males was 1.36 in 1984. The corresponding figure for Sweden was 0.68 (0.66 including females). Thus, according to this measure, wage dispersion was about twice as high in the United States as in Sweden in 1984. The Swedish figure was also much lower than those for the other three countries examined in the Katz, Loveman, and Blanchflower study, namely, Britain (1.04), France (1.18), and Japan (1.02).

The general pattern of changes in wage dispersion in LNU and HUS, shown in table 9.1 and figure 9.1, is confirmed by statistics on wages and salaries obtained from SAF.[5] The data at our disposal are in the form P90/P10 or P75/P25. Data on individual hourly wages for blue-collar workers in the private sector are available since 1970. The message from figure 9.2 is clear; there is a fall in the wage dispersion by 15 percent between 1970 and 1983, followed by a rise of 6 percent from 1983 to 1990. The 90–10 wage differential in the early 1990s is of the same order of magnitude as the corresponding ratio in the mid-1970s.

Data on individual salaries for full-time, private-sector, white-collar workers are available since the late 1950s. Figure 9.3 reveals a pronounced pay compression during most of the 1960s and the 1970s, followed by an increase in the dispersion during the 1980s. Pay compression has been particularly strong

5. These data cover all workers whose employers are members of SAF. We are grateful to Douglas Hibbs and Håkan Locking for providing data on blue-collar workers and to Birgitta Preussner, SIF, for data on white-collar workers.

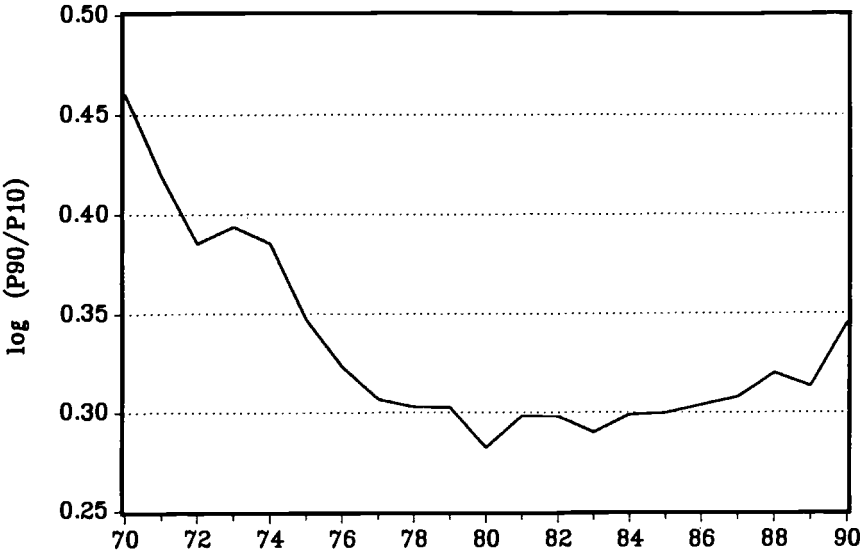

Fig. 9.2 Log wage differentials for private-sector blue-collar workers, 1970–90
Source: SAF.

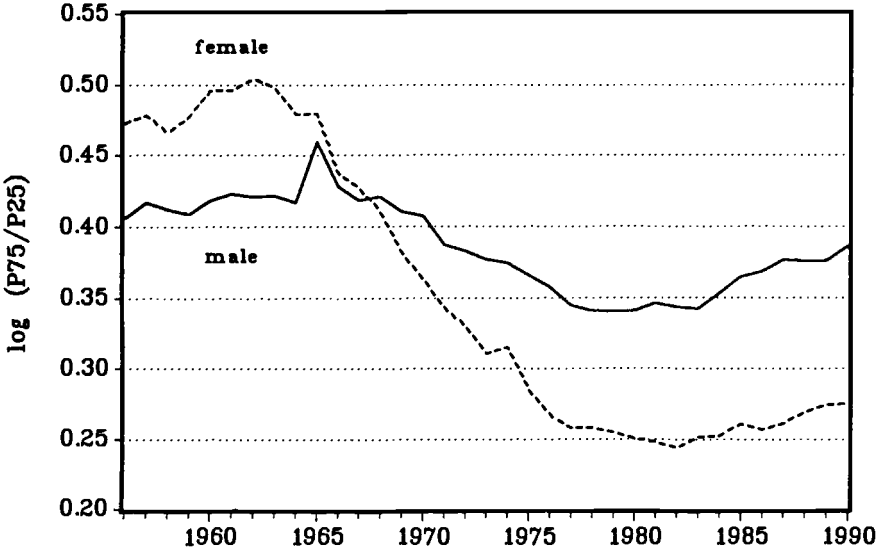

Fig. 9.3 Log wage differentials for private-sector white-collar workers, males and females, 1956–90
Source: SAF.

for female workers. Note that both figure 9.2 above and figure 9.3 show that wage compression started to lose its edge in the late 1970s and that the minimum wage dispersion occurs earlier than was implied by table 9.1 above.

Public-sector employees have also experienced widening wage differentials from the mid-1980s, again a clear reversal of the trends that prevailed during the 1970s and the early 1980s (see Statistics Sweden 1987, 1991). The 90–10 ratio for central government employees fell by some 20 percent between 1973 and 1985 and has increased during the second half of the 1980s. The data for local government employees show a similar picture. Computations based on LNU from 1974 and 1981 shown in Zetterberg (1988) reveal a decrease in the standard deviation of log wages by over 20 percent between 1974 and 1981 for local government employees; the corresponding change for central government employees was 16 percent. The period after 1984 involves a gradual increase in the 90–10 ratio for white-collar local government employees organized in TCO and SACO (Statistics Sweden 1991). The development in wage dispersions for blue-collar workers in the local public sector is more erratic, but the general trend is clearly consistent with the basic patterns for other groups (Statistics Sweden 1991).

9.2.2 Accounting for Changes in Wage Dispersion

In this section, we use the LNU and HUS micro data to investigate changes in the wage dispersion over the period 1968–91. We are interested in the extent to which changes in productive characteristics and changes in returns to these characteristics can account for the observed changes in wage dispersion. A similar exercise using the first four of our samples (LNU 1968, 1974, and 1981 and HUS 1984) is found in Björklund (1987); consequently, he dealt with the decline in wage dispersion. Hibbs (1990) used the first five of the samples to investigate whether changes in measured human capital characteristics could explain the changing wage dispersion among LO workers. He found that changes in human capital variance were much smaller than changes in earnings variance.

To address the question of changes in wage dispersion, we start by estimating simple human capital–type wage equations for each sample. We regress the log of hourly earnings on gender, a quadratic in experience, and years of schooling. The construction of hourly earnings is described above. Years of work experience is obtained from a direct question. Schooling is represented by dummy variables for each year of schooling above nine years, which corresponds to the compulsory schooling limit of the current system. (The schooling variable is truncated at eighteen years.) This choice was dictated by differences in the definition of schooling degrees obtained across the two surveys.[6]

6. The difference is in the definition of a university degree. The LNU samples apply a more strict definition of a university degree and do not include some degrees from the new *Högskola*, which were given university status in 1977. These degrees are counted in the HUS samples.

Table 9.2 Estimated Wage Equations

	1968	1974	1981	1984	1986	1988	1991
Const.	1.936	2.594	3.307	3.403	3.609	3.721	3.926
	(.020)	(.018)	(.016)	(.026)	(.031)	(.041)	(.040)
Female	−.262	−.205	−.148	−.125	−.128	−.129	−.135
	(.014)	(.011)	(.009)	(.013)	(.014)	(.017)	(.017)
Exp.	.037	.028	.023	.022	.019	.019	.024
	(.002)	(.001)	(.001)	(.002)	(.002)	(.003)	(.003)
Exp.^{2}/100	−.065	−.047	−.036	−.028	−.023	−.026	−.037
	(.004)	(.003)	(.003)	(.004)	(.005)	(.006)	(.006)
Years of schooling:							
10	.189	.088	.095	.071	.089	.114	.088
	(.022)	(.019)	(.017)	(.022)	(.026)	(.031)	(.034)
11	.189	.077	.104	.149	.122	.193	.140
	(.028)	(.019)	(.015)	(.020)	(.024)	(.028)	(.028)
12	.292	.164	.142	.162	.133	.167	.154
	(.033)	(.022)	(.016)	(.023)	(.026)	(.031)	(.030)
13	.452	.221	.216	.198	.197	.264	.216
	(.039)	(.024)	(.019)	(.024)	(.027)	(.031)	(.031)
14	.571	.277	.268	.302	.236	.279	.276
	(.041)	(.026)	(.021)	(.025)	(.029)	(.034)	(.035)
15	.669	.398	.274	.313	.335	.336	.346
	(.047)	(.031)	(.026)	(.026)	(.032)	(.039)	(.041)
16	.878	.449	.346	.358	.371	.384	.411
	(.057)	(.036)	(.028)	(.035)	(.037)	(.045)	(.046)
17	.975	.616	.400	.367	.400	.468	.399
	(.076)	(.045)	(.031)	(.038)	(.045)	(.048)	(.045)
18+	.920	.614	.414	.446	.421	.541	.431
	(.058)	(.035)	(.025)	(.034)	(.041)	(.046)	(.046)
N	2,957	3,009	3,431	1,629	1,818	1,537	1,323
R^2	.405	.348	.283	.352	.234	.225	.246
σ_ε	.353	.291	.264	.246	.301	.326	.306

Note: Standard errors are in parentheses. 18–65-year-olds excluding the self-employed. The 1968, 1974, and 1981 results refer to the LNU sample, and 1984, 1986, 1988, and 1991 are from the HUS sample. Definitions of the variables are given in the text.

