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# ABSTRACT

# Worker Separations in a Nonstationary Corporate Environment

This paper investigates differences in worker turnover characteristics between periods of workforce expansion and contraction in a firm. We derive a Cox proportional hazard model from a simple model of job separation based on the expected surpluses from the firm and its workers. We account for non-stationarity in the baseline hazard reversing the role of calendar time and employment duration (Imbens (1994)), and estimate the model using personnel data from a large Dutch aircraft manufacturer over a period from January 1987 until March 14th, 1996, one day before its bankruptcy. Performance evaluations, blue versus white collar employment, and career paths within the firm are found to play an important role explaining differences in turnover behavior. A generally important result is that smooth functional forms of the age effect on worker mobility can produce misleading results, blurring a better understanding of the design of early retirement schemes for corporate reorganizations.

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# 1 Introduction

This paper analyzes empirically the firm-specific relationship between separation rates of workers and their characteristics. Particular attention is paid to the question how this relation differs between times of expansion and contraction. The data come from a large firm and lend itself for such an analysis as it spans ten years that can be divided in a period of employment expansion followed by a period of workforce contraction (see Figure 5.1).

Hazard rates for the event of a job separation are estimated. A Cox proportional hazard model is chosen to allow for a flexible baseline hazard, as our main interest is in the prevalent correlations between individual characteristics and separation rates. Our preferred specification is driven by flexibility, since too many restrictions can obscure the true underlying process. Flexibility comes at the price of efficiency loss, though. The size and quality of our dataset, however, enables us to achieve a high degree of precision of estimates.

This is an exploratory study rather than a test of some particular theory on turnover. But the uniqueness of our data set allow us to discuss how existing theories of turnover correspond with the empirical findings. The results suggest important discontinuities of separation hazards with respect to age. This asks for an economic explanation on the one hand, but also has implications for empirical work and human resource management policy within the firm. We spell out a warning that forcing a smooth functional form of the age effect, like a quadratic form, entails a great risk of severe misspecification in the presence of such discontinuities. In fact, in our case, fitting a quadratic age effect produces misleading results.

The paper is organized as follows. Based on theoretical predictions about worker separation in the considered in section 2, section 3 develops a simple model of job separation. Section 4 introduces the econometric model. Section 5 describes the data and covariates used in the empirical application, while section 6 discusses our estimation results. Finally, section 7 concludes.

## 2 Theoretical Predictions about Worker Separations

Theories on worker turnover have arisen from different strands in economics, often stressing different aspects and proposing different mechanisms that lead to job separations. In general, these theories imply a relation between job separations rates and the joint surplus that the relationship creates on top of the value of alternative options. The size of the joint surplus for a worker and her employer depends on worker characteristics (like education, experience, or age), firm-specific characteristics (such as size, technology, etc.) as well as on external conditions (industry effects, labor market conditions or institutional aspects).

The concept of specific investments is broad and concerns any investment that increases the joint payoff of the relation but is worthless when the relation is not continued. A separation is efficient if the joint payoff associated with continuation of the relation falls below the sum of the value of both parties' alternative option, so that the joint payoff cannot be shared in such a way that the worker and the firm both earn at least their outside option. The separation decision is therefore intrinsically related to the joint surplus.

Inefficient separations can result when the value of the outside option and the value of the relationship depend on random shocks while information about individual payoffs from the relation is asymmetric. Hall and Lazear (1984) show that inefficient quits result when a firm cannot observe the outside option of a worker. After observing the realization of the joint payoff, the firm sets wages to maximize its expected payoff from the relation. Since the firm cannot verify the worker's alternative, it sets a wage that optimally trades off the probability that the employment relation is continued against the payoff it receives given continuation. This offer is strictly smaller than the difference between the joint payoff and the firm's alternative. Consequently workers with an outside offer exceeding the firm's wage offer quit. If information were symmetric, the firm would optimally match their outside offer as long as it earns at least as much as under the alternative; and it would thus prevent workers from quitting. Similarly, if the firm could credibly commit to paying a higher wage than the monopolistic wage in the second period it would do so in return for a money transfer of workers in the first period. Workers are prepared to paying this transfer when being compensated by higher expected earnings in the second period. But since workers cannot verify whether the firm fulfills its promise, they do not accept paying the transfer.

Teulings and Hartog (1998) illustrate how inefficient quits can be prevented if both parties agree on a fixed-wage contract before the true value of the employment relation and the alternative is revealed. Inefficient quits are avoided in situations where the fixed wage exceeds the worker's alternative offer and is higher than the wage under monopolistic wage setting in the Hall and Lazear model. When the fixed wage turns out to be lower than the monopolistic wage, there is scope to adjust the wage upward to the monopolistic wage to preclude inefficient quits. Yet, inefficient layoffs result when the wage exceeds the payoff to the firm. In this case it is not feasible to lower the wage to the monopolistic wage. Such renegotiation, would undermine the contract.

Commitment problems affect turnover even under symmetric information when separations are efficient because knowledge about the alternative options ensures that redistribution of the surplus is feasible. Since the cost of a separation depends on the amount of specific investment, the continuation probability increases with the level of specific investment. To achieve an optimal level of investment, it is crucial that the investing party receives the full return to its investment. However, as investment costs are sunk (the investment only pays off if the relation is continued), a hold-up problem arises that results in less than optimal investment levels. MacLeod and Malcomson (1993) show how nominal contracts can alleviate the hold-up problem so that higher investment levels and lower separation rates result. If specific investments are made at all times during the employment relation, investment levels are likely to increase with job tenure which implies a negative relation between tenure and separation rates.

Jovanovic (1979a) derives the structural negative dependence between the separation probability and job tenure as well as experience. While the tenure effect is caused by the growth of firm-specific human capital, the effect of experience follows from the shorter remaining lifetime of the worker over which such investments can be amortized. The model predicts that investments levels tend to be higher, and therefore separation probabilities tend to be lower, the better the quality of the match and the longer the expected remaining duration of the current match. Thus, uncertainty about the duration of the match impacts on separation rates. Pfann (1998) shows how uncertainty about the future creates an option value of waiting when separations are irreversible, thereby offering a closed form solution of Jovanovic's model.

Dustmann and Meghir (1998) propose a mechanism that renders expectations about future surpluses important. They develop a model of wage growth based on learning by doing in which different firms offer different career structures in terms of the rate of human capital accumulation. Separations are expected to occur more frequently early in the career since workers are then more likely to receive a better wage offer than their current, reflecting higher returns to on-the-job search, and at the same time lower forgone returns from job-specific investments. In addition, workers are more likely to separate the longer the period over which they can amortize the investment of job change is.

The idea that careers matter is prominent in the theory of internal labor markets. Baker et al. (1994), for example, find empirical evidence that promotions are serially correlated and associated with wage growth. In such a setting, a worker is willing to make job-specific investments and accept current payment below the alternative option if the job offers sufficient wage growth resulting from sufficiently large future surpluses.

Other predictions stem from models developed in the field of personnel economics.[1] Lazear (1979) argues that seniority pay results from a lifetime incentive scheme where workers are paid less than their productivity early in their career and are rewarded later with pay exceeding their marginal value product. The model relies on the assumption that workers accept an incentive scheme where effort provision and remuneration are distant in time. This creates a severe commitment problem since the firm has an incentive to renegotiate the wage contract or even dismiss workers once it has to start repaying workers on their previous investment. It remains questionable whether this problem can be solved by imposing suitable constraints. If a stable explicit or implicit contract[2] exists that constraints the layoff decision of the firm, the model nevertheless suggests that separation rates are higher for older workers and workers with longer tenure when the firm is hit by a shock affecting the marginal value product. This is because there are more

[1]See Lazear (1995).

[2]An implicit contract that rewards workers at the end of the career for effort provided earlier may be credible if for example reneging on the contract would damage the firm's reputation and make it impossible for the firm to hire new workers.

acceptable and cheaper buyout offers to older workers after a negative shock to the marginal value product. A buyout offer is accepted by the worker if it matches the discounted value of the difference between wages under the (implicit) contract and the worker's alternative from the present until retirement. A buyout is profitable for the firm if it costs less than continuation of the employment relation (i.e. the discounted value of the difference between contracted wages and actual productivity of the worker). As the alternative value tends to rise when workers approach retirement age, it is likely that older workers are more willing to accept buyout offers.

# 3 A Simple Model of Job Separation

We propose a simple model that incorporates many of the above discussed features. We build on the idea that separation rates depend on the joint surplus $S$. Workers receive a wage $W_t$ in every period $t$ employed. We assume that workers prefer higher wages to lower wages such that utility strictly increases in $W$. Not working at the firm renders a utility $U_A$ which can be expressed in wage units as $A_t$. The value of alternative use of time expressed in wage units, $A_t$, is determined by a number of factors, including the state of the labor market, job offer distribution for individual workers, and the sum of benefits when unemployed or retired (clearly it depends as well on factors that determine eligibility to benefits, e.g. on wealth and prior labor market experience). We also like to think about $A_t$ as including the wage equivalent to the utility loss associated with working at the firm. (Alternatively we could have set the utility loss associated with working to zero.) The utility loss depends undoubtedly on the effort that the worker has to provide on the job, but also on non-labor income if utility is not linear in wages. We can express the instantaneous utility of working in period $t$ as $W_t - A_t$, while the total surplus for the worker in period $t$, ignoring discounting, is given by

$$S_t^W = W_t - A_t + \sum_{s=t+1}^{T} E_t(W_s - A_s).$$

This formulation takes account of the fact that not only the surplus created in period $t$ is important, but also expected future surpluses.

The firm pays an employed worker a wage $W_t$ in every period $t$. The worker produces output $V_t$ in period $t$. If the worker separates, production is either zero, or the firm has to hire a new worker, so the expected value of output in case of separation, $V^A$, is determined by the probability of finding a suitable worker times the wage that the worker would demand. Without loss of generality we normalize $V^A$ to equal zero. So the instantaneous value is given by $V_t - W_t$, assuming that the wage paid by the firm equals the wage the worker receives. However, the total surplus for the firm, $S^F$ is given by

$$S_t^F = V_t - W_t + \sum_{s=t+1}^{T} E_t(V_s - W_s)$$

such that the total expected surplus of the employment relation is given by

$$S_t^E = V_t - A_t + \sum_{s=t+1}^{T} E_t(V_s - A_s)$$

We assume that firms and workers fix the nominal wage to solve the hold-up problem, that can result from asymmetric information about $V$ and $A$ or from specific investments that are not verifiable to the other party. Workers and firms set wages so as to maximize the total surplus. The share of the expected surplus the firm receives depends on its bargaining power.

The expected surplus can change over time when more information about $V$ and $A$ arrives. An employment relation remains efficient as long as the expected surplus remains positive. The future surplus is stochastic as there are stochastic elements in both the alternative option $A_s$ and $V_s$. $V_s$ depends on random shocks to productivity, demand or input and output prices. $A_s$ depends on other wage offers that arrive according to some probability distribution. Also, $A_s$ depends on wage growth offered by other firms, which may for example depend in turn on human capital accumulation. With new information arriving constantly, this also implies that the surplus includes an option value of separation, defined as $O_t$. To illustrate the idea, if there is uncertainty about $\sum_{s=t+1}^{T} E_t(V_s - A_s)$ at time $t$, the expected loss for the firm is truncated at $V_{t+1} - W_{t+1}$ for the firm since it can layoff a worker in the next period, while the losses for workers are truncated at $W_{t+1} - A_{t+1}$ as they can quit in the next period. Obviously, the option value of a separation is higher, the more uncertain future surpluses and their sizes are.

Next, we assume that a worker separates if the joint expected surplus at time $t$ falls below the cost of separation, $C_t$, including fixed and variable mobility costs and the option value associated with a separation. That can happen for several reasons. For example, the alternative option might rise when the worker becomes eligible for retirement benefits or when prospective retirement benefits rise, for example because of an additional period of work. Other factors working via the alternative option may be an increase in non-labor income or the expectation of receiving an even better offer in the near future. These are all cases of efficient separations. But inefficient separations can result when wages cannot be renegotiated. Then, workers optimally quit if their surplus is negative even if the total surplus is positive. If there are mechanisms to renegotiate the wage, the firm could raise the wage, e.g. by promoting the worker if just raising the wage were infeasible, and so prevent an inefficient separation. On the other hand, when the surplus that accrues to the firm becomes negative while the joint surplus is positive, workers may, provided changing the fixed terms of the contract is possible, accept lower wages to prevent being laid off. Such a situation can arise in the case of a downward productivity shock.

The mechanism described above implies that the probability of separation at time $t$, $P_t^S$, given that the worker is employed at the firm at $t$, is a function of the joint expected surplus, i.e.

$$P_t^S = F(S_t^E - C_t) = F(C_t, A_t, V_{t;}E(A_{t+1}), ..., E(A_{t+T}); E(V_{t+1}), ..., E(V_{t+T}))$$

$P^S$ is the hazard of job separation. The marginal value product $V$ depends on worker characteristics like firm-specific human capital (that is only valuable at the firm and is sunk upon separation) and general human capital, on firm characteristics like capital, production technology, and on external factors including product market demand, competition, factor prices, etc. We like to define firm-specific human capital broadly, e.g. including work relations to colleagues and the like. The value of the alternative usage of time, $A$, is determined by the probability distribution of job offers, the value of job offers, which in turn depends on worker characteristics and in particular on the rate of human capital accumulation in that job. Furthermore, the alternative value of being employed at the current firm depends on the value of non-labor income, including unemployment benefits or pensions. Finally, the costs of separation depend on fixed and variable mobility costs, on worker characteristics, and on the option value of a separation which is influenced by uncertainty about future surpluses.

# 4 The Econometric Model

We are interested in the timing of a job separation. Therefore we want to determine the hazard rate of a job separation at time $t$. Denoting the entry date by $t_0$ and the exit or failure date as $t_1$ we define this hazard rate as

$$\lambda = \lambda(t, t_0, X) = \lim_{\varepsilon \to 0} P[t_1 \in [t, t+\varepsilon \mid t_1 \geq t, t_0, X]/\delta \tag{1}$$

for $t > t_0$. As seen in section 2, this hazard rate depends on individual characteristics $X$ that determine the value of the surplus and the duration $t - t_0$ of the spell at time $t$. But it also depends on other factors at time $t$, such as product prices, product demand, other factor prices as well as labor market conditions, which all affect the value of the match. We refer to these factors as the environment at time $t$.

A popular approach in the literature on duration models is to specify a parametric form of the hazard and estimate its parameters by maximum likelihood techniques. The hazard function as defined in equation (1) may then be specified as

$$\lambda(t, t_0, X) = h(t, t_0, X; \beta) \tag{2}$$

where $h$ is a known function and $\beta$ is an unknown parameter.

One class of such models, the class of proportional hazard models, assumes that the function $h$ can be factored in a part that depends only on duration $t - t_0$, that is identical for all individuals and usually referred to as the baseline hazard, and a part that depends only on characteristics $X$. Thus,

$$\lambda(t, t_0, X) = h(t, t_0, X; \beta) = \lambda_0(t - t_0) * f(X; \beta) \tag{3}$$

where $\lambda_0$ is the baseline hazard, $\beta$ is an unknown parameter and $f$ is a non-negative function.

Functional forms are assumed for both factors, where characteristics usually enter exponentially, i.e. $f$ is the exponential function, while the functional form of the baseline hazard $\lambda_0$ is derived from the distribution function of the durations $t_1 - t_0$ in fully parametric models. The hazard function then becomes

$$\lambda(t, t_0, X) = \lambda_0(t - t_0) * \exp(X\beta). \tag{4}$$

An alternative to the fully parametric models is to leave the functional form of the baseline hazard $\lambda_0$ unspecified and estimate it semiparametrically. Such a model (as described in equation (4) above with an unknown form of $\lambda_0$) was proposed by Cox (1972, 1975).

However, these models do not allow for a dependence on calendar time, i.e. they implicitly assume a stationary environment. In other words, the hazard rate is assumed the same at any calendar date $t$ for given characteristics $X$ and elapsed duration $t - t_0$. While this assumption may be valid if the period of analysis is sufficiently short, the environment is unlikely to remain stationary if the observation period is long as in our application, and extends over spells from a growing as well as a declining workforce.

Such non-stationarity can in principle be controlled for in the model as described by equation (3) by parameterizing the functional dependence on calendar time $t$, thus obtaining

$$\lambda(t, t_0, X) = \lambda_0(t - t_0) * f(g(t), X; \beta) \tag{5}$$

where $g(t)$ is the process that influences the baseline hazard.[3] The drawback of this approach is that $g$ must be known exactly. Stated differently, the approach is rather restrictive if the correct functional form of $g$ is unknown or unobservable. An alternative to specifying a particular process that allows for more flexibility is introducing time dummies. The problem with this approach is that time dummies must be specified for particular periods, but with duration data it is not obvious what should constitute such a period.

A more flexible and satisfying approach in our context, where non-stationarity is important, is to reverse the role of calendar time and employment duration in a Cox model, as proposed by Imbens (1994). Anything that affects the separation hazard of employees in the same way on a particular calendar date and is not controlled for by elements in $X$ will be picked up by the baseline hazard $\lambda_0(t)$. Duration dependence has to be parameterized by a function $z$ of duration $t - t_0$. We therefore specify our model as

$$\lambda(t, t_0, X) = \lambda_0(t) * f(z(t - t_0), X; \beta) \tag{6}$$

[3]The identification of $g$ comes from a non-degenerate distribution of entry times $t_0$.

where we do not have to model calendar time dependence but have to parameterize the duration dependence. A flexible way of parameterizing duration dependence is to introduce dummy variables in $z$. Hence we specify $z$ as

$$z(t-t_0) = \exp\sum_{i=1}^{I}\alpha_i\omega_i(t-t_0)$$

where $\omega_i(t-t_0) = I[d_i < t-t_0 \leq d_{i+1}]$ and $I$ is the indicator function and $d_{i+1} - d_i$ denotes a particular period length. We can still obtain the form of duration dependence from the estimation of the parameters $\alpha_i$ of the function $z(t-t_0)$. A complete specification of our model is hence given by

$$\lambda(t, t_0, X) = \lambda_0(t) * \exp X\beta * \exp\sum_{i=1}^{I}\alpha_i\omega_i(t-t_0). \tag{7}$$

We thus assume that calendar time effects enter the hazard function multiplicatively. This assumption appears adequate as a first approximation since all workers in our data set can, in principle, be affected by the same set of personnel policies on a given calendar date, since that our data come from one firm only. Moreover, firm-specific effects and labor market conditions affect workers on the same calendar date.

However, firm-specific effects, like personnel policies, and labor market conditions may not affect workers similarly on a given calendar date. We could depart from the assumption that non-stationary forces affect all workers proportionally to the time-independent part of their hazard rate, but we would have to model such non-proportionalities. For example, we can control for non-stationarity in labor market conditions by correcting for differences in unemployment rates of different groups of workers. Clearly, given the host of sources for non-stationarity, such a parametric approach is easier said than done. An alternative - and more promising approach if the main interest is not in the quantitative effects of particular sources of non-stationarity - is stratification. When different baseline hazards are estimated for the different strata we allow for different effects of a common environment on the individual hazard rate. Moreover, in the empirical application, stratification is helpful to assess the sensitivity of estimates to *asymmetric or* non-proportional effects of non-stationary forces.

We can estimate model (7) for different periods to answer whether observed characteristics in the design matrix $X$ affect the hazard of job separation differently in changing environments. We are particularly curious whether such differences exist between times of workforce expansion and workforce contraction. In terms of model (7) this amounts to asking whether the parameters $\beta_j$ and $\alpha_{ij}$ in

$$\lambda^j(t^j, t_0, X) = \lambda_0^j(t) * \exp X\beta_j * \exp \sum_{i=1}^{I} \alpha_{ij}\omega_i(t - t_0).$$

differ when the model is estimated for $j$ sub-periods, i.e. if we partition time in $J$ intervals such that $\{T\} = \cup_j \{T_j\}$ and $\{T_j\} \cap \{T_i\} = \emptyset$ for all $j \neq i$. We call the earliest date of such a sub-period the starting date of analysis time, $t^s$. A worker enters the risk pool either at the starting date, if employed at that date, or at the day of entering the firm, if hired later than the starting date. The date of entering the firm, i.e. the beginning of the employment spell is $t_0$. Hence $t_0 \leq t^s$ for workers employed at the starting date and $t_0 > t^s$ for workers hired during the observation period. We know the beginning date of an employment spell, $t_0$, for all spells, such that we can control for elapsed tenure duration and consequently infer the duration dependence of employment spells. A worker leaves the risk pool on the date of separation. A separation is either a quit, dismissal or retirement.[4] We censor observations of workers still employed at the end of analysis time, of workers who leave the personnel files but do not loose their job (for example if the employing unit is spun off).

Our data contain complete information from the wage files of the firm. Any change in compensation or working hours is recorded as a new observation. Each observation has a starting date and ending date associated with it. An observation ends when either a change in the wage file is recorded or when the worker separates. For the bulk of the observation such a change is recorded once a year. The average length of an observation is 217.5 days. This allows us to control for changes in observed characteristics, i.e. include time-varying variables in our regression so that model (7) modifies to

$$\lambda(t, t_0, X) = \lambda_0(t) * \exp X(t)\beta * \exp \sum_{i=1}^{I} \alpha_i\omega_i(t - t_0). \tag{8}$$

One example for a time-varying covariate is the performance evaluation score which is recorded with each wage contract. But we also treat age and

[4]In this paper we do not focus on the determinants of competing risks, but stress the role of the surplus of the employment relation.

tenure as time-varying by calculating the age or tenure at the ending date of an observation. The ending date is also the failure date when a failure occurs and the partial likelihood in the Cox model is calculated at the failure dates. More information on the covariates is provided in the next section.

# 5 The Data

The data come from a large Dutch company and contain information on all tenured workers who were on payroll between January 1987, when the firm introduced an electronic personnel data system, and March 1996, when the firm was officially declared bankrupt. The company was the Netherlands national aircraft builder N.V. Fokker. The data were made available to us for academic purposes by the company's bankruptcy trustees[5].

The personnel files contain information on gender, age, tenure duration, marital status, schooling, and vocational training degrees. Moreover, calendar date changes in hours worked, wage changes and the reason for such changes are recorded in the files as well. Reasons for wage changes include promotions, demotions, completion of a degree, and job change within the firm. The bulk of wage changes accrues, however, to such mass mutations as contractual increases reflecting the tenure profile or collectively negotiated wage increases including price compensations.[6] In addition, we have information about the date of ending the employment relation.

The data are converted into a format that lends itself for duration analysis. For each individual worker we record the beginning and ending date of a wage contract along with observable characteristics during this period. So we have time event data with time invariant and time-varying variables. A contract either ends with a job separation or at the beginning of a new wage contract. We analyze the determinants of separation rates only until the day before the bankruptcy and treat observations of workers still employed on

[5]The report of the bankruptcy trustees is publicly available (see Deterink et. al 1997).

[6]Nominal contracts are characteristic for the Dutch labor market. Yearly wage increases can generally be decomposed into three components (see Teulings and Hartog (1998)): First, contractual experience and tenure profiles result because most collective agreements define wage levels (within a hierarchy of wage scales) that usually award workers with a higher wage for every additional year of tenure. Second, contractual initial increases adjust all wages to changes in aggregate conditions. Third, incidental wage increases relate to any other type fo wage increase like promotions.

the day of the bankruptcy, when more than 3000 jobs are killed, as censored. Apart from the technical problem of many ties for this failure date, results would likely be blurred and misleading because the hazard rate of loosing ones job is by definition infinite for workers falling under the bankruptcy. To obtain more reliable estimates, the day of bankruptcy is excluded from the study.[7]

The time period spanned by the data can be divided into a period of workforce expansion and a period of employment reductions. The employment dynamics are presented in Figure 5.1, which shows the number of individuals in our data set employed on the 14th of each month. Employment increased from about 10000 full-time equivalent workers in 1987 to reach a peak of about 12500 full-time equivalent workers in 1991 and subsequently fell to less than 6000 workers in 1996 after a number of reorganizations with mass layoffs. We analyze the separation hazards until the day before the bankruptcy, i.e. just before the final sharp decline of the workforce in Figure 5.1.