Table 9.2 shows the estimates for the seven samples. We see that the absolute values of the estimated coefficients decrease in most cases between 1968 and 1984. This is consistent with the strong tendencies toward wage compression during this period. The gender wage differential is almost halved during this period, the experience profiles become much more flat, and the returns to education fall. The picture after 1984 is much less clear-cut. There are some tendencies toward increasing differentials, but these changes are relatively small. Note also that the explanatory power of the wage equation, measured in terms of R^2, falls markedly after 1984. It is also worth noting that the standard

deviation of the residual follows the same time pattern as overall wage dispersion.[7]

Before turning to a decomposition of the overall changes in wage dispersion, we take a closer look at wage differentials by education and age. These dimensions of wage inequality will receive additional attention in subsequent sections. Figure 9.4 shows the returns to higher education in terms of the university-gymnasium (college–high school) log wage premium, calculated from table 9.2 above as the wage differential between workers with sixteen and twelve years of education. Our estimated wage equations imply dramatic changes in the returns to education. The estimates show a sharp decrease in the return to a university degree between 1968 and 1974 and a continued fall until 1984; after 1984 there is a slight recovery. A similar pattern is found if the model is estimated with dummies for education levels instead of dummies for years of schooling.[8] We also plot the university-gymnasium wage differential from another data source. This series refers to monthly salaries for male, full-time, white-collar workers in mining, manufacturing, and construction. This series confirms the basic pattern from our wage equations. Using the wage difference between fifteen and twelve years of schooling from table 9.2 above as our measure of the university wage premium, we obtain a series that closely follows the "manufacturing" data.

Table 9.2 also revealed a substantial flattening of the experience-earnings profile. This profile is of course closely related to the age-earnings profile. Table 9.3 reports some results from estimations of wage equations where the experience variables are replaced by age dummies. The table gives the estimated log wage differentials for different groups, along with the corresponding wage ratio, relative to prime-age workers (aged thirty-five to forty-four years). The relative wage of eighteen- to nineteen-year-olds increased dramatically from about 55 percent of prime-age wages in 1968 to almost 80 percent in 1986. After 1986 there is a moderate drop in the relative wage of eighteen- to nineteen-year-olds by about 6 percentage points. The relative wage of twenty- to twenty-four-year-olds has been much more stable around 80 percent, with a minor increase between 1968 and 1974.

To what extent can changes in productive characteristics and changes in returns to these characteristics account for the observed changes in wage dispersion? In table 9.4, we use the estimated equations in table 9.2 above to generate

7. One might argue that changes in the wage structure should be more visible for workers who have recently entered the labor market. Therefore, we have estimated similar wage equations for workers twenty-five to thirty-four years old. These estimates show a similar development over time, but the estimates are in general much less precise, especially in 1986, 1988, and 1991. (The estimates are available from the authors on request.)

8. As a check for quality changes among university graduates, we estimated the seven wage equations separately for the cohort aged twenty-five to thirty-four years in 1968. These estimates show the same basic patterns as the full samples, thus providing no evidence for substantial quality changes.

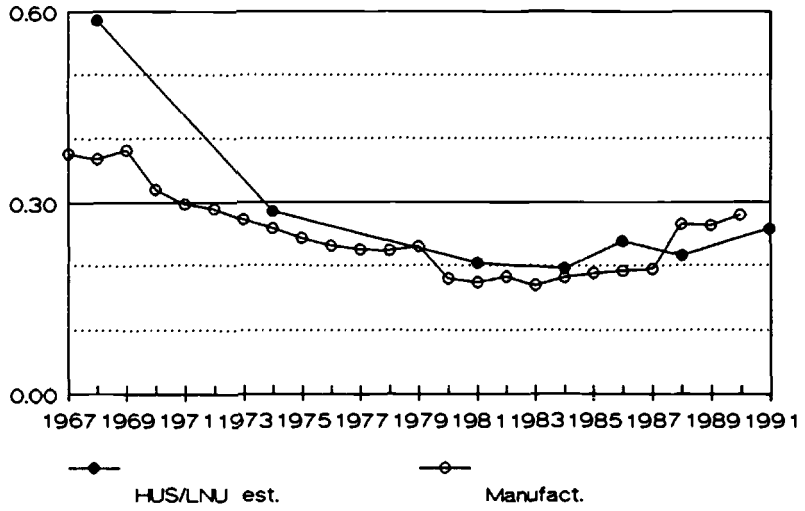

Fig. 9.4 University-gymnasium log wage differentials, 1967–91
Sources: Calculations based on table 9.2 (16 vs. 12 years of education) and Statistics Sweden.

the dispersion in predicted wages. The first panel shows that changes in the *characteristics* of the samples, weighted by the 1968 wage equation, are unable to account for the changing pattern of wage dispersion over time. If anything, the changes in sample characteristics would have produced *increasing* wage dispersion between 1968 and 1984, that is, during the period when the actual wage dispersion was dramatically reduced. In the second panel, we find that the changing *returns* to different characteristics produce a strong trend decline in dispersion (using characteristics of the 1968 sample as weights).[9] The standard deviation of predicted log wages falls from 0.29 in 1968 to 0.16 in 1981 and stays roughly constant thereafter. This decrease corresponds to almost 88 percent of the overall decrease in wage dispersion between 1968 and 1981 of 14.5 log points.[10]

In conclusion, then, we have shown that the substantial pay compression that took place during the 1960s and 1970s has been partly reversed during the second half of the 1980s. Wage compression in the earlier period was mainly due to decreasing dispersion between gender-experience-education groups, while the recent increase in dispersion has to a larger extent taken place within

9. The results are qualitatively the same if we use the 1991 characteristics and wage equations as weights.

10. A similar pattern is found for the young worker sample, with more than a 50 percent decrease in wage dispersion from 1968 (0.231) to 1981 (0.108). Also in this case we see a break in the trend after 1981; in fact, there is an *increase* in the standard deviation of predicted log wages during the 1980s. The predicted wage dispersion of young workers is almost as high in 1991 as in 1974 if we use the 1968 sample as weights. However, given the small number of observations (and low precision) in the young worker sample, these figures should be interpreted with caution.

groups. We have also shown that the earnings of young workers rose dramatically until the mid-1980s and that the return to higher education has changed sharply over time, closely mimicking the trends in overall wage dispersion.

9.3 Alternative Explanations

9.3.1 Demand and Supply Factors

Why have wage differentials in Sweden been reduced from the mid-1960s up to the early 1980s, and why are they widening from the mid-1980s? We

Table 9.3 **Youth Wage Differentials (vs. 35–44 years)**

	18–19		20–24		25–34	
	$\hat{\beta}$	Ratio	$\hat{\beta}$	Ratio	$\hat{\beta}$	Ratio
1968	−.605	.546	−.274	.760	−.073	.930
	(.035)		(.023)		(.020)	
1974	−.575	.563	−.224	.799	−.070	.932
	(.032)		(.020)		(.015)	
1981	−.396	.673	−.199	.820	−.105	.900
	(.031)		(.017)		(.013)	
1984	−.406	.663	−.220	.802	−.121	.886
	(.071)		(.026)		(.017)	
1986	−.229	.795	−.221	.802	−.052	.949
	(.056)		(.030)		(.020)	
1988	−.272	.762	−.186	.830	−.093	.911
	(.059)		(.036)		(.023)	
1991	−.303	.738	−.215	.806	−.077	.926
	(.087)		(.040)		(.028)	

Note: The estimates are based on wage equations with dummies for education, gender, and age (18–19, 20–24, 25–34, 45–54, 55–65). Ratio is the relative wage calculated as $\exp(\hat{\beta})$. Standard errors are in parentheses.

Table 9.4 **Standard Deviation of Predicted Log Wages**

	$\hat{\beta}_{68}$		X_{68}
X_{68}	.290	$\hat{\beta}_{68}$	.290
X_{74}	.314	$\hat{\beta}_{74}$	.200
X_{81}	.328	$\hat{\beta}_{81}$	.163
X_{84}	.351	$\hat{\beta}_{84}$	.179
X_{86}	.346	$\hat{\beta}_{86}$	.164
X_{88}	.349	$\hat{\beta}_{88}$	.165
X_{91}	.353	$\hat{\beta}_{91}$	.171

Note: The left panel shows the standard deviation of predicted log wages using the 1968 estimates for all samples, while the right panel shows the standard deviation when estimates for different years are applied to the 1968 sample.

begin our investigation by examining how far conventional demand and supply factors can explain movements in wage differentials by education and age. We make use of a variety of data sources that provide time-series variation in relative wages as well as potential explanatory variables, including the seven micro-data sets that were used in the previous section.

A simple theoretical framework is illustrated in figure 9.5. Consider two types of workers, for example, young (y) and adult (a) workers. The number of potential labor force participants in the two categories is denoted L_y and L_a, respectively. Effective supply is lower than potential supply because of frictional unemployment and other kinds of nonparticipation. Let effective supply be given as $N_y = \nu L_y W_y^{\eta}$ and $N_a = \mu L_a W_a^{\eta}$, where W_y and W_a are real-wage rates. Effective relative supply is then obtained as $N_y/N_a = (\nu/\mu)(L_y/L_a)(W_y/W_a)^{\eta}$. As drawn, the figure implies $\eta = 0$. The downward-sloping curve represents a relative demand schedule that is compatible with a production function of the CES variety. Equilibrium obtains where relative demand (D_r) equals effective relative supply (S_r).

Suppose that wages are flexible, and consider an increase in the potential relative supply of young workers. If the effective relative supply is independent of the relative wage, as implied by figure 9.5, we obtain a relative wage response to the increase in relative supply as given by the elasticity $-1/\sigma$, where σ is the (constant) elasticity of substitution between young and adult workers. The relative employment response is in this case equal to one, implying that

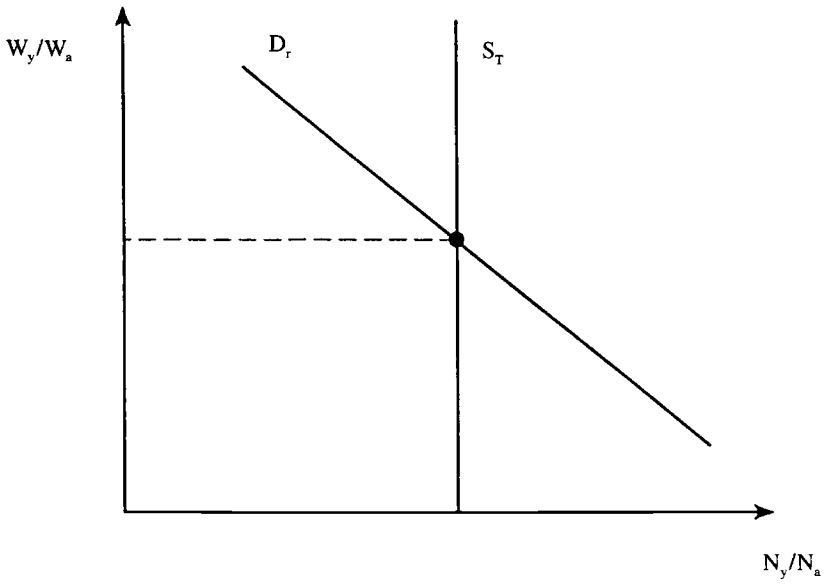

Fig. 9.5 The determination of relative wages

employment–to–labor force ratios remain constant. These wage and employment responses are modified when the relative supply depends on the relative wage. Suppose that the effective relative supply is wage elastic, with η denoting the (constant) elasticity. The market-clearing wage response to an exogenous increase in the potential supply is then given by the elasticity $-1/(\sigma + \eta)$, whereas the employment elasticity is given as $\sigma/(\sigma + \eta)$.

We apply this simple framework to an analysis of wage differentials by education and age categories. The key exogenous variable on the supply side is potential relative supply. We take relative labor force shares as exogenous in the analysis of education wage differentials. (The results are almost identical if relative population shares are used instead of relative labor force shares.) Participation decisions among youths are, however, sensitive to labor market conditions and schooling opportunities, so relative labor force shares may fail to be exogenous with respect to relative wages. Relative population shares are therefore taken as exogenous in the analysis of age-earnings differentials.

Educational Wage Differentials

We have documented a substantial fall and a subsequent partial rebound of the university wage premium, that is, the relative wage differential between university and high school graduates. Movements in the university wage premium can usefully be interpreted as the outcome of shifts in the relative supply of and relative demand for highly educated workers or—to use the terminology of Tinbergen (1975)—the "race" between education and technology. To the extent that market forces have been of importance in forming the Swedish wage structure, the market for university graduates should have been particularly responsive. The direct influence of union egalitarianism has most likely been least pervasive at the upper end of the wage distribution.

There is a common presumption that technological progress is associated with a steady increase in the relative demand for highly educated labor. Direct evidence on this matter is meager, however. We have confined ourselves to examining the role of sectoral shifts in employment by making use of simple "fixed manpower requirements" models. (For similar applications, see Freeman 1980; and Katz and Murphy 1992.) The two data sets at hand are far from ideal, but they both tell a similar story. One data set is based on the labor force surveys and captures the whole economy but has little industrial detail (only seven sectors including the public sector). The other data set describes mining and manufacturing, with a disaggregation into forty-four industries. Education by sector data are available in the labor force surveys from 1971 on; for mining and manufacturing we have education by industry data for 1970 and 1985. We use four education categories: (i) primary education (education levels below gymnasium); (ii) secondary education (gymnasium one to three years); (iii) some university (one to two years); and (iv) university (three years or more). The basic formula yielding the relative demand for education category k at time t is

$$D_{kt} = \sum_j a_{kj}(N_j/N)_t, \tag{1}$$

where N_j is employment in sector j, N is total employment, and $a_{kj} = N_{kj}/N_j$ is the fixed labor skill coefficient calculated as the ratio of the number of workers in education k and industry j to total employment in industry j. For mining and manufacturing we compute the labor skill coefficients as averages of the coefficients for 1970 and 1985. For the whole economy we make use of three years—1971, 1984, and 1991—to obtain measures of skill coefficients.

The results of these computations, expressed as annualized percentage changes, are displayed in table 9.5. The basic pattern is that the relative demand for highly educated workers grows at a *slower* pace during the late 1980s than during the 1970s and the early 1980s. This pattern differs from what has been observed in Britain and the United States, where skill-biased demand shifts are of the same order of magnitude in the 1980s as in the 1970s (see Katz and Murphy 1992; and Katz, Loveman, and Blanchflower, chap. 1 in this volume). Our results thus suggest that sectoral shifts offer little help in explaining the observed movements in the university wage premium. Measured changes in the allocation of labor among industries seem to have been *less* favorable to more educated workers during the period of rising returns to university education. This is clearly inconsistent with a simple demand-side explanation of the changes in the university wage premium.

Turning next to the supply side, two distinct patterns in the data are required in order to explain observed movements in the wage differentials (absent obvious explanatory power from the demand side). There must be a trend increase in the relative supply of highly educated workers during a period lasting roughly from the 1960s to the early 1980s; the sharp fall in the university wage premium would otherwise be difficult to explain by conventional market forces. There must also be a pronounced *deceleration* in this relative supply growth in order to explain the rebound of the returns to higher education since the mid-1980s. In fact, both these patterns do appear in the data.

Table 9.5 **Demand Shift Indices, 1970–91**

	Mining and Manufacturing (44 sectors)		All Industries (7 sectors)	
	1970–84	1984–90	1971–84	1984–91
Primary education	−.18	−.01	−.56	−.32
Secondary education	.20	.04	.05	.14
Some university (1–2 years)	.61	−.01	1.13	.36
University (3 years or more)	.83	−.22	1.44	.43

Sources: Own computations based on eq. (1) using unpublished tables from Statistics Sweden (mining and manufacturing) and the labor force surveys (all industries). The table shows annualized percentage changes in relative demand.