On the day the electronic personnel system was put into use (01/01/1987), the company's organizational structure was made up of a holding corporation (N.V. Koninklijke Nederlandse Vliegtuigenfabriek Fokker), an administration company (Fokker Administration B.V.), a production company (Fokker Aircraft B.V.), with plants in three different locations, as well as five other subsidiaries spread over different locations (see Appendix). Most of the company's organizational structure remained unchanged until the day of the bankruptcy.

We define eight dummy variables for each of the different subsidiaries or locations. Clearly, not all subsidiaries were hit by the company's demise equally hard. Therefore we control for the location where each worker is physically employed (this may vary through time). The company's core business, aircraft construction, is done by Fokker Aircraft B.V. at three different locations, which we call location 0, 2 and 6 as is explained in more detail in the Appendix. About 80% of the entire workforce is employed in one of these three locations on March 1st 1991 (see Figure 5.2a). Employees of Fokker Administration B.V. also work in location 0. These subsidiaries and the holding eventually go bankrupt.[8] Location 1 only exists until 1990 when it is

[7]This procedure is not least justified by the fact that the bankruptcy came as a surprise to many.

[8]It should be noted that some parts of the firm survived or were spun off, so that not

integrated with the main activity at location 0. Location 3, 4, 5 and 7 coincide with the remaining four subsidiaries. It should be noted that subsidiary 3 is spun off in December 1995 when workers employed at this subsidiary consequently leave the personnel files of the firm. We treat observations on those workers as censored as they kept their job under the new ownership.

In our empirical analysis, we include also information on education age, tenure, age, education, gender, marital status, part-time work, and on performance evaluations. Furthermore, we include a number of measures that track a worker's career path inside the firm. Information on wage scales of the firm allows us to distinguish between white-collar and blue-collar workers. All these characteristics - variables are defined in the Appendix - are expected to affect the surplus, via an effect on productivity or via an impact on the outside option. We avoid much functional form restrictions on the effect of such variables by defining categorical variables.

Tenure duration is divided into 16 categories. These are obtained by calculating tenure in days at the end of an observation and then transforming this variable by the function $\omega_i(t - t_0) = I[d_i < t - t_0 \leq d_{i+1}]$, $i = 1, .., 16$, where $I$ is the indicator function and $d_i$ denotes a particular cut off date. We allow the length of the period to increase with tenure duration as the distribution of tenure at the firm is skewed (see Figure 5.2b).[9] Age categories are defined similarly with an interval length of one year.

Figures 5.2a - f provide information on the composition of the workforce on March 1st 1991, when the first reorganization was announced (cf. Deterink et al., 1997). Figure 5.2b shows the tenure distribution. About 11.8% of the workforce has less than one year of tenure, and 43.2% of the workforce has been hired in the previous 5 years. Almost 14.4% of the workers have been employed for more than 20 years. Median tenure is 6.16 years, while the mean tenure is 9.66 years. Figure 5.2c shows the age distribution. Half of the workforce is younger than 33 years of age; 11.1% are older than 50 and 12.2% are younger than 24. Less than one percent of the workforce is older than 60.

We include nine categorical dummy variables for the highest educational degree obtained[10]. Most workers employed on March 1st 1991 hold, as their

all workers automatically lost their job during the firm's downsizing period.

[9]For details on the interval lengths see the Appendix.

[10]Since information on the highest educational degree is missing for almost a quarter of the employees, we define an extra category for those workers in order not to lose valuable

highest completed degree, a vocational degree as Figure 5.2d illustrates. A quarter of the workforce has completed an apprenticeship, 17.9% completed lower vocational schooling, 20.3% intermediate and 13.1% higher vocational schooling.

Performance evaluation scores are denoted by 6 categorical dummy variables. They show little variation and are skewed towards the high end (Figure 5.2e). More than 89% of workers employed on March 1st 1991 are judged to be good or very good (59.0% and 30.2% in categories 3 and 4 respectively); more than 9.1% received even higher scores, 1.6% perform satisfactorily while the performance of only 0.1% is unsatisfactory.

We account for the 18 different wage scales that exist at the firm.[11] Workers in the 10 lower wage scales (scales 2-11) are referred to as "blue-collar workers" and are bound by collective wage bargaining agreements. Workers in the higher scales (12-19) are referred to as "white-collar workers". Their wages are not bound by collective wage bargaining agreements. Figure 5.2f shows that most workers (73.55%) are in the lower ten wage scales. The proportion of workers in each of these wage scales increases initially from less than a percent in scales 2 and 3 to peak at more than 15% in scale 8. The number of workers in the next three higher scales falls consecutively. The remaining 26.45% of the workers are not bound by collective agreements. Figure 5.2f reveals the pyramidal composition in these higher wage scales with more than 60% of the higher-wage workers in scales 12-14 and less than one twelve% in scales 17-19. As workers in the lower scales (2-11) are predominately employed in production, the clear cut in the firm's low and high salary scales coincides with the division of the workforce into blue-collar and white-collar workers. White-collar workers represent a large share (more than 70%) of the workforce at location 3. Blue-collar workers represent a large share of the workforce at location 2, 4, 6 (more than 80%) and location 5 (about 70%). A considerable share of white-collar employees (more than 30%) works at location 0.

We hold the first observed wage scale of a worker constant[12] and include

information. Information on education is missing for workers in all wage classes.

[11]Note that wage levels exist within each scale which can be interpreted as contracted tenure profiles as workers generally move to a higher level automatically after additional years of employment at the firm.

[12]This is either the wage scale observed on January 1st, 1987, or the entering wage scale of a worker who joins the firm after that date. It should also be noted that scale 12 is a

dummy variables that trace transitions in wage scales. By March 1991, less than 0.6% have moved down the wage ladder, 31.4% have moved up one scale, 17.8% two scales, and 8.0% three or more scales. We use additional information from the wage data files of the firm to follow the path of formal promotions, completion of a higher educational degree, and wage growth associated with such events. Less than 19% of the workers employed on March 1st 1991 received a new contract because of a promotion during the period starting on January 1st 1987 (16.62% were promoted once, 2.24% twice and 0.3% received more than 2 times a new wage contract because of a formal promotion). The cumulated percentage wage growth associated with such new contracts ranges from less than 1% to more than 50% (while it is less than 25% for 99.5% of those who are ever promoted). Contracts were changed for only 2.86% of workforce because of a degree completion. Cumulated wage increases associated with such contract changes range from about 1% to almost 10%. A further dummy variable conveys information on a prior completed employment spell at the firm. 165 workers (less than 1.3% of the workforce employed in 1991) have such prior experience.

Figures 5.3a-f and 5.4a-f show the distribution of characteristics of workers who separate during the periods 1987-1991 and 1991-1996 respectively. Figures 5.3a and 5.4a reveal that the share of separations from locations 2 and 6 is larger in the second period while a smaller share separates from location 0. Yet in both periods most workers were employed at location 0 when they separate, which is not surprising as the largest fraction of the workforce is employed there (see Figure 5.2a). Figure 5.3b illustrates that most separations occur at short tenure during the period of workforce expansion: 23.6% of separating workers have been with the firm for less than a year; more than half of the separations take place during the first four years and about three quarters during the first ten years of the employment relation. While a small proportion of the separating workers has been employed at the firm for 15 to 30 years (6.16% only), separations become more frequent again after around 35 years of tenure. The tenure distribution among separations is similar in the period of downsizing: Separations occur most frequently at short tenure, least at intermediate tenure duration and again more frequently after tenure duration of more than 30 years (see Figure 5.4b). However, a considerably smaller proportion has less than a year of tenure (only 6.8%

particular one, since most white-collar workers who enter the firm start in that scale.

compared to 23.6%) - which might reflect lower hiring rates in the period of downsizing and hence a smaller pool of workers with less than a year of tenure - while a larger proportion has 4-10 years of tenure (33.5% compared to 22.7%). Therefore, average tenure of separating workers is longer in the period of downsizing (9.4 years as compared to 8.6 years).

Figures 5.3c and 5.4c show the age distribution of separating workers in the two periods. In both periods, the distribution is not unimodal. The first peak is at the age of 25 years in both periods (at 6.2% and 5.9% of the separating workforce in the first and second period respectively). Most workers who separate are 60 years old in the first period (14.0%). In the second period the peak at age 60 is less marked. Instead, a peak in the age distribution occurs earlier at 55 and 15.8% of those who separate are aged 55-60. Given that a separating worker is older than 50, he is expected to be younger in the second period, while the opposite holds for workers younger than 50. The net effect is that separating workers are on average somewhat younger in the first period, 34.8 years in the first compared to 35.5 years in the second period.

Comparing the educational achievements of the separating workers in the two period, it becomes apparent that a larger proportion of workers holds lower degrees in the second period. In addition, relatively fewer workers hold a vocational degree in the first period (see Figures 5.3d and 5.4d).

A considerable proportion of separating workers has an above average performance evaluation score in both period. However, the average performance score of separating workers is always lower (3.36 in the first and 3.39 in the second period) than that of the workforce employed on March 1st 1991 (3.48) (see Figures 5.3e and 5.4e).

Figures 5.3f and 5.4f indicate that workers separating in the second period had on average further advanced careers in the firm. The largest proportion blue-collar workers is in wage scale 5 at the date of separation in the first period, but in wage scale 8 in the second period. This is similar for white-collar workers: Relatively more separating workers are in the firm's lower wage scales in the first period.

# 6 Estimation Results

We estimate different specifications of model (7) by Cox partial likelihood regressions where the Breslow method is used to deal with ties. We start with a basic specification which includes all variables described in the previous section. This specification is estimated for the period from January 1st 1987 until March 14th 1996 and for two sub-periods: from January 1st 1987 until March 1st 1991, the period of workforce expansion, and from March 1st 1991 until March 14th 1996, the period of downsizing. The coefficient estimates are in Tables 6.1a-f. Estimating the model for different time periods allows coefficients as well as the baseline hazard to differ. We compare the baseline hazard from the model estimated for the entire period with the baseline hazards from the models estimated for the sub-periods to get an impression how changes in separation rates in the different regimes decompose into an effect that is the same for everybody in the sample (and hence reflected in the baseline hazard) and group specific effects (reflected in changes of coefficient estimates).

Furthermore, we restrict the parameter vector $\beta$ in different ways and allow for different forms of stratification to check the robustness of our results. Allowing the baseline hazard to differ for different strata while restricting the remaining coefficients to be identical across strata also allows us to assess the proportionality assumption and the sensitivity of other estimates to the validity of this assumption. Finally, we report the parameters estimated for the sub-samples of blue-collar and white-collar workers in Tables 6.2a -f and 6.3a-f respectively.

The picture that emerges is briefly sketched as follows. The shape of the baseline hazard differs in periods of workforce expansion and downsizing, being rather flat and comparably small in the period of employment growth but erratic and much higher in the period of downsizing. The shape of the baseline hazard remains similar after splitting the period, accentuating that the risk of job separation is generally higher in the second period (compare panels a) and b) of Figure 6.1)

A comparison of parameters estimated separately for the high and low turnover regime indicates that relative separation rates differ in the two regimes (compare Table 6.1 columns 2 and 3). Some parameter estimates even change sign between the two regimes. For example, women face higher separation hazards in the low turnover regime, while they are less likely to separate than their male colleagues in the period of downsizing.[13]. White-collar workers have higher turnover rates in the first period and lower ones in the second period than their blue-collar colleagues. The impact of other characteristics also changes.

Third, the results from imposing different restrictions on the vector of observed characteristics show that coefficient estimates are generally robust in the sense that the exclusion of variables does not have a significant effect on other estimated coefficients. For example, leaving out controls for a worker's career does not significantly change the size of coefficients for marital status, gender, tenure, age, education, location dummies and controls for wage scales. Leaving out location dummies, or controls for gender and part-time workers does not change coefficient estimates of other variables either. The fit, however, worsens significantly when such control variables are left out.