Figure 9.6 displays the labor force shares of three main categories of education—primary, secondary, and higher education—over the period 1971–91. The period is clearly characterized by a steady increase in the level of education. Those with only primary education constitute less than 30 percent of the labor force in the early 1990s. The fraction with higher (at least some university) education has more than doubled since the early 1970s.

A closer look at the relative supply changes is provided by table 9.6 and figure 9.7. The labor force share of university graduates (with university education for at least three years) has increased steadily up to the mid-1980s; the share stays roughly *constant*, however, during the second half of the 1980s and up to the early 1990s.

The decline and subsequent rebound of the university wage premium thus seems consistent with a simple explanation emphasizing relative supply movements. The ratio between the number of labor force participants with a university degree and the number with (three years of) gymnasium stood at 0.48 in 1971 and reached 0.90 in the mid-1980s; by 1991 the ratio had declined to 0.80. The university wage premium, obtained from the estimated wage equations in table 9.2 above, is negatively correlated with the relative supply of university graduates. The negative relation between relative wages and relative supplies appears consistent with a simple model with stable relative demand and fluctuating relative supply. There are only seven data points, however, and one would like to see corroborating evidence from other sources. This leads us

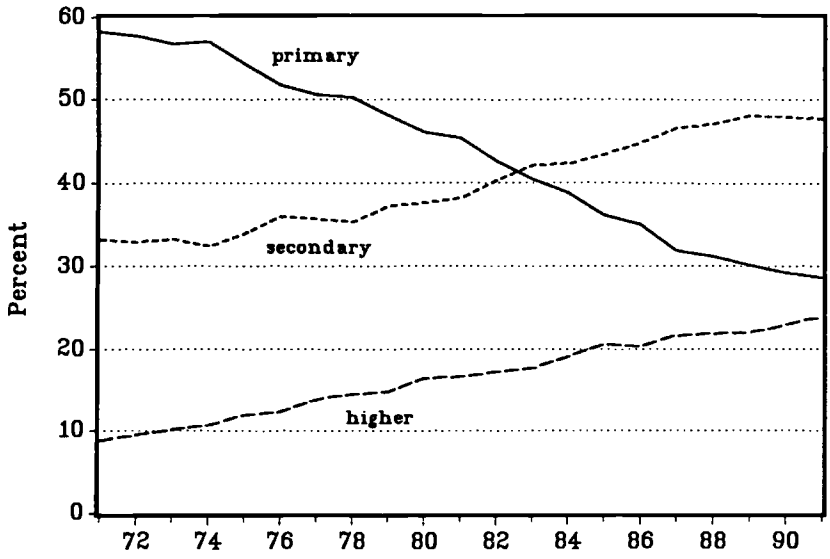

Fig. 9.6 Education in the Swedish labor force, 1971–91
Source: The labor force surveys, Statistics Sweden.

Table 9.6 **Relative Supply Changes by Education, 1972–91**

	1972–74	1975–80	1981–84	1985–91	1972–91
Primary	−.39	−1.82	−1.82	−1.46	−1.48
	(−.67)	(−3.55)	(−4.30)	(−4.37)	(−3.56)
Some gymnasium (1–2 years)	−.47	.91	.80	.50	.54
	(−2.19)	(3.89)	(2.89)	(1.59)	(1.97)
Gymnasium (3 years)	.20	−.04	.35	.28	.19
	(1.74)	(−.38)	(2.93)	(2.06)	(1.46)
Some university (1–2 years)	.23	.53	.18	.57	.43
	(6.09)	(9.62)	(2.38)	(5.77)	(6.29)
University (3 years or more)	.43	.42	.48	.11	.33
	(7.36)	(5.38)	(4.81)	(.99)	(4.02)

Source: The labor force surveys, Statistics Sweden.

Note: The figures are mean annual changes of labor force shares, multiplied by 100; the parentheses show mean annual changes of *log* shares, multiplied by 100.

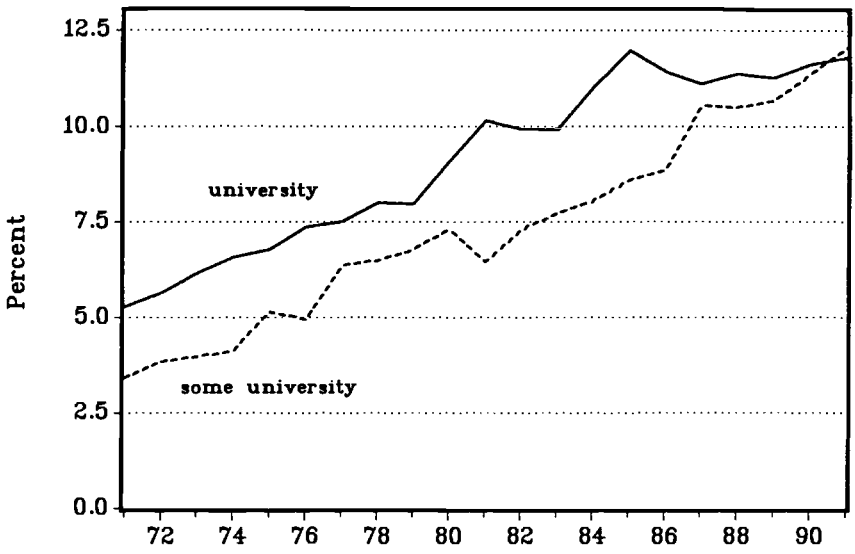

Fig. 9.7 University education in the Swedish labor force, 1971–91
Source: The labor force surveys, Statistics Sweden.

to an examination of movements in the university wage premium within Swedish industry (mining, manufacturing, and construction).

Statistics on private-sector, white-collar workers' salaries, disaggregated by education, are available in official statistics from the late 1960s (see fig. 9.4 above). There is a pronounced decline in the university wage premium from the late 1960s to the early 1980s followed by a rise in the late 1980s, similar

to the pattern found in our micro data. We take the private-sector university wage premium as a proxy for the corresponding economy-wide differential and apply the simple relative demand–relative supply framework, including a time trend to allow for shifts in relative demand. Table 9.7 displays the regression results. The simple model is remarkably successful in explaining the relative wage movements. The estimated elasticity with respect to relative supply in column 2 suggests an elasticity of substitution between university and high school graduates of 2.9 (assuming wage-inelastic relative supply). Available evidence from other countries suggests elasticities of substitution between highly educated and less educated workers of between one and two (see Freeman 1986). It is noteworthy that the regressions in the last two columns, based on only seven data points, produce estimates of the relative supply effect that are of a similar order of magnitude. The positive trend coefficients in columns 2 and 3 suggest that secular demand shifts have favored highly educated workers.

Youth Relative Wages

Our estimated wage equations have revealed a substantial fall in the returns to experience from the late 1960s. This has implied rising relative wages

Table 9.7 **The University Wage Premium and Relative Supply: Dependent Variable, $\ln(W_u/W_g)$**

	Industry			All Sectors (68, 74, 81, 84, 86, 88, 91)	
	1971–90		1972–90	16–12 Years	15–12 Years
	(1)	(2)	(3)	(4)	(5)
Constant	.179	.024	−.026	.144	.124
	(13.40)	(.73)	(.72)	(4.50)	(7.08)
$\ln(L_u/L_g)$	−.143	−.350	−.251	−.429	−.259
	(4.16)	(7.33)	(4.33)	(5.73)	(6.29)
$\ln(L_u/L_g)_{-1}$			−.155		
			(2.45)		
Time		.008	.011		
		(4.93)	(5.88)		
$\bar{R}^2$	.462	.765	.790	.842	.865
SE	.031	.020	.018	.055	.030
D-W	.49	2.27	2.35		

Note: Absolute *t*-values are in parentheses. The dependent variable in cols. 1–3 is the university/gymnasium log wage differential among male white-collar workers in mining, manufacturing, and construction. The dependent variables in the last two columns are the estimated university/gymnasium log wage differentials obtained from table 9.2, 16 vs. 12 years and 15 vs. 12 years of schooling. $L_u(L_g)$ is the number of labor force participants with university (gymnasium) education. The relative supply figure for 1968 is imputed by using the figure for 1971 and assuming that the change in L_u/L_g over the period 1968–71 is the same as the observed change over the period 1971–74.

among youths in the labor market, as is evident from table 9.3 above. The relative wage improvement is particularly striking for teenagers; the wage of eighteen- to nineteen-year-olds relative to thirty-five- to forty-four-year-olds rose from 55 percent in 1968 to 80 percent in 1986, with some decline over the following years.