Yet, not controlling for wage scales has an impact on estimated coefficients for education levels and measures of career attainment in the period of restructuring. This reflects the fact that high-wage workers face a much lower increase in the hazard of job separation than workers in lower wage scales, while schooling and income class are highly correlated. The impact of education on separation rates can therefore be decomposed into two effects: the effect of education given the job level and the effect of education on the probability of attaining a particular job level.

Coefficient estimates are also robust when the baseline hazard is allowed to differ across strata for gender, part-time workers, locations or wage scales. In addition, the baseline hazards for men and women, full-time and part-time workers, and workers employed at different locations are similar, implying that the proportionality assumption is valid. This is encouraging if our aim is to quantify the effect of particular characteristics on separation rates. We can therefore refer to coefficient estimates from our basic specification when comparing relative separation rates for different groups and do not report the results of all stratified models. However, as the baseline hazard differs for blue- and white-collar workers, we discuss the differences in the baseline hazards obtained from this stratification in more detail. These results allow us also to be more precise with respect to the differences in the exact timing of events.

[13]This might reflect that many women work as secretaries. This job is complementary to many white-collar jobs, which are cut relatively less in the period of restructuring.

## 6.1 Baseline Hazards

Entire Sample

Figure 6.1 (panel a) shows the baseline hazard obtained from the basic specification estimated for the entire period.[14] It reveals large differences in the baseline hazard between the period of workforce expansion and the period of downsizing. These differences of the hazard rate at different calendar dates highlight the importance of non-stationarity. Controlling for such non-stationarity is crucial. The figure shows that the hazard rate for a job separation is rather flat in the period of expansion until 1991, while it is much more erratic and considerable higher thereafter, especially from 1993 onwards. The fact that the baseline hazard does not rise sharply until 1993 while the workforce shrinks since 1991 (see Figure 3.1) suggests that the workforce reductions are accomplished by either lower hiring at a given separation rate or are born by particular groups of the workforce. Such group-specific differences in hazard rates show up in the estimated coefficients of the control variables that characterize such groups, as for example age. This squares nicely with our prior knowledge that workforce reductions were mainly accomplished by natural turnover such as retirement as well as early retirement prior to 1993 (see Deterink et al. 1997).

White-Collar vs Blue-Collar Workers

Figure 6.2, 6.3 and 6.4 provide information on the question whether blue-collar workers and white-collar workers are affected in similar ways by changes in the environment. The baseline hazards in Figure 6.2 are obtained from a stratified model that allows only the baseline hazard to differ for the strata of blue- and white-collar workers and is otherwise identical to the model underlying Figures 6.1 as it restricts the parameter estimates to be the same for both groups of workers. Figures 6.3 and 6.4 plot the baseline hazards that are obtained after splitting the sample into blue-collar and white-collar workers, such that the underlying models allow coefficients and baseline hazards to differ across strata and periods. The corresponding parameter estimates are in Table 6.2.

All estimated baseline hazards reveal that white-collar workers face a

[14]The corresponding parameter estimates are in Table 6.1, column 1. Panel b) of Figure 6.1 plots the baseline hazards obtained after splitting the period; and the corresponding parameter estimates are in Table 6.1, columns 2 and 3.

lower separation hazard in the period of downsizing while they are more likely to separate in the period of workforce expansion. Although, the baseline hazard rate peaks in 1993, 1994 and 1995 for both types of workers, these peaks are much larger for blue-collar workers, especially in the earlier years 1993 and 1994. This clearly suggests that downsizing is asymmetric in this period, which may result from differences in adjustment costs and a perception that the crisis is temporary (cf. Hamermesh and Pfann, 1996). Similar asymmetries are also found within the group of blue-collar workers. If we stratify according to wage scales, we find that workers in lower wage scales face higher hazard rates earlier in the period of downsizing.[15]

Given this result and the fact that blue-collar and white-collar workers are employed in different proportions at the different subsidiaries, it is not surprising that job separation rates differ across subsidiaries. Hazard rates increase markedly in 1993 at production sites, paralleling the increase in the baseline hazard for blue-collar workers in Figure 6.3. The hazard rate increases most at production sites of the core activity (locations 0, 2 and 6) in later years. This becomes apparent when stratifying with respect to locations. It should also be noted that the hazard rate is markedly higher at location 6 than elsewhere in 1995 when there were plans of closing that site.[16]

## 6.2 Duration Dependence of Job Tenure

The duration dependence of job tenure can be inferred from the estimated coefficients $\alpha$ from model(7). Tables 6.1a - 6.1f report the coefficients estimated for the entire period (column 1) and two different sub-periods (columns 2 and 3). Tables 6.2a - 6.2f and 6.3a - 6.3f present the estimated coefficients for the strata of blue-collar and white-collar workers respectively. Estimates for the entire period are again in column 1 while the estimates for the two sub-periods are in columns 2 and 3. All coefficients in a given column of the different panels of the tables are estimated jointly, but are presented separately here for illustrative reasons. Column 4 gives in each case the p-value for the test that the coefficient in column 3 equals the point estimate of the coefficient in column 2. This gives an indication whether coefficients are

[15]We do not plot these baseline hazards in this paper.

[16]See Deterink et al. (1996) for more details on such plans.

differ in the two sub-periods.

The coefficients correspond to the elements of the coefficient vectors $\alpha$ and $\beta$ in model (7), and measure therefore the effect on the log hazard rather than hazard ratios. The coefficients ought to be interpreted as follows: A unit change in a covariate $x$ changes the log hazard by the amount of $\beta_x$, where $\beta_x$ is the estimated coefficient of covariate $x$, or in other words, a unit change in $x$ changes the hazard by approximately $\beta * 100\%$ for values of $\beta$ close to zero. Thus, we can interpret coefficients of categorical variables as semi-elasticities.

The estimated coefficients for the tenure categories in Tables 6.1a, 6.2a and 6.3a indicate that turnover rates are especially high in the first three months of an employment relation. Although the risk of job separation falls considerably after this initial period, it remain relatively high during the first year. Subsequently, the hazard of job separation falls gradually throughout the first 15 years of tenure with most of the decline taking place in the first ten years of an employment relation. After about 15 years of job tenure, the hazard rate is rather low and remains flat only to increase again at very long tenure duration, a feature that can be ascribed to (mandatory) retirement. This broad pattern emerges in all specifications of the model.

However, there are important differences in the two sub-periods. While, in the period of expansion, the hazard rate of job separation is 29 times higher for workers with less than 3 months of job tenure than for workers in the reference group who have 15-20 years of job tenure, it is only about 22 times higher during the period of downsizing. However, the hazard rate does not fall as much during the first five years of tenure in the period of downsizing as it does in the period of expansion. The difference is considerable and the p-values in column 4 of Table 6.1a indicate that the separation risk from the 4th month until the 5th year of the employment relation is significantly higher during downsizing. The point estimates suggest that, in the period of downsizing, the hazard rate is on average about 6.5 times higher for workers with 4-12 months of tenure than for workers in the reference group, while it is on average only about 4.5 times higher in the period of expansion.

While the hazard rate relative to workers in the reference group falls considerably after the first year of tenure during the period of expansion, it remains very high throughout the first three years of the employment relation during the period of downsizing; in the 5th year of the employment relation the separation hazard is still more than 3 times higher during the period of downsizing and roughly 2.5 times higher during expansion than for workers in the reference group. Relative hazard rates remain higher for workers with more than 5 and less than 15 years of tenure during the period of downsizing, yet the difference is less marked. Thereafter, relative rates are rather similar. Only after 35 years of tenure rise relative hazard rates more sharply in the period of downsizing. While workers with 35-40 years of tenure face not a significantly higher hazard rate than their colleagues in the reference group with 15-20 years of tenure during the period of expansion and workers with more than 40 years of tenure face a hazard rate that is about twice as high, workers with 35-40 years of tenure have a significantly higher hazard rate in the period of downsizing when those with more than 40 years of tenure face even 3 times higher hazard rates than those in the reference group. Again, the p-values in column 4 indicate that these differences are significant.

A glance at Tables 6.2a and 6.3a reveals that these results are largely driven by changes in hazard rates for blue-collar workers. The p-values in column 4 of Table 6.3a show that relative hazard rates do not differ significantly in the two sub-periods for white-collar workers with less than 25 years of tenure. Relative hazard rates for white-collar workers differ only at long tenure. For blue-collar workers, the patterns is as described above.

High turnover rates early in a relationship are often ascribed to the fact that the lack of quality of the match is revealed after a short period of work.[17] If the match product turns out to be low, a separation results. The negative duration dependence can also be explained by human capital accumulation.[18] We would expect separation rates to fall with tenure as long as firm-specific knowledge is accumulated. The rate of specific human capital accumulation as well as the rate at which returns from such capital is decreasing would affect the rate of decline of job separation rates with tenure. In principle, any model with match-specific investment would generate the same kind of duration dependence, as long as the joint surplus increases while the alternative option of workers and firms remains unchanged.

A life-cycle incentives model, as for instance proposed by Lazear (1979), also generates a negative duration dependence. In Lazear's model, separation rates should fall with tenure until the worker gets repaid for the effort

[17]See for example Jovanovic (1979b).

[18]Jovanovic (1979a) focuses on the relationship between firm-specific human capital and turnover rates.

he provided early in his career. Then it may rise if buy-outs are feasible. In absence of shocks that make such buy-outs optimal for both parties we should expect the hazard rate to remain flat until retirement. When shocks are large, separation probabilities should be higher the more feasible a buy-out opportunity becomes. This is more likely the shorter the period until mandatory retirement and hence the longer tenure (at given age). This is roughly what the hazard rates for the period of downsizing suggest.

The increase in the hazard rate at long tenure suggests that (early) retirement occurs more frequently in the period of downsizing. The higher hazard at short tenure, especially during the first 5 years, indicates that those who were hired in the previous expansion are hit more severely in the period of downsizing than workers who had joined the firm before 1987. These results illustrate that different tenure groups are affected differently. This points at a dependence relation between a worker's past career path within the firm and turnover (costs).

The result that relative turnover rates rise for workers with shorter tenure in periods of downsizing is also consistent with the LIFO-layoff model of Kuhn (1988) and Kuhn and Roberts (1989). Since unions impose the LIFO-layoff rule in these models to extract rents from the firm, we expect that the relative increase of the separation rate for workers with short tenure in periods of downsizing is stronger for blue-collar workers, who are covered by collective bargaining agreements, than for white-collar workers who are not bound by such agreements. Indeed, a comparison of the differences between tenure coefficients for blue-collar workers in the two different periods (columns 2 and 3 of Table 6.2) and differences for white-collar workers (columns 5 and 6) yields support for this view. While the tenure effect during the first 25 years of tenure is similar for white-collar workers in both periods, blue-collar workers with short tenure face significantly higher hazards of job separation in the declining phase than in the growing phase relative to their colleagues in the reference group. This effect is especially strong during the first five years of tenure.

## 6.3 Age Effects

The effect of age on separation rates produces novel results. The effects are not smooth. Figures 6.5a, 6.5b and 6.5c, which plot the coefficient estimates for the age categories from the models reported in Tables 6.1b, 6.2b and

6.3b, illuminates that discontinuieties are especially important for workers older than 50 years. The hazard rate for blue-collar workers (Figure 6.5b and Table 6.5b) falls only gradually with age during the period of expansion for those aged 25 to 50 and the estimated hazard rate for most age categories is not significantly different from the hazard rate of workers in the reference group. In addition, the p-values in column 4 of Table 6.2b for the test that the estimated coefficient in the period of downsizing is equal to the point estimate for the corresponding coefficient in the period of expansion indicate that age effects are similar for workers aged 25-50 during downsizing. Then, the hazard rate exhibits even less variation for workers younger than 45.

But the hazard rate drops markedly in both periods for blue-collar workers in their early fifties. This drop is more severe in the period of downsizing when the dramatic decline of the hazard rate sets in at a somewhat younger age. Hazard rates are lowest for workers aged 53 (90% lower than that of workers in the reference category) in the period of expansion and for workers aged 52 (92% lower) in the period of downsizing (Table 6.1). After the respective minima are reached, the hazard rate rises steeply thereafter in both periods. During the period of expansion, the hazard rate of those aged 54 to 59 is not significantly different from the hazard rate of workers in the reference group aged 35. This is different during downsizing when the hazard jumps up for workers aged 55 and remains high thereafter. The p-values in column 4 indicates that this difference is significant for workers aged 55 to 58. The hazard rate of workers aged 55 to 58 is on average about 9 times as high as the rate for workers in the reference group.