To what extent can these movements in youth relative wages be explained by relative supply changes, assuming smooth and possibly nonneutral demand shifts? The youth labor market in postwar Sweden, as well as in many other countries, has been exposed to substantial demographic shocks (cf. Freeman and Bloom 1986). The timing of the baby boomers' impact is illustrated in figure 9.8 by the number of eighteen- to nineteen-year-olds. The size of this age group peaked in the mid-1960s and decreased substantially between 1965 and 1980. The second wave of large youth cohorts entered the labor market in the mid-1980s, and there are noticeable fluctuations in the number of youths over the late 1980s and up to 1991.

The marked fluctuations in the size of the youth cohorts translate into substantial changes in relative population ratios. The period of rising youth relative wages coincides with a trend decline in the relative youth population. The ratio of eighteen- to nineteen-year-olds relative to thirty-five- to forty-four-year-olds declined from .25 to .19 over the period 1968–86. By regressing the estimated log wage differentials in table 9.3 on the corresponding log relative population ratios, we obtain for the eighteen- to nineteen-year-olds an estimated coeffi-

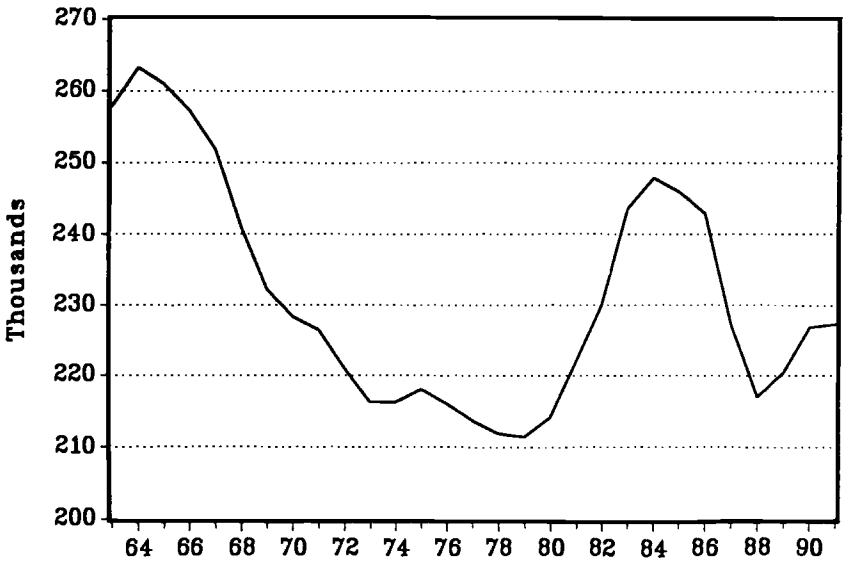

Fig. 9.8 The number of 18–19-year-olds in the population, 1963–91
Source: The labor force surveys, Statistics Sweden.

cient on the relative supply variable of −0.96 with a *t*-value of 6.2. For twenty- to twenty-four-year-olds the corresponding relative supply elasticity is −0.12 with a *t*-value of 2.5. These estimates have the reasonable implication that twenty- to twenty-four-year-olds are closer substitutes to prime-age workers than eighteen- to nineteen-year-olds are. The results are encouraging and suggest that explorations of other data sources may be worthwhile.

We make use of time series on youth relative wages in mining and manufacturing over the period 1970–88.[11] In these data, youths are identified as those aged eighteen to twenty-four, whereas adults are those aged twenty-five to forty-nine. Table 9.8 presents the results of simple models with only two explanatory variables; the population ratios capture relative supply, and the trend captures everything else with a trend component, including relative quality changes and nonneutral demand shifts. For three of the four groups we obtain sizable negative estimates of the relative supply effect. The exception is young female blue-collar workers, whose relative wages have shown a continuous upward trend over the whole period.

Our examination of wage differentials by age thus leads to the same basic conclusion as the analysis of educational wage differentials: relative wage fluctuations seem to be driven by fluctuations in relative supply. It is clear, however, that the estimated models have been extremely simple and allowed only for "own effects" in the quantity-to-wage link. This means that the particular estimates are unlikely to survive a more elaborate modeling of factor demand systems. The magnitudes of the estimated relative supply effects are plausible, however, and usually not very different from estimates obtained in other studies.

Gender Wage Differentials

From 1968 to 1981 we also observe a remarkable increase in the relative wage of females. This has occurred simultaneously with a large increase in the female labor supply (table 9.9). After 1981 the gender wage gap has been more or less stable at the same time as the growth of female relative supply has gone down. There are several factors that may help explain these movements in relative wages and relative supply, such as the abolishment of separate female wage scales by SAF and LO in the early 1960s, the introduction of separate taxation for spouses between 1965 and 1971, the changing rules and benefits for maternity leave, and the increasing supply of public day care. We will not go into details about the possible explanations, however. It will be sufficient here to highlight one factor, namely, demand. Applying the fixed manpower requirements model, and calculating the relative demand for females for the whole economy (using seven sectors), we get the demand changes reported in table 9.9. Measured relative demand for females increased sharply between 1968 and 1981. During the 1980s, in contrast, we find no changes in

11. We are grateful to Per Skedinger for providing these data. For details, see Skedinger (1990).

Table 9.8 **Youth Relative Wages and Relative Population Ratios (18–24 vs. 25–49 years), 1970–88: Dependent Variable, $\ln(W_y/W_a)$**

	Blue-Collar Workers			White-Collar Workers			
	Males		Females	Males		Females	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	−.397	−.507	−.124	−.805	−.778	−.763	−.801
	(9.95)	(3.25)	(3.45)	(10.34)	(4.47)	(10.61)	(6.32)
$\ln(P_y/P_a)$	−.201	−.291	−.028	−.241	−.215	−.378	−.407
	(5.71)	(2.28)	(.89)	(3.52)	(1.47)	(5.97)	(3.78)
Time	.003	.003	.002	.002	.003	−.0009	−.0008
	(6.99)	(3.42)	(4.91)	(2.91)	(2.09)	(1.15)	(.72)
$\bar{R}^2$	.945	.947	.788	.811	.819	.760	.745
SE	.007	.006	.006	.014	.012	.012	.012
D-W	1.03	1.95	1.44	1.02	1.47	1.24	1.82
AR(1)	No	Yes	No	No	Yes	No	Yes

Note: For details on the wage variables, which refer to mining and manufacturing, see Skedinger (1990). The population series refer to both males and females and are obtained from the labor force surveys. Absolute t-values are in parentheses.

Table 9.9 **Changes in Female Relative Wages, Relative Demand and Supply**

	$\Delta \ln (W_f/W_m)$	$\Delta \ln D_f$	$\Delta \ln (L_f/L_m)$
1968–74	.057	.084	.152
1974–81	.057	.069	.170
1981–84	.023	.018	.039
1984–91	−.010	−.012	.041

Note: $\Delta \ln (W_f/W_m)$ is the change in the standardized female relative wage, as implied by table 9.2. $\Delta \ln D_f$ is the measured change in relative demand for female labor, applying eq. (1) to data from the labor force surveys, and using the average weights (a_{kj}) for 1968, 1981, and 1991. $\Delta \ln (L_f/L_m)$ is the change in female/male shares of the labor force from the labor force surveys.

relative demand. This development is partly driven by the rapid growth of public-sector employment during the 1970s and the subsequent deceleration of public-sector expansion during the 1980s. The demand pattern is strikingly similar to the relative wage pattern of females. Clearly, relative demand shifts for female labor is a factor that cannot be overlooked in an investigation of gender wage differentials in Sweden.

9.3.2 Institutional Factors

Egalitarianism became a pervasive ingredient of LO's solidarity wage bargaining from the mid-1960s through the 1970s. The policy was implemented through central framework agreements with low-wage provisions. TCO's egali-

tarian ambitions were always less explicit than LO's, but there is little doubt that the unions within TCO adhered to wage policies that were largely similar to those of LO.

Wage bargaining within the LO-SAF area from 1956 to 1983 took place at three levels, namely, the national, the industry, and the local plant levels. The central frame agreement typically involved three components: (i) a common flat rate amount specified in öre; (ii) a wage-drift guarantee with the purpose of compensating workers who received no or only small pay rises in excess of the contractual increase; and (iii) a low-wage adjustment amount targeted at workers whose actual hourly wages were lower than a specified reference level (the low-wage boundary). In addition, cost-of-living adjustments, typically on a flat rate basis, were negotiated in some of the frame contracts.