At the age of 60, the hazard rate jumps up markedly again. Then, the hazard rate is more than 30 times higher than that of workers aged 35 in both periods. The hazard rate falls somewhat thereafter, but remains high. This effect is driven by retirement and the result suggests that workers are most likely to retire at the age of 60 in the period of expansion. The pattern for white-collar workers older than 50 is similar to that described for blue-collar workers as Figure 6.5c and Table 6.3b reveal.

These results reflect the consequences of early retirement schemes, especially in the period of downsizing. The age effect may be driven by changes of the alternative option for workers older than 50 years. This assumption is reasonable since discrete jumps in productivity related to age are unlikely. Such an effect can result from early retirement options at a certain age. The option to retire early at the age of 55 is not uncommon in the Netherlands.

Such a pension scheme may explain the discrete jump in exit rates at age 55. Moreover, early retirement also seems to have an option value. This option value of waiting for the possibility to retire early seems to be highest for workers aged 50-54 and their separation probabilities are consequently lowest.[19] This result has important personnel policy implications for the design of early retirement plans.

Age effects for workers younger than 50 are more in line with findings of existing studies. Table 6.1b shows that workers aged 20 to 34 face higher hazards than workers in the reference group aged 35. This effect is stronger and significant in the period of corporate growth when hazard rates for those younger workers are on average about 60% higher than for workers in the reference group, but the effect is insignificant in the period of decline. Relative hazard rates for workers in their late thirties and early forties are smaller but not significantly so. Only in the period of downsizing do workers in their late forties face significantly lower separation rates than workers in the reference group.

More differentiated results surface when the model is estimated separately for blue- and white-collar workers (see Tables 6.2b and 6.3b). The estimates indicate that hazard rates decline stronger with age for young white-collar workers, and hazard rates relative to those of the respective reference group are higher for young white-collar workers than for young blue-collar workers in both periods. Table 6.3b shows in addition that young white-collar workers face especially higher separation rates in the period of corporate growth and the hazard of job separation then declines more with age for young white-collar workers. Separation hazards of workers younger than 30 are then 2.3-7.3 times higher than for white-collar workers aged 35.

White-collar workers have usually completed higher education and acquire relatively less skills on the job. They probably make fewer firm-specific investments than their blue-collar counterparts. Consequently, the surplus of the current match over the outside option tends to be smaller for white-collar workers and job-shopping is therefore a more common phenomenon early in the career of a white-collar worker.

It is interesting to note that blue-collar workers who are younger than 20

[19] Stock and Wise (1990) develop a retirement model which takes into account the option value of continuing work and thereby keeping the option to retire on better terms alive. Their model fits firm retirement data, marked by sharp discontinuous jumps in retirement rates at specificic ages, well.

years face lower separation rates in the period of workforce expansion. These workers are typically acquiring job-specific skills and often complete some vocational schooling (they are frequently apprentices). The results suggest that they become more likely to separate when the prospects of their current employer worsen, possibly because the horizon over which they can amortize their investments becomes more uncertain.

Finally, the hazard rate falls when workers are in their forties (see Table 6.1b). The hazard rate is on average about 33% lower for workers in their late forties than for workers in the reference category. Again, this effect is somewhat stronger for white-collar workers (see Table 6.2b). So we can summarize that young workers are less likely to stay with the same firm and separation rates fall for some time with age to rise again at retirement age. Existing studies often fit a quadratic age effect to capture such a pattern. However, this approach is flawed, because it ignores the discontinuities described above. Typically these studies estimate the minimum separation rates to occur at age 35-40. In fact, we have simulated this approach by also fitting a quadratic age effect in our data and found the minimum to be at age 36.8 for the model in the first column of Table 6.1b. Such a result would be consistent with lifetime incentive models because we should expect the firm's liability for the worker to be highest towards the middle of his working career. In addition, the chance that a profitable buyout is possible when productivity shocks hit is small as the claims of the worker would be large.

However, with the effects as estimated above it is not entirely obvious why it is optimal for firms that workers older than 55 separate more frequently in periods of downsizing while workers who are slightly younger stay. Early retirement schemes have strong spill-over effect on slightly younger workers that should be taken into account. Downsizing firms may want to offer less generous early retirement schemes to a broader group in worker to retain productive workers.

## 6.4 Effects of education

Education has both a direct impact on turnover rates and an indirect one via the assignment to a higher job level. Higher education raises the probability of being in higher wage scales of the firm. Workers in higher wage scales tend to have higher separation rates in the low-turnover regime but lower separation rates in the high-turnover regime (compare columns 2 and 3 of

Table 6.1e and note also that coefficients for low scales (4-9) and high scales (15-19) differ significantly across periods as the p-values in column 4 of Table 6.1e indicate). Assuming that the wage scales proxy for job complexity, we find the effect of education given job complexity when holding the wage scales constant. This is the direct effect of education.

Controlling for wage scales, we find that vocationally educated workers have lower separation rates than those with a general education. Workers holding only a general schooling degree (i.e. basic education (lo), intermediate general education (mavo), higher general schooling (havo) or general schooling that entitles to take university courses (vwo)) are more likely to separate than those who complete a vocational schooling degree at the level for which the general educational degree qualifies.[20] Furthermore, given wage scales, the effect of education is u-shaped, meaning that separation rates are lowest among workers with medium level education. While the impact of the educational level on the separation hazard does not change significantly for white-collar workers in the period of corporate decline (see coefficient estimates in columns 2 and 3 of Table 6.3c and p-values in colums 4 of the same Table), higher educated blue-collar workers become relatively less likely to separate during downsizing (see Table 6.3c).

Workers with completed apprenticeship face the lowest hazard of job separation in both periods. Apprenticeships are frequently completed at the firm. More than 57% of the workers, who join the firm after 1987 and obtain a higher degree during the employment spell, complete an apprenticeship, 18% complete intermediate vocational schooling, 8% higher vocational schooling, almost 6% obtain a college or university degree and roughly 10% achieve a higher general qualification. Since vocational schooling offered by the firm is likely to teach firm-specific skills and knowledge, our results suggest that separation rates are lower the more firm-specific a worker's human capital is. This is consistent with the prediction from human capital models.

The total effect of education on the job separation hazard is estimated when we do not control for wage scales. Since the separation rates of workers in different wage scales are affected non-proportionally by non-stationary forces, with workers in lower wage scales becoming relatively more likely to

[20]For example, intermediate general education (mavo) is a prerequisite for intermediate vocational schooling (mbo) and workers with an intermediate vocational schooling degree have lower separation rates than those with an intermediate general schooling degree only.

separate in the period of downsizing, it is important to distinguish between the high- and low-turnover regime. In the low-turnover regime, when separation rates are rather similar across wage scales, the effect of education is barely affected by leaving out controls for wage scales. The u-shaped effect becomes somewhat more pronounced and vocationally trained workers are less likely to separate. However, the u-shaped effect disappears in the second period, when hazard rates fall with the level of education. This result is largely driven by the indirect effect of education, i.e. the fact that workers in higher wage scales face significantly lower hazard rates. The hazard rate of a worker with a university degree is more than 25% lower than that of a worker who has completed an apprenticeship, the group that was least likely to separate in the first period. Vocationally trained workers still have lower hazard rates than their colleagues who hold a general degree that qualifies for the vocational training. Workers with vocational training at the highest level are least likely to separate in the period of downsizing.

Thus, in periods of turmoil vocationally trained workers and workers in more complex jobs face lower separation rates. Since higher educated workers have a higher probability of being in a more complex job, higher educated workers are less affected by non-stationary forces that raise the hazard of job separation.

## 6.5 The Effect of Performance Evaluation and Career Paths

The effect of the performance evaluation measures is significant and strong throughout (see Tables 6.1d, 6.2d and 6.3d). Workers with very low scores are much more likely to separate than workers in the reference group who were judged to perform well (see the Appendix for definition of variables). Overall, workers with the lowest score are 6.3 times more likely to separate than workers in the reference group (Table 6.1d, column 1); this effect is stronger for white-collar workers than for blue-collar workers in both subperiods (compare Tables 6.2d and 6.3d). In addition, the effect of having the worst evaluation score compared to having the reference group's evaluation score never changes significantly across periods (see columns 4 of Tables 6.1d, 6.2d and 6.3d).

This is different for blue-collar workers with evaluations better than those of the reference category. These workers become significantly less likely to separate during downsizing. In this period of corporate decline they have 30.4% (evaluation score of 4) to 47.4% (evaluation score of 6) lower hazards than workers in the reference group, whereas only workers with an evaluation score of 4 are significantly less likely to separate than workers in the reference group in the period of corporate growth and then their hazard is only 10.9% lower than that of reference group workers. Therefore we conclude that evaluation scores become more important for the determination of separation rates of blue-collar workers in the period of downsizing. Such an effect is not found for white-collar workers. The impact of performance evaluation scores on their separation rates does not change significantly across periods and, if anything, relative separation probabilities for differently evaluated workers are more similar in the second period (Table 6.3d).

Workers who have been promoted or have climbed up in the wage scale of the firm have lower separation hazards than those who have not made career from 1987 onwards. Variables that control for transitions in wage scales tend to have a stronger and statistically significant effect in the period of downsizing. In this period, a worker who has climbed up two wage scales, faces a job separation hazard that is permanently 15.7% lower than that of a worker who is still in the same scale as in 1987 (see Table 6.1d, column 3). Moreover, the effect of a recent transition in wage scales is larger and more significant in the period of downsizing than in the period of growth.

Table 6.2d reveals that recent transitions in wage scales especially reduce separation rates of blue-collar workers during downsizing; this effect is less strong for white-collar workers. Moreover, upward transitions in wage scales have a strong and significant negative persistent effect on separation rates for blue-collar workers in the period of workforce expansion, while the persistent effect of a transition is smaller in the period of downsizing. The persistent effect of upward transitions is insignificant for white-collar workers in both periods, yet moving down the wage scale has a larger positive effect and moving up in the wage scale has a negative effect on separation rates in the period of downsizing (Table 6.3d).

Promotions recorded in the wage files reduce the hazard of job separation: The coefficient estimate in column 1 of Table 6.1d is statistically significant at the 1%-level and suggests that the hazard rate falls by 15.8% per promotion. Yet the effect of a promotion differs for different groups of workers and across periods. It is strongest, but only significant at the 5%-level for white-collar workers during the period of corporate growth when a promotion lowers the hazard of job separation by 42.9% (Table 6.3d, column2). But a promotion does not affect the separation hazard of white-collar workers significantly during downsizing. The change of the effect of promotions on separation rates is significant as the p-value in column 4 of Table 6.3d indicates. Interestingly, the opposite holds for blue-collar workers. Promotions do not impact significantly on their separation rates during the growth phase, but reduce the risk of job loss significantly by 15.4% during downsizing. Wage growth associated with promotions is significant only for white-collar workers during downsizing, when 1% extra wage growth leads to a reduction of the separation hazard of 2%.

The completion of a degree affects only the separation rates of blue-collar workers significantly during the period of downsizing, when it raises separation rates by 66.9%. Wage growth associated with a degree completion tends to reduce separation rates, but the effect is insignificant and generally small. It is largest, but insignificant, for blue-collar workers during downsizing when a degree completion has a large positive effect. Then, a percentage point wage increase associated with a degree completion reduces the hazard rate by almost 8% suggesting more a wage increase of more than 8% is required to offset the effect of obtaining a higher degree. Clearly, the wage growth required by blue-collar workers to leave separation rates unaffected after obtaining a higher degree is larger during downsizing, indicating that workers then demand a larger share of the current surplus.