Hibbs (1990) has simulated the wage distribution implied by complete implementation of the frame agreement in the LO-SAF area. His main finding is that the trend decline in the actual dispersion from the early 1970s to the early 1980s is closely tracked by the frame dispersion. The frame always implied a more compressed wage structure than the actual outcome, however; on average, around 80 percent of the frame compression was achieved. Hibbs's results are striking, but they give no information on whether the frame agreements were compatible with the fundamental demand and supply forces. For example, we have seen that the market environment during the 1970s favored rising youth relative wages, which surely explains part of the decline in overall dispersion among LO workers.

We have not attempted any detailed examination of the sources of the reduced wage dispersion among LO workers to ascertain to what extent the wage agreements have conformed to demand and supply factors. It seems implausible, however, to rule out any independent role for egalitarian union wage policies. Solidarity wage bargaining is closely linked to coordinated wage negotiations, and centralized wage negotiations were effectively dismantled from 1983 on. If the changes in the wage-bargaining system are more substance than form, we should expect to find significant changes in wage behavior over the second half of the 1980s.

We address the issue of institutional changes by offering a brief analysis of wage determination at the industry and regional levels. One issue is whether the breakdown of centralized wage bargaining has made industry wages more responsive to industry-specific factors. Earlier work has indicated that industry-specific factors such as output prices or productivity have a negligible effect on industry wages in Sweden (Holmlund and Zetterberg 1991; Forslund 1992, 1994). If centralization matters, one would expect to see more scope for rent sharing as the system becomes more decentralized.

We have estimated simple industry wage equations to explore whether sectoral variables become more important after 1983. We make use of pooled time-series and cross-sectional data for twenty-eight industries within Swedish

manufacturing, covering the period 1963–89.[12] The hourly wage rate pertains to blue-collar workers. The basic idea is to view the industry wage as shaped by a blend of industry-specific variables and general labor market variables as in studies by, among others, Blanchflower, Oswald, and Garrett (1989), Nickell and Wadhwani (1990), Holmlund and Zetterberg (1991), and Forslund (1992, 1994). We expect that the shift to more decentralized wage bargaining has increased the importance of the industry-specific variables, here captured by (lagged) profits per employee. The general labor market variables are captured by time dummies.

Table 9.10 presents the results of estimations of error correction type specifications, where the change in the log wage rate of the industry ($\Delta \ln W_{it}$) is explained by the lagged dependent variable, the lagged wage *level,* as well as the lagged profit variable. The latter is defined as $R_{it} = (\mathrm{VA}_{it} - \mathrm{WT}_{it})/E_{it}$, where VA is value added, WT is the total wage bill in the industry, and E is the total number of employees. (WT and E include both blue- and white-collar workers.) The second column includes dummy interaction terms to test the hypothesis that sectoral variables have become more important as a result of the shift to industry bargaining. There is some evidence in favor of the hypothesis. The coefficient on the lagged profit variable is significantly larger during the period 1983–89 than during the earlier years, suggesting an increasing albeit small role for rent sharing during the latter part of the 1980s.

A more decentralized wage-bargaining system may also make regional wages more responsive to regional labor market conditions. Some evidence on this matter can be obtained from a different data source pertaining to regional wages. We use pooled cross-sectional and time-series data for twenty-four regions (*län*) over the period 1966–89 (see Jansson and Östros 1991). We allow for regional fixed effects as well as time dummies. The major difference compared to the industry wage equations is that we include a measure of regional labor market tightness, the difference between the vacancy rate and the unemployment rate ($V - U$) in the region (as a percentage of the labor force). Measures of firms' performance are not available, however. Table 9.11 gives the results. Regional wages do respond to changes in tightness, but the effect is quantitatively small. There is no evidence that wages have become more responsive after 1983, as is clear from column 2 in the table.

The basic message that emerges from these analyses of industry and regional wage behavior is that the changes in the wage-bargaining system have so far had only weak effects on wage behavior at the sectoral level. The effect that can be identified suggests an increasing role for rent sharing, as should be expected.

One piece of evidence that may indicate that the wage policy has been important is the behavior of residual wage dispersion. As was observed in connection with table 9.2 above, residual dispersion followed a time pattern that was

12. This is an updated version of the data set used in Holmlund and Zetterberg (1991).

Table 9.10 **Industry Wage Equations, 1965–89: Dependent Variable, $\Delta \ln W_{it}$**

	(1)	(2)
$\ln W_{i,t-1}$	−.222	−.248
	(7.97)	(8.66)
$\Delta \ln W_{i,t-1}$	−.271	−.263
	(7.01)	(6.85)
$\ln R_{i,t-1}$	.005	.001
	(1.17)	(.34)
D8389 · $\ln R_{i,t-1}$		.009
		(3.42)
$\bar{R}^2$	.605	.611
SE	.020	.020

Note: Absolute t-values are in parentheses. D8389 is a dummy for the period 1983–89. Full sets of time dummies and industry dummies are included. There are 700 observations.

Table 9.11 **Regional Wage Equations, 1966–89: Dependent Variable, $\Delta \ln W_{it}$**

	(1)	(2)
$\ln W_{i,t-1}$	−.138	−.138
	(7.50)	(7.48)
$\Delta(V - U)_{i,t-1}$	.002	.002
	(3.16)	(3.18)
$(V - U)_{i,t-1}$	.002	.002
	(2.24)	(2.25)
D8389 · $\Delta(V - U)_{i,t}$		−.001
		(.72)
D8389 · $(V - U)_{i,t-1}$		−.0002
		(.17)
$\bar{R}^2$	.883	.882
SE	.009	.009

Note: Absolute t-values are in parentheses. D8389 is a dummy for the period 1983–89. Full sets of time dummies and regional dummies are included. U and V are measured in percentages. There are 576 observations.

similar to overall dispersion. We do not have obvious candidates for supply shifts that can explain this fact. Other studies indicate that a substantial part of this decreasing within-group dispersion was associated with decreasing wage differentials between industries (Arai 1991; Edin and Zetterberg 1992).

9.4 The Performance of the Labor Market for Youths

Economists and other observers have expected to see a deterioration in youth labor market performance as a response to institutionally driven increases in youth relative wages. Our analysis, however, suggests that movements in wage differentials by age are largely consistent with a simple demand and supply

framework with flexible wages. The trend increase as well as the subsequent modest decline in youth relative wages can be accounted for by changes in the relative supply of young workers. This view also implies that youth relative *employment* should adjust to changes in the relative size of the youth population. This section examines this hypothesis, along with other aspects of youth labor market performance. The evidence that emerges is somewhat mixed, but severe distortions are difficult to establish.

We have noted sharp increases in youth relative wages over the 1970s and the 1980s (see table 9.3 above). The relative wage increases have been particularly strong for eighteen- to nineteen-year-olds, whereas the relative wages of twenty- to twenty-four-year-olds have increased only modestly. If youth relative wages can be explained by demand and supply forces, we should also expect youth relative employment shares to be highly responsive to movements in youth relative population shares. Youth relative employment should in fact be unit elastic with respect to relative population if relative supply is wage inelastic. If the youth labor market is characterized by rigid relative wages, perhaps owing to negotiated minimum wages, we should on the other hand expect only weak employment responses to population changes. These responses should in that case be particularly weak among eighteen- to nineteen-year-olds as relative wage increases have been most dramatic for this group.

Table 9.12 presents results of relative employment regressions of the form

$$\ln(N_y/N_a) = \alpha + \beta \ln(P_y/P_a) + \gamma U + \varepsilon, \tag{2}$$

Table 9.12 **Youth Relative Employment and Relative Population Ratios, 1964–91: Dependent Variable, $\ln(N_y/N_a)$**

	Males 18–19		Males 20–24		Females 18–19		Females 20–24	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	−.675	−.848	−.469	−.486	.307	.914	.912	−.163
	(.99)	(1.61)	(8.05)	(5.45)	(.33)	(1.97)	(.142)	(1.19)
$\ln(P_y/P_a)$	.859	.730	.768	.754	1.225	1.310	.825	.766
	(3.51)	(3.28)	(19.47)	(11.99)	(3.72)	(6.66)	(5.86)	(7.32)
	[.58]	[1.21]	[5.95]	[3.57]	[.68]	[1.57]	[1.24]	[2.23]
U	−.065	−.060	−.030	−.030	−.053	−.065	−.022	−.026
	(4.37)	(4.12)	(6.09)	(5.97)	(2.74)	(3.73)	(2.42)	(3.06)
Time		−.007		−.0003		−.013		−.012
		(1.52)		(.24)		(4.77)		(8.42)
$\bar{R}^2$	.941	.944	.986	.985	.973	.978	.985	.989
SE	.032	.031	.011	.011	.043	.038	.022	.019
D-W	2.31	2.15	1.32	1.32	2.50	1.94	2.69	1.82

Note: All estimations allow for first-order autocorrelated errors. Absolute t-values are in parentheses and brackets; tests for coefficients equal to unity are in brackets. The unemployment rate (U) is measured in percentages.