It seems that blue-collar workers make career by increasing their human capital and obtaining degrees and thereby climb the wage scale of the firm, while the career path is via promotions for white-collar workers. The transition to a higher wage scale and wage growth associated with either degree completion or promotion has a stronger negative effect on separation rates for blue-collar workers in the period of downsizing, while the event of obtaining a higher vocational or general schooling degree has a stronger positive effect on separation rates during downsizing. This implies that in periods when prospects are good, most of the reduction in separation probabilities comes from better prospects on future surpluses, while during periods of downsizing, blue-collar workers that make career, e.g. by obtaining a higher degree, require more current wage growth to prevent a separation. When prospects are bad, workers put much weight on their current share of the surplus.

Similarly, promoted white-collar workers are less likely to separate in the period of expansion, holding constant the wage. A rise into a higher wage scale or wage growth associated with the promotion does not have a significant impact on separation rates in times of expansions when prospects are good. However, the negative effect of a promotion, holding constant the wage, disappears in the period of downsizing, while higher wages have a stronger negative impact on separation rates.

## 6.6 Effects of Marital Status, Gender, and Worker Status

Married workers face 39.6% lower separation hazards than non-married workers during the period of expansion but only 16.6% lower hazards during the period of downsizing (see Table 6.1e). These effects are quantitatively similar for blue-collar and withe-collar workers (see Tables 6.2e and 6.3e). The differences between periods are always significant (see column 4 of Tables 6.1e, 6.2e and 6.3e).

Men are less likely to separate during the period of expansion (37.3% lower separation hazards than women) but face a higher risk of job loss in the period of downsizing when their job separation hazard is on average about 9.9% higher than that of women (Table 6.1e). Again the difference is highly significant. A comparison of the coefficient estimates of the gender effect in Tables 6.2e and 6.3e reveals, however, that differences of the effect between the episodes of corporate growth and decline are more pronounced and significant only for blue-collar workers. In fact, male white-collar workers are always less likely to separate than female white-collars and there is no significant difference in the point estimate of the gender effect in the two periods; yet the gender effect is only significant among white-collar workers during downsizing (the hazard is then 26.9% lower for white-collar males).

Hazard rates for part-time workers are significantly higher than for full-time workers. The estimates for the entire sample (Table 6.1e) indicate that hazard rates are 60% higher during expansion and 50% higher during downsizing for part-time workers, but the difference between periods is not significant. Tables 6.2e and 6.3e make however clear that the effect is stronger among blue-collar workers (70% higher hazards for part-timers during expansion and 55% during contraction and no significant difference between periods). While the impact of working part-time is significant for blue-collar workers in both regime, no significant effect is found for white-collar workers in the period of expansion. The point estimate is even negative then. However, the impact of having part-time status on separation rate changes significantly for white-collar workers during downsizing when part-time employees face 33.6% higher separation hazards.

Workers who are rehired during the observation period face a lower risk of job separation. This may result if some specific investments that were made during the unobserved employment spell are still valuable for the current surplus. While the effect of a previous employment spell with the firm never changes significantly across periods, it is significant only in the second period.

Finally, blue-collar workers have lower separation rates than white-collar workers when the workforce grows, but become more likely to separate during downsizing. This effect which shows up in the different baseline hazards for the sub-samples of blue- and white-collar workers is also reflected by the estimated coefficient of controls for the first observed wage scale of a worker in Table 6.1e. These estimated parameters suggest that separation rates are lowest for workers in the lower wage scales during expansion, but highest during downsizing. While estimates for all but one blue-collar wage scale are negative during expansion and all become positive during downsizing, the change in separation rates is especially pronounced and significant in scales 4-8. Analogously, workers in higher white-collar scales (15-19) are more likely to separate during expansion than workers in the reference scale 11, but all white-collar workers become less likely to separate during the period of expansion. The change is highly significant for workers in scales 15-19 (see column 4 of Table 6.1e).

Moreover, separation rates fall with an increase the first observed wage scale during downsizing. Hence the higher the wage - and therefore the higher the job level - the less likely a worker is to separate in the period of downsizing. This result is supported by the observation that a transition to a higher wage scale reduces the separation rate in the that period. In the period of expansion, separation rates differ less across wage scales. Neither workers in lower wage scales than the reference category (scale 11) nor workers in higher scales have separation rates that differ significantly from those of workers in scale 11. However, workers in the highest scales (15-19) are more likely to separate than those in lower scales (3-9).

# 7 Conclusion

This paper investigates differences in effects of worker separation characteristics between periods of workforce expansion and contraction. In a downsizing phase, workers are less willing to accept wage incentive contracts that postpone earnings, and career paths within the firm become an increasingly important indicator of a worker's mobility hazard. At the same time, the worker's current share of the surplus becomes more important when the firm's prospects worsen. Workforce reductions thus increase a worker's rate of discounting future earnings at the firm, decreasing the value of postponing mobility. This is in accordance with the implications from theoretical models that take account of the option value associated with a separation. A downsizing firm should recognize this and should offer sufficient current compensation to workers it it wants to stay.

Performance evaluation scores gain importance for blue-collar workers in periods of downsizing. In our data, this effect is not found for white-collar workers. Less than 2% of all workers get performance evaluation score in the lower third of the scale, but they face substantially higher job separation hazards. When turnover rates are high, as in periods of downsizing, individual separation hazards are much lower for those in the upper four deciles of the performance evaluation score distribution.

Career paths within the firm exhibit a dependence relation with a worker's turnover probability. Promotions are important to lower white-collar worker turnover during prosperous periods of the firm, but do not matter in bad times. Blue-collar workers experience the opposite effect of career paths. Promotions do not change the probability of turnover when the workforce expands, but reduces the chance of leaving when the firm is contracting.

Fitting a quadratic age effect produces misleading results. In fact, the effect of age on separation rates is marked by important discontinuities, which are probably driven by discontinuous changes of the value of the retirement option. Option values for retirement schemes change dramatically with the prospects of the firm. Workers kill the option to retire early more frequently in periods of downsizing. However, if early retirement is offered only beyond a certain age, the option to retire early at a given age has important spill-over effects for slightly younger workers who become consequently less likely to separate. A downsizing firm should take this crowding out effect into account when designing early retirement plans. The role of retirement and its relation to worker turnover rates deserves a more careful treatment in future work on corporate downsizing and worker mobility.

We have presented a case history analysis of worker mobility and compared the characteristics of turnover between prosperous and diminishing periods of a firm. This work can be expanded upon in a variety of ways. First, the behavior of other declining firms could be studied - nothing guarantees that in all such firms turnover will be characterized in the same way as we did. A second, more important route would be the development of a theoretical model to explain differences in turnover behavior between blue- and white-collar workers in good and bad times. The generally important point we have made - that smooth functional forms of the age effect in mobility studies produce misleading results - seems applicable to better understand and design early retirement plans and incentive schemes for corporate reorganizations.

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## Table 6.1a

Tenure

| | (1)<br>1987-1996 | (2)<br>1987-1991 | (3)<br>1991-1996 | p-value |
|---|---|---|---|---|
| ten3m | 3.452 | 3.367 | 3.100 | 0.0374 |
| | (0.083)** | (0.153)** | (0.128)** | |
| ten6m | 1.800 | 1.459 | 1.949 | 0.0001 |
| | (0.090)** | (0.163)** | (0.128)** | |
| ten9m | 1.523 | 1.175 | 1.744 | 0.0000 |
| | (0.088)** | (0.161)** | (0.121)** | |
| ten12m | 1.815 | 1.561 | 1.897 | 0.0010 |
| | (0.081)** | (0.160)** | (0.102)** | |
| ten1 | 1.495 | 0.926 | 1.931 | 0.0000 |
| | (0.067)** | (0.145)** | (0.078)** | |
| ten2 | 1.493 | 1.028 | 1.803 | 0.0000 |
| | (0.065)** | (0.145)** | (0.075)** | |
| ten3 | 1.408 | 1.074 | 1.627 | 0.0000 |
| | (0.064)** | (0.147)** | (0.072)** | |
| ten4 | 1.100 | 0.918 | 1.252 | 0.0000 |
| | (0.065)** | (0.155)** | (0.073)** | |
| ten5_9 | 0.780 | 0.745 | 0.823 | 0.2149 |
| | (0.056)** | (0.133)** | (0.063)** | |
| ten10_14 | 0.341 | 0.158 | 0.419 | 0.0001 |
| | (0.058)** | (0.143) | (0.065)** | |
| ten20_24 | -0.108 | -0.066 | -0.125 | 0.5242 |
| | (0.082) | (0.186) | (0.093) | |
| ten25_29 | -0.094 | 0.174 | -0.174 | 0.0010 |
| | (0.088) | (0.174) | (0.105)* | |
| ten30_34 | 0.291 | 0.242 | 0.281 | 0.6752 |
| | (0.077)** | (0.154) | (0.093)** | |
| ten35_39 | 0.359 | 0.079 | 0.442 | 0.0001 |
| | (0.079)** | (0.158) | (0.094)** | |
| ten40 | 0.976 | 0.642 | 1.132 | 0.0000 |
| | (0.093)** | (0.175)** | (0.114)** | |
| Observations | 172492 | 97806 | 87492 | |

Standard errors in parentheses
* significant at 5% level; ** significant at 1% level

Table 6.1b

Age Effects

| | (1)<br>1987-1996 | (2)<br>1987-1991 | (3)<br>1991-1996 | p-value |
|---|---|---|---|---|
| old17 | -0.231 | 0.038 | 0.099 | 0.9324 |
| | (0.418) | (0.528) | (0.719) | |
| old18 | -0.337 | -0.460 | 0.266 | 0.0009 |
| | (0.167)* | (0.276)* | (0.218) | |
| old19 | -0.321 | -0.478 | 0.026 | 0.0010 |
| | (0.127)** | (0.236)* | (0.153) | |
| old20 | -0.043 | 0.002 | 0.188 | 0.1455 |
| | (0.105) | (0.197) | (0.128) | |
| old21 | 0.070 | 0.275 | 0.147 | 0.2817 |
| | (0.096) | (0.182) | (0.119) | |
| old22 | 0.041 | 0.508 | -0.132 | 0.0000 |
| | (0.092) | (0.172)** | (0.118) | |
| old23 | 0.188 | 0.621 | 0.005 | 0.0000 |
| | (0.089)* | (0.169)** | (0.111) | |
| old24 | 0.067 | 0.438 | -0.087 | 0.0000 |
| | (0.086) | (0.169)** | (0.104) | |
| old25 | 0.295 | 0.534 | 0.214 | 0.0008 |
| | (0.081)** | (0.167)** | (0.095)* | |
| old26 | 0.162 | 0.494 | 0.051 | 0.0000 |
| | (0.082)* | (0.167)** | (0.096) | |
| old27 | 0.188 | 0.373 | 0.135 | 0.0108 |
| | (0.081)* | (0.170)* | (0.093) | |
| old28 | 0.117 | 0.414 | 0.010 | 0.0000 |
| | (0.082) | (0.169)** | (0.095) | |
| old29 | 0.129 | 0.412 | 0.025 | 0.0000 |
| | (0.082) | (0.170)** | (0.095) | |
| old30 | 0.152 | 0.432 | 0.041 | 0.0000 |
| | (0.082)* | (0.170)** | (0.094) | |
| old31 | 0.086 | 0.344 | -0.003 | 0.0003 |
| | (0.084) | (0.175)* | (0.097) | |
| old32 | 0.156 | 0.495 | 0.054 | 0.0000 |
| | (0.084)* | (0.175)** | (0.097) | |
| old33 | -0.020 | 0.184 | -0.076 | 0.0125 |
| | (0.091) | (0.189) | (0.104) | |
| old34 | -0.056 | 0.102 | -0.097 | 0.0565 |
| | (0.092) | (0.196) | (0.104) | |
| old36 | -0.014 | 0.145 | -0.059 | 0.0587 |
| | (0.095) | (0.199) | (0.108) | |
| old37 | 0.014 | -0.081 | 0.049 | 0.2386 |
| | (0.098) | (0.213) | (0.111) | |
| old38 | -0.107 | -0.232 | -0.085 | 0.2099 |
| | (0.104) | (0.229) | (0.117) | |
| old39 | -0.116 | -0.378 | -0.035 | 0.0031 |
| | (0.104) | (0.241) | (0.116) | |
| old40 | 0.081 | 0.229 | 0.046 | 0.1205 |
| | (0.102) | (0.209) | (0.118) | |