Table 9.13 **The Youth Labor Market, 1968–91 (%)**

	Unemployment Rate					Employment/Population			
		Males		Females		Males		Females	
	All, 16–64	18–19	20–24	18–19	20–24	18–19	20–24	18–19	20–24
1968	2.2	5.8	3.0	4.6	3.0	62.4	75.3	61.3	61.7
1974	2.0	4.3	2.7	7.4	3.2	64.9	78.5	60.6	68.3
1981	2.5	7.6	4.8	9.9	4.7	62.1	79.5	62.2	78.8
1984	3.1	5.0	6.2	3.9	6.6	57.3	77.7	61.8	74.8
1986	2.7	4.2	6.3	4.1	6.2	58.6	76.4	61.5	75.8
1988	1.6	2.3	3.3	3.3	3.4	60.8	81.4	64.5	78.0
1991	2.7	7.5	6.7	6.8	5.8	53.0	77.2	59.1	73.8

Source: The labor force surveys, Statistics Sweden.

Note: The figures are not adjusted for the changes in measurement techniques introduced in 1987.

where N_y/N_a is relative youth/adult employment, P_y/P_a is relative population, and U is the aggregate unemployment rate. P_a is represented by the number of twenty-five- to forty-nine-year-olds. If the labor market is competitive and relative supply is wage inelastic, we expect $\beta = 1$. The alternative extreme case involves complete wage rigidity and $\beta = 0$. The unemployment rate is included to capture the possibility that the cyclic variability of the ratio of effective to potential supply varies among age groups.

The results displayed in table 9.12 show substantial employment responsiveness to population changes. The point estimates of β are typically lower than unity, but in most cases we cannot reject the hypothesis of complete employment adjustment, that is, $\beta = 1$. The exception is male twenty- to twenty-four-year-olds. There is no support for the hypothesis that teenage employment is particularly rigid with respect to population changes.

There is, however, some evidence indicating a deterioration in youth labor market performance. From the mid-1960s to the early 1980s there is a trend increase in youth unemployment rates and also a trend increase in youth relative to adult unemployment (tables 9.13 and 9.14). Youth participation in labor market programs has also increased, particularly during the mid-1980s. For example, over 10 percent of sixteen- to nineteen-year-olds were engaged in public employment programs in 1984.

Employment/population ratios among sixteen- to nineteen-year-olds have shown a trend decline since the 1960s (table 9.14). This is mainly due to a rise in school enrollment, however. There is a strong trend increase in school enrollment among teenagers, reflecting in part an expansion of the senior high school to provide (usually two years of) vocational training. School enrollment among sixteen- to nineteen-year-olds—measured as the number of full-time students as a percentage of the population—stood at 30 percent in the mid-

Table 9.14 Labor Market Activities and School Enrollment among 16–19-Year-Olds (%)

	U	LFPR	*N/P*	*S/P*	*R/P*	*M/P*	$(N + S)/P$	$(N - R + S)/P$
1968	5.7	54.6	51.4	32.8			84.2	
1974	6.6	55.2	51.6	32.7			84.3	
1981	9.4	49.7	45.1	41.3	1.5	1.8	86.4	84.9
1984	4.9	45.3	43.1	44.5	10.1	1.3	87.6	77.5
1986	4.1	45.0	43.2	47.3	7.3	.7	90.5	83.2
1988	3.1	47.3	45.9	49.3	4.0	.5	95.2	91.2
1991	6.7	44.7	41.7	51.2			92.9	

Source: The labor force surveys, Statistics Sweden, and the Swedish Labor Market Board.

Note: U = unemployment rate; LFPR = labor force participation ratio; P = population; N = employment; S = school enrollment; R = relief jobs (including youth jobs and youth teams); M = manpower training (including vocational introduction programs); N is inclusive of R; and S is inclusive of M.

1960s and had risen to 50 percent in the early 1990s. Column 7 of table 9.14 shows that the fraction of teenagers in employment or school has increased from 84 percent in 1968 to over 90 percent in the early 1990s. A similar picture emerges if employment is confined to "regular" employment by excluding workers in public employment programs (col. 8).

The evidence on the performance of the youth labor market is thus mixed. There is some increase in youth relative unemployment and/or youth participation in labor market programs. There is, however, also a trend rise in the proportion of teenagers engaged in "productive activities," that is, an increase in the share engaged in employment or education. Rising school enrollment has made the labor force participants among teenagers an increasingly selected group with relatively low educational attainment; this contributes to higher relative youth unemployment. Other institutional changes have worked in the same direction. There have, for example, been marked changes in the availability and levels of unemployment benefits; the Swedish unemployment insurance system was much more generous in the 1980s than in the 1960s (Björklund and Holmlund 1991). Labor market regulations, in particular the legislation on employment protection, may also have contributed to some increase in youth unemployment by making firms less likely to hire workers with little previous labor market experience.

9.5 The Returns to Education and School Enrollment

We have documented a sharp fall and a subsequent modest rebound of the university wage premium. How has the demand for higher education been affected by these movements? It should be noted that the university wage premium is an imperfect measure of the private gains from university education. The private internal rate of return is also affected by the progressivity of the

tax system, by tuitions, and by the availability and generosity of student loans and stipends. The Swedish tax system became gradually less progressive in the late 1980s; a new comprehensive tax system was introduced in 1990–91 with roughly 50 percent as the top marginal tax rate on labor earnings. Swedish university students have had access to stipends and subsidized loans since the early 1960s. A new student loan system was introduced in 1989. A university student receives a monthly tax-free sum of approximately 70 percent of a blue-collar worker's average after-tax earnings; one-third of this sum is a pure stipend, and the remainder is a loan.

Accounting for taxes and subsidized student loans has a substantial effect on calculations of the private internal rate of return to university education. We have undertaken calculations based on the standard procedure of computing internal rates of return from a single cross section, thus ignoring general economic growth. We consider a man aged twenty who has left gymnasium and contemplates four years of university education. The estimated wage equations are used to calculate lifetime income profiles for the two alternatives assuming that retirement takes place at age sixty-five; the discount rate that equalizes the two paths is the private internal rate of return to university education. Any direct costs of education are ignored; tuition is essentially zero in Sweden, and other direct costs (books etc.) are probably offset by access to low-priced housing, drinking, and dancing. The first column of table 9.15 shows the rate of return unadjusted for taxes, and the second column accounts for taxes. The progressive tax system sharply reduced the return in the 1970s and early 1980s, while increasing wage differentials and lowered tax rates have increased the returns during recent years.

The calculations reported in table 9.15 do not account for stipends, which of course will lead to an underestimate of the returns to education. (We cannot compare the old and the new student loan systems in a meaningful way without making explicit assumptions about inflation.) For 1991 we have calculated the return to education assuming forward-looking expectations concerning infla-

Table 9.15 **Internal Rates of Return to Higher Education, Males, 1968–91, Static Expectations (%)**

	Without Taxes	With Taxes
1968	15.7	11.9
1974	6.9	3.6
1981	4.3	.5
1984	3.9	1.7
1986	5.3	3.3
1988	4.7	2.7
1991	6.0	4.5

Note: The calculations are based on the estimated wage equations in table 9.2. The tax system that prevails in a particular year is assumed to remain intact over the individual's life cycle. The calculations do not account for stipends.

Table 9.16 **Internal Rates of Return to Higher Education, Males, 1991, Forward-Looking Expectations (%)**

	Without Taxes	With Taxes
No stipends or loans	7.0	6.6
Stipends and loans (8 percent interest rate)	9.8	11.0

Note: The calculations are based on the estimated wage equations in table 9.2. The 1991 tax system is assumed to remain intact over the individual's life cycle. The calculations are based on the assumptions of 4 percent annual nominal wage increases and a 3 percent rate of inflation.

tion and general economic growth. This allows for *shifts* of the cross-sectional age-earnings profiles as well as movements *along* a given profile. We assume 4 percent nominal wage increases and 3 percent inflation. The 1991 tax system is assumed to prevail during the full life cycle. This produces a 7 percent return to university education in the absence of taxes and stipends (table 9.16). The after-tax and after-stipend rate of return in 1991 is over 11 percent.[13]

To what extent can movements in the rates of return to education explain fluctuations in school enrollment? School enrollment among young adults has shown marked fluctuations, and there is a marked upward trend in the female enrollment rate (fig. 9.9). Enrollment peaked around 1968–71, declined during most of the 1970s, and started to rebound in the 1980s. Other data sources, capturing the number of students registered at the universities, show a similar pattern (see Fredriksson 1992). There is also a trend increase in school enrollment among prime-age individuals, presumably to a large extent driven by legislation permitting leaves of absence for education reasons.