(continued on next page)

Table 6.1b (continued)

| | | | | |
|---|---|---|---|---|
| old41 | -0.140 | -0.336 | -0.037 | 0.0200 |
| | (0.114) | (0.251) | (0.128) | |
| old42 | -0.280 | 0.139 | -0.425 | 0.0001 |
| | (0.120)** | (0.222) | (0.145)** | |
| old43 | -0.182 | -0.456 | -0.081 | 0.0037 |
| | (0.116) | (0.273)* | (0.129) | |
| old44 | -0.308 | -0.135 | -0.326 | 0.1987 |
| | (0.129)** | (0.264) | (0.149)* | |
| old45 | -0.252 | -0.231 | -0.214 | 0.9112 |
| | (0.132)* | (0.291) | (0.148) | |
| old46 | -0.314 | -0.390 | -0.284 | 0.4808 |
| | (0.135)** | (0.315) | (0.150)* | |
| old47 | -0.499 | -0.484 | -0.465 | 0.9081 |
| | (0.146)** | (0.336) | (0.163)** | |
| old48 | -0.535 | -0.433 | -0.506 | 0.6776 |
| | (0.155)** | (0.336) | (0.175)** | |
| old49 | -0.787 | -0.258 | -0.925 | 0.0014 |
| | (0.173)** | (0.315) | (0.209)** | |
| old50 | -1.109 | -1.181 | -1.062 | 0.6510 |
| | (0.229)** | (0.472)** | (0.262)** | |
| old51 | -1.744 | -1.127 | -2.000 | 0.0238 |
| | (0.297)** | (0.473)** | (0.386)** | |
| old52 | -1.712 | -1.262 | -1.871 | 0.0936 |
| | (0.297)** | (0.523)** | (0.363)** | |
| old53 | -1.350 | -1.966 | -1.201 | 0.0082 |
| | (0.268)** | (0.724)** | (0.289)** | |
| old54 | -1.151 | -0.390 | -1.402 | 0.0001 |
| | (0.205)** | (0.352) | (0.256)** | |
| old55 | 1.878 | -0.912 | 2.255 | 0.0000 |
| | (0.092)** | (0.437)* | (0.101)** | |
| old56 | 1.326 | -0.230 | 1.873 | 0.0000 |
| | (0.112)** | (0.319) | (0.122)** | |
| old57 | 1.521 | 0.264 | 2.019 | 0.0000 |
| | (0.110)** | (0.279) | (0.122)** | |
| old58 | 1.476 | -0.035 | 2.223 | 0.0000 |
| | (0.114)** | (0.304) | (0.125)** | |
| old59 | 0.683 | 0.518 | 0.867 | 0.0444 |
| | (0.143)** | (0.257)* | (0.174)** | |
| old60 | 3.543 | 3.836 | 3.317 | 0.0000 |
| | (0.086)** | (0.169)** | (0.107)** | |
| old61 | 1.618 | 2.183 | 1.259 | 0.0000 |
| | (0.154)** | (0.243)** | (0.216)** | |
| old62 | 1.840 | 2.358 | 1.554 | 0.0002 |
| | (0.161)** | (0.261)** | (0.214)** | |
| old63 | 0.366 | 1.971 | -0.394 | 0.0000 |
| | (0.252) | (0.359)** | (0.370) | |
| old64 | 1.457 | 2.759 | 1.122 | 0.0000 |
| | (0.136)** | (0.240)** | (0.168)** | |
| Observations | 172492 | 97806 | 87492 | |

Standard errors in parentheses
* significant at 5% level; ** significant at 1% level

## Table 6.1c

Education

| | (1) | (2) | (3) | |
|---|---|---|---|---|
| | 1987-1996 | 1987-1991 | 1991-1996 | p-value |
| school_mis | 0.364 | 0.645 | 0.253 | 0.0000 |
| | (0.037)** | (0.071)** | (0.044)** | |
| school_1 | 0.298 | 0.325 | 0.310 | 0.9060 |
| | (0.096)** | (0.163)* | (0.124)** | |
| school_2 | 0.249 | 0.222 | 0.272 | 0.2577 |
| | (0.038)** | (0.076)** | (0.044)** | |
| school_3 | 0.192 | 0.325 | 0.173 | 0.0106 |
| | (0.049)** | (0.090)** | (0.059)** | |
| school_5 | 0.297 | 0.596 | 0.178 | 0.0000 |
| | (0.070)** | (0.117)** | (0.089)* | |
| school_6 | 0.103 | 0.238 | 0.055 | 0.0002 |
| | (0.042)** | (0.080)** | (0.049) | |
| school_7 | 0.208 | 0.528 | 0.056 | 0.0000 |
| | (0.075)** | (0.124)** | (0.096) | |
| school_8 | 0.112 | 0.415 | 0.002 | 0.0000 |
| | (0.057)* | (0.101)** | (0.071) | |
| school_9 | 0.210 | 0.459 | 0.106 | 0.0000 |
| | (0.067)** | (0.117)** | (0.083) | |
| Observations | 172492 | 97806 | 87492 | |

Standard errors in parentheses
* significant at 5% level; ** significant at 1% level

## Table 6.1d

Performance Evaluation and Career Paths

| | (1) | (2) | (3) | |
|---|---|---|---|---|
| | 1987-1996 | 1987-1991 | 1991-1996 | p-value |
| eval_mis | 0.348 | 0.619 | | - |
| | (0.137)** | (0.140)** | | |
| eval_1 | 1.837 | 1.813 | 1.946 | 0.5049 |
| | (0.142)** | (0.220)** | (0.199)** | |
| eval_2 | 0.677 | 0.847 | 0.573 | 0.0001 |
| | (0.055)** | (0.088)** | (0.070)** | |
| eval_4 | -0.225 | -0.122 | -0.279 | 0.0000 |
| | (0.027)** | (0.052)** | (0.031)** | |
| eval_5 | -0.361 | -0.112 | -0.449 | 0.0000 |
| | (0.049)** | (0.085) | (0.060)** | |
| eval_6 | -0.350 | -0.003 | -0.472 | 0.0002 |
| | (0.096)** | (0.150) | (0.127)** | |
| Δscale1 | -0.759 | -0.354 | -0.844 | 0.0000 |
| | (0.046)** | (0.099)** | (0.052)** | |
| Δscale2 | -0.686 | -0.011 | -0.781 | 0.0000 |
| | (0.136)** | (0.264) | (0.163)** | |
| Δscale<0 | -0.646 | 0.186 | -0.768 | 0.0000 |
| | (0.195)** | (0.543) | (0.210)** | |
| d_scale<0 | 0.105 | -0.010 | 0.195 | 0.1319 |
| | (0.123) | (0.320) | (0.136) | |
| d_scale1 | -0.042 | -0.192 | -0.040 | 0.0000 |
| | (0.031) | (0.070)** | (0.037) | |
| d_scale2 | -0.156 | -0.272 | -0.171 | 0.0285 |
| | (0.041)** | (0.125)* | (0.046)** | |
| d_scale3 | -0.127 | -0.222 | -0.160 | 0.2841 |
| | (0.052)** | (0.197) | (0.058)** | |
| Promotion | -0.147 | -0.206 | -0.162 | 0.3932 |
| | (0.049)** | (0.142) | (0.052)** | |
| prom_Δwage | 0.018 | 0.017 | 0.030 | 0.1206 |
| | (0.008)** | (0.023) | (0.008)** | |
| Degree | 0.479 | -0.085 | 0.544 | 0.0000 |
| | (0.101)** | (0.238) | (0.121)** | |
| degr_Δwage | -0.007 | 0.102 | -0.056 | 0.0000 |
| | (0.030) | (0.058)* | (0.038) | |
| Observations | 172492 | 97806 | 87492 | |

Standard errors in parentheses
* significant at 5% level; ** significant at 1% level

## Table 6.1e

Marital Status, gender and work status

| | (1)<br>1987-1996 | (2)<br>1987-1991 | (3)<br>1991-1996 | p-value |
|---|---|---|---|---|
| married | -0.298 | -0.505 | -0.182 | 0.0000 |
| | (0.023)** | (0.040)** | (0.029)** | |
| divorced | -0.308 | -0.830 | -0.082 | 0.0000 |
| | (0.106)** | (0.222)** | (0.121) | |
| male | -0.126 | -0.467 | 0.094 | 0.0000 |
| | (0.034)** | (0.056)** | (0.044)* | |
| part_time | 0.390 | 0.474 | 0.407 | 0.2075 |
| | (0.044)** | (0.081)** | (0.053)** | |
| rehire | -0.358 | -0.128 | -0.433 | 0.0018 |
| | (0.086)** | (0.185) | (0.098)** | |
| scale_2 | 0.129 | 0.699 | 0.099 | 0.1115 |
| | (0.259) | (0.359)* | (0.377) | |
| scale_3 | -0.137 | -0.297 | 0.018 | 0.0903 |
| | (0.139) | (0.222) | (0.186) | |
| scale_4 | 0.140 | -0.207 | 0.424 | 0.0000 |
| | (0.085) | (0.144) | (0.108)** | |
| scale_5 | 0.230 | -0.067 | 0.490 | 0.0000 |
| | (0.081)** | (0.137) | (0.104)** | |
| scale_6 | 0.195 | -0.097 | 0.418 | 0.0000 |
| | (0.080)** | (0.134) | (0.102)** | |
| scale_7 | 0.129 | -0.042 | 0.265 | 0.0030 |
| | (0.081) | (0.132) | (0.104)** | |
| scale_8 | 0.122 | -0.129 | 0.277 | 0.0001 |
| | (0.080) | (0.132) | (0.103)** | |
| scale_9 | 0.086 | -0.080 | 0.239 | 0.0036 |
| | (0.086) | (0.142) | (0.110)* | |
| scale_10 | 0.069 | 0.065 | 0.105 | 0.7334 |
| | (0.093) | (0.153) | (0.118) | |
| scale_12 | -0.432 | -0.208 | -0.476 | 0.0153 |
| | (0.086)** | (0.142) | (0.110)** | |
| scale_13 | -0.205 | -0.113 | -0.193 | 0.5087 |
| | (0.096)* | (0.161) | (0.121) | |
| scale_14 | -0.306 | -0.101 | -0.328 | 0.0685 |
| | (0.098)** | (0.161) | (0.125)** | |
| scale_15 | -0.175 | 0.197 | -0.402 | 0.0000 |
| | (0.102)* | (0.159) | (0.136)** | |
| scale_16 | -0.208 | 0.216 | -0.412 | 0.0000 |
| | (0.111)* | (0.174) | (0.146)** | |
| scale_17 | -0.130 | 0.287 | -0.380 | 0.0002 |
| | (0.141) | (0.226) | (0.181)* | |
| scale_18 | -0.373 | 0.332 | -0.705 | 0.0000 |
| | (0.139)** | (0.213) | (0.187)** | |
| scale_19 | -0.628 | 0.315 | -1.068 | 0.0000 |
| | (0.232)** | (0.344) | (0.318)** | |
| Observations | 172492 | 97806 | 87492 | |

Standard errors in parentheses
* significant at 5% level; ** significant at 1% level

# Table 6.1f:

Location

| | (1) 1987-1996 | (2) 1987-1991 | (3) 1991-1996 | p-value |
|---|---|---|---|---|
| location1 | 1.179 | 0.689 | | - |
| | (0.271)** | (0.278)** | | |
| location2 | 0.202 | 0.287 | 0.126 | 0.0000 |
| | (0.031)** | (0.056)** | (0.038)** | |
| location3 | -0.537 | -0.052 | -0.818 | 0.0000 |
| | (0.076)** | (0.112) | (0.106)** | |
| location4 | -0.216 | -0.117 | -0.253 | 0.0329 |
| | (0.052)** | (0.091) | (0.064)** | |
| location5 | -0.019 | -0.142 | -0.014 | 0.0422 |
| | (0.054) | (0.105) | (0.063) | |
| location6 | 0.136 | 0.270 | 0.047 | 0.0000 |
| | (0.036)** | (0.073)** | (0.043) | |
| location7 | -0.532 | 0.008 | -0.857 | 0.0000 |
| | (0.053)** | (0.090) | (0.067)** | |
| Observations | 172492 | 97806 | 87492 | |