It is tempting to relate fluctuations in the enrollment rate among young adults to our estimated rates of return to education. If the male enrollment rate is regressed on the after-tax rate of return (RoR), we obtain

$$\ln(\text{enrollment rate}) = 2.19 + \underset{(5.33)}{3.36} \cdot \text{RoR},$$

where RoR is given by the second column of table 9.15 above (divided by 100). The rate of return coefficient is highly significant ($t = 5.33$), and R^2 is 0.82. This is clearly consistent with the conventional wisdom that the demand for education is responsive to the prospective rates of return. It would be premature, however, to place much confidence on the particular estimate obtained from a crude specification using only seven data points. We have therefore also exploited another data source, namely, the time series on private-sector wage

13. The income tax system of 1991 has essentially two brackets. There is a large segment with a tax rate of roughly 30 percent. The marginal tax rate increases to 50 percent beyond a certain threshold. This threshold is indexed to inflation. It is also increased annually to prevent tax hikes owing to general economic growth (expected to be 2 percent per year). The rate of return would fall to 9 percent were the "real wage protection" rule of the tax system abolished.

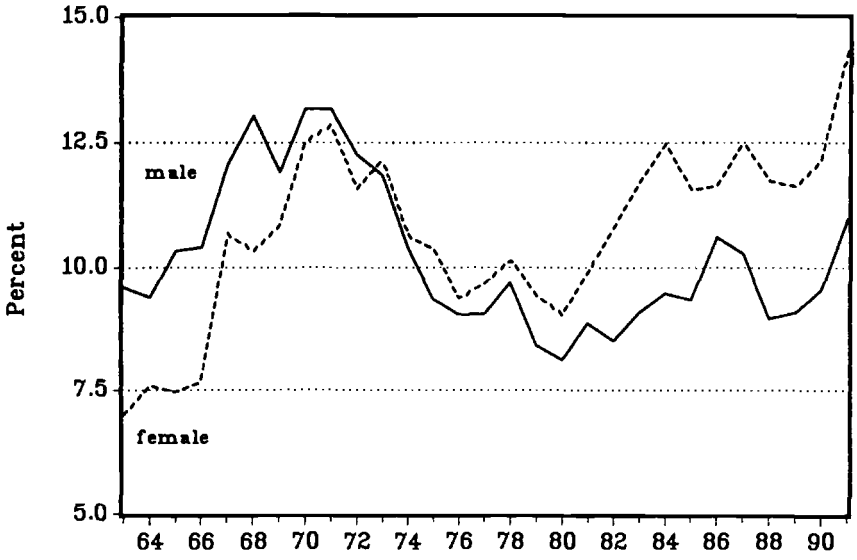

Fig. 9.9 School enrollment rates among 20–24-year-olds, 1963–91
Source: The labor force surveys, Statistics Sweden.

differentials between male university and high school graduates. The basic specification applied is

$$(3) \qquad \ln(\text{enrollment rate}) = \alpha + \beta \ln\left[\frac{(1 - U_u)W_u(1 - \tau_u)}{(1 - U_g)W_g(1 - \tau_g)}\right] + \varepsilon,$$

where U is the unemployment rate, W the monthly salary, and τ the average tax rate; the subscripts u and g denote university and gymnasium, respectively. The independent variable can be thought of as the expected after-tax university wage premium. A higher unemployment risk among university graduates reduces the expected returns to higher education; a higher unemployment rate among gymnasium graduates increases the relative attractiveness of higher education. Unemployment among university graduates is represented by the unemployment rate in the unemployment insurance fund of university graduates (*Akademikernas arbetslöshetskassa*), whereas unemployment pertaining to the gymnasium category is represented by the unemployment rate among male twenty- to twenty-four-year-olds according to the labor force surveys.

The dynamic specification of equation (3) was chosen after a few experiments that suggested that the relative after-tax wage should be lagged one year. Table 9.17 gives the results of alternative regressions for the period 1968–91, where the restrictions implied by equation (3) are successively relaxed. The model fits very well and conforms to our priors. The most restrictive specification in column 1 is only marginally improved on by relaxing the restrictions.

Table 9.17 **Male School Enrollment and the Returns to Higher Education: Dependent Variable, ln(enrollment rate)**

	(1)	(2)	(3)
Constant	1.939	1.879	1.598
	(57.11)	(36.67)	(4.66)
$\ln\left(\frac{1-U_u}{1-U_g}\right)_t + \ln\left[\frac{W_u(1+\tau_u)}{W_g(1-\tau_g)}\right]_{t-1}$	1.901		
	(11.57)		
$\ln\left[\frac{W_u(1+\tau_u)}{W_g(1-\tau_g)}\right]_{t-1}$		1.968	
		(11.91)	
$\ln\left(\frac{1-U_u}{1-U_g}\right)_t$		3.240	2.942
		(3.67)	(2.74)
$\ln W_{u,t-1}$			2.081
			(7.20)
$\ln W_{g,t-1}$			−2.049
			(7.51)
$\ln\left(\frac{1-\tau_u}{1-\tau_g}\right)_{t-1}$			2.242
			(4.08)
$\bar{R}^2$	.852	.861	.853
SE	.058	.056	.058
D-W	1.68	1.81	2.01

Note: The estimation period is 1968–91. Absolute *t*-values are in parentheses.

In fact, the data accept the restrictions imposed in column 2 relative to the least restrictive form in column 3. The enrollment elasticity with respect to the relative wage is around two, very similar to estimates obtained in studies based on data from other countries (see Freeman 1986).

The demand for higher education thus seems highly responsive to the returns to university education. The higher the university wage premium, the larger the fraction of twenty- to twenty-four-year-olds enrolled in education. The higher the degree of tax progressivity, the lower the demand for education. The late 1980s and the early 1990s have seen an increase in the returns to higher education through a rise in the university wage premium and via marked reductions in top marginal tax rates. Those changes will all contribute to a rising demand for higher education over the next few years. This scenario presupposes of course that the education system is responsive enough to increased demand for higher education. Restricted entry is as usual conducive to the emergence and persistence of rents in the labor market.

9.6 Conclusions

Our analysis of Swedish wage differentials over the past twenty-five years or so has identified two largely distinct periods. The period of pay compression, lasting from the late 1960s and up to the early 1980s, involved dramatic changes in wage differentials across gender, experience, and education categories. The (standardized) female/male wage ratio increased by 10 percentage points, and the returns to schooling and experience fell by 50 percent. The period of pay compression is followed by a period of widening wage differentials, including a rebound of the returns to higher education.

Swedish discussions of the causes and consequences of pay compression have typically been centered around union wage policies in general and solidarity wage bargaining in particular. Alternative plausible explanations have largely been ignored, however, and this may be a serious omission. Our analysis suggests that a simple demand and supply framework can account for movements in educational wage differentials as well as fluctuations in youth relative wages. The fall in the university wage premium is, according to our story, driven by the rapid growth of university graduates in the labor force, assuming a smooth trend relative demand growth. The rise in the university wage premium is then explained by the fact that the growth of the supply of more educated workers stops in the mid-1980s. Changes in youth relative wages are analogously explained by fluctuations in the relative supply of young workers. It should be recognized, however, that we do not have much direct evidence on the nature of relative demand shifts.

We do not offer formal models that are able to quantify the relative importance of market forces as opposed to union compression push. We find the compression push story plausible for the LO-SAF area but seriously incomplete as an explanation of movements in the educational wage differentials. Suffice it to say that white-collar unions organizing workers with intermediate schooling levels could pursue successful pay compression policies because the market conditions favored wage moderation at the top end of the earnings distribution. The breakdown of centralized wage bargaining and the retreat from radical egalitarianism occur during a period where the market winds blow in favor of more educated workers.

Fluctuations in the relative supply of more educated workers are determined by past school enrollment decisions, and the latter in turn are influenced by the prospective returns to higher education. The sharp fall from the mid-1980s in the rate of growth of university graduates can be viewed as a lagged response to falling returns to higher education. The rising returns in the late 1980s and the early 1990s reflect a higher university wage premium as well as policy decisions on taxes and subsidized student loans. The increase in the returns to investment in higher education is likely to further increase school enrollment and subsequently depress educational wage differentials.

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