## Table 6.2a

Tenure

| Blue-Collar Workers | | | | |
|---|---|---|---|---|
| | 1987-1996 | 1987-1991 | 1991-1996 | p-value |
| ten3m | 3.506 | 3.360 | 3.053 | 0.0356 |
| | (0.092)** | (0.178)** | (0.146)** | |
| ten6m | 1.819 | 1.381 | 1.907 | 0.0002 |
| | (0.100)** | (0.187)** | (0.143)** | |
| ten9m | 1.581 | 1.104 | 1.812 | 0.0000 |
| | (0.096)** | (0.185)** | (0.131)** | |
| ten12m | 1.850 | 1.490 | 1.884 | 0.0004 |
| | (0.090)** | (0.185)** | (0.112)** | |
| ten1 | 1.555 | 0.764 | 2.036 | 0.0000 |
| | (0.075)** | (0.170)** | (0.087)** | |
| ten2 | 1.517 | 0.838 | 1.846 | 0.0000 |
| | (0.073)** | (0.170)** | (0.082)** | |
| ten3 | 1.414 | 0.879 | 1.638 | 0.0000 |
| | (0.071)** | (0.172)** | (0.079)** | |
| ten4 | 1.075 | 0.750 | 1.206 | 0.0000 |
| | (0.072)** | (0.183)** | (0.080)** | |
| ten5_9 | 0.673 | 0.555 | 0.674 | 0.0870 |
| | (0.062)** | (0.154)** | (0.070)** | |
| ten10_14 | 0.343 | 0.073 | 0.405 | 0.0000 |
| | (0.064)** | (0.164) | (0.071)** | |
| ten20_24 | -0.188 | -0.230 | -0.220 | 0.9255 |
| | (0.097)* | (0.229) | (0.108)* | |
| ten25_29 | -0.041 | 0.094 | -0.132 | 0.0719 |
| | (0.103) | (0.204) | (0.125) | |
| ten30_34 | 0.375 | 0.163 | 0.376 | 0.0601 |
| | (0.091)** | (0.181) | (0.113)** | |
| ten35_39 | 0.300 | -0.021 | 0.351 | 0.0013 |
| | (0.095)** | (0.187) | (0.116)** | |
| ten40 | 0.952 | 0.667 | 1.100 | 0.0027 |
| | (0.116)** | (0.217)** | (0.144)** | |
| Observations | 125465 | 73771 | 61118 | |

Standard errors in parentheses
* significant at 5% level; ** significant at 1% level

<u>Table 6.2b</u>

Age

| | Blue-Collar Workers | | | |
|---|---|---|---|---|
| | 1987-1996 | 1987-1991 | 1991-1996 | p-value |
| old17 | -0.166 | -0.089 | 0.245 | 0.6437 |
| | (0.421) | (0.538) | (0.722) | |
| old18 | -0.295 | -0.594 | 0.351 | 0.0000 |
| | (0.174)* | (0.295)* | (0.225) | |
| old19 | -0.292 | -0.598 | 0.034 | 0.0001 |
| | (0.135)* | (0.258)* | (0.162) | |
| old20 | -0.017 | -0.104 | 0.162 | 0.0542 |
| | (0.114) | (0.222) | (0.138) | |
| old21 | 0.089 | 0.171 | 0.118 | 0.6809 |
| | (0.106) | (0.209) | (0.129) | |
| old22 | 0.059 | 0.409 | -0.144 | 0.0000 |
| | (0.103) | (0.201)* | (0.127) | |
| old23 | 0.174 | 0.511 | -0.016 | 0.0000 |
| | (0.100)* | (0.199)** | (0.122) | |
| old24 | 0.055 | 0.366 | -0.103 | 0.0001 |
| | (0.098) | (0.200)* | (0.116) | |
| old25 | 0.338 | 0.509 | 0.283 | 0.0358 |
| | (0.093)** | (0.198)** | (0.108)** | |
| old26 | 0.164 | 0.361 | 0.117 | 0.0271 |
| | (0.096)* | (0.201)* | (0.110) | |
| old27 | 0.222 | 0.325 | 0.209 | 0.2819 |
| | (0.095)** | (0.204) | (0.108)* | |
| old28 | 0.112 | 0.373 | 0.022 | 0.0015 |
| | (0.096) | (0.203)* | (0.111) | |
| old29 | 0.081 | 0.220 | 0.037 | 0.0971 |
| | (0.097) | (0.211) | (0.110) | |
| old30 | 0.128 | 0.411 | 0.015 | 0.0003 |
| | (0.097) | (0.208)* | (0.111) | |
| old31 | 0.063 | 0.129 | 0.027 | 0.3645 |
| | (0.100) | (0.220) | (0.113) | |
| old32 | 0.028 | 0.270 | -0.034 | 0.0089 |
| | (0.103) | (0.221) | (0.116) | |
| old33 | -0.074 | 0.152 | -0.154 | 0.0256 |
| | (0.110) | (0.232) | (0.125) | |
| old34 | -0.113 | -0.180 | -0.100 | 0.5153 |
| | (0.110) | (0.257) | (0.122) | |
| old36 | 0.021 | 0.099 | 0.003 | 0.4475 |
| | (0.112) | (0.245) | (0.126) | |
| old37 | 0.070 | -0.008 | 0.094 | 0.4329 |
| | (0.116) | (0.255) | (0.130) | |
| old38 | -0.174 | -0.497 | -0.122 | 0.0077 |
| | (0.127) | (0.301)* | (0.141) | |
| old39 | -0.138 | -0.539 | -0.025 | 0.0002 |
| | (0.124) | (0.307)* | (0.137) | |
| old40 | 0.224 | 0.271 | 0.221 | 0.7072 |
| | (0.118)* | (0.251) | (0.134)* | |

Standard errors in parentheses
* significant at 5% level; ** significant at 1% level

(continued on next page)

Table 6.2b (continued)

| | | | | |
|---|---|---|---|---|
| old41 | -0.091 | -0.482 | 0.045 | 0.0005 |
| | (0.137) | (0.321) | (0.151) | |
| old42 | -0.258 | 0.052 | -0.362 | 0.0660 |
| | (0.142)* | (0.274) | (0.169)* | |
| old43 | -0.182 | -0.635 | -0.063 | 0.0002 |
| | (0.139) | (0.351)* | (0.152) | |
| old44 | -0.298 | -0.149 | -0.308 | 0.3550 |
| | (0.150)* | (0.314) | (0.172)* | |
| old45 | -0.210 | -0.227 | -0.163 | 0.7102 |
| | (0.155) | (0.351) | (0.173) | |
| old46 | -0.335 | -0.655 | -0.272 | 0.0257 |
| | (0.158)* | (0.419) | (0.172) | |
| old47 | -0.401 | -0.376 | -0.406 | 0.8717 |
| | (0.167)** | (0.379) | (0.186)* | |
| old48 | -0.567 | -0.737 | -0.500 | 0.2620 |
| | (0.190)** | (0.446)* | (0.211)** | |
| old49 | -0.923 | -0.708 | -0.943 | 0.3332 |
| | (0.213)** | (0.447) | (0.243)** | |
| old50 | -0.958 | -1.140 | -0.901 | 0.3982 |
| | (0.250)** | (0.532)* | (0.283)** | |
| old51 | -1.945 | -1.289 | -2.243 | 0.0608 |
| | (0.387)** | (0.606)* | (0.509)** | |
| old52 | -2.045 | -1.216 | -2.502 | 0.0278 |
| | (0.417)** | (0.607)* | (0.585)** | |
| old53 | -1.245 | -2.295 | -1.050 | 0.0001 |
| | (0.301)** | (1.017)* | (0.316)** | |
| old54 | -1.277 | -0.257 | -1.611 | 0.0000 |
| | (0.244)** | (0.400) | (0.316)** | |
| old55 | 1.922 | -0.569 | 2.267 | 0.0000 |
| | (0.107)** | (0.449) | (0.116)** | |
| old56 | 1.486 | -0.262 | 1.983 | 0.0000 |
| | (0.130)** | (0.383) | (0.141)** | |
| old57 | 1.627 | 0.338 | 2.098 | 0.0000 |
| | (0.133)** | (0.321) | (0.147)** | |
| old58 | 1.550 | -0.141 | 2.375 | 0.0000 |
| | (0.139)** | (0.371) | (0.150)** | |
| old59 | 0.681 | 0.501 | 0.752 | 0.2750 |
| | (0.179)** | (0.306) | (0.230)** | |
| old60 | 3.735 | 3.888 | 3.465 | 0.0009 |
| | (0.102)** | (0.205)** | (0.128)** | |
| old61 | 1.592 | 1.852 | 1.452 | 0.1414 |
| | (0.204)** | (0.336)** | (0.272)** | |
| old62 | 1.804 | 2.365 | 1.541 | 0.0034 |
| | (0.212)** | (0.342)** | (0.281)** | |
| old63 | -0.782 | 0.656 | -1.280 | 0.0011 |
| | (0.461)* | (0.737) | (0.593)* | |
| old64 | 1.269 | 2.436 | 0.986 | 0.0000 |
| | (0.167)** | (0.301)** | (0.204)** | |
| Observations | 125465 | 73771 | 61118 | |

Standard errors in parentheses
* significant at 5% level; ** significant at 1% level

## Table 6.2c

Education

| | Blue-Collar Workers | | | |
|---|---|---|---|---|
| | 1987-1996 | 1987-1991 | 1991-1996 | p-value |
| school_mis | 0.343 | 0.577 | 0.242 | 0.0000 |
| | (0.039)** | (0.075)** | (0.047)** | |
| school_1 | 0.370 | 0.358 | 0.366 | 0.9481 |
| | (0.097)** | (0.163)* | (0.126)** | |
| school_2 | 0.257 | 0.200 | 0.284 | 0.0657 |
| | (0.039)** | (0.078)** | (0.046)** | |
| school_3 | 0.199 | 0.300 | 0.200 | 0.1032 |
| | (0.051)** | (0.093)** | (0.062)** | |
| school_5 | 0.327 | 0.587 | 0.214 | 0.0002 |
| | (0.076)** | (0.123)** | (0.099)* | |
| school_6 | 0.145 | 0.264 | 0.104 | 0.0020 |
| | (0.044)** | (0.084)** | (0.052)* | |
| school_7 | 0.371 | 0.632 | 0.168 | 0.0015 |
| | (0.104)** | (0.156)** | (0.143) | |
| school_8 | 0.425 | 0.497 | 0.436 | 0.6509 |
| | (0.105)** | (0.170)** | (0.135)** | |
| school_9 | 0.631 | 0.004 | 0.970 | 0.0010 |
| | (0.254)** | (0.510) | (0.294)** | |
| Observations | 125465 | 73771 | 61118 | |

Standard errors in parentheses
* significant at 5% level; ** significant at 1% level

# Table 6.2d

Performance evaluation and career paths

| | Blue-Collar Workers | | | |
|---|---|---|---|---|
| | 1987-1996 | 1987-1991 | 1991-1996 | p-value |
| eval_mis | 0.448 | 0.720 | | - |
| | (0.148)** | (0.152)** | | |
| eval_1 | 1.163 | 1.006 | 1.260 | 0.4257 |
| | (0.222)** | (0.329)** | (0.319)** | |
| eval_2 | 0.681 | 0.972 | 0.517 | 0.0000 |
| | (0.069)** | (0.116)** | (0.088)** | |
| eval_4 | -0.292 | -0.115 | -0.362 | 0.0000 |
| | (0.029)** | (0.059)* | (0.034)** | |
| eval_5 | -0.475 | -0.121 | -0.569 | 0.0000 |
| | (0.051)** | (0.092) | (0.063)** | |
| eval_6 | -0.523 | -0.025 | -0.642 | 0.0000 |
| | (0.099)** | (0.155) | (0.132)** | |
| Δscale1 | -0.859 | -0.348 | -0.988 | 0.0000 |
| | (0.050)** | (0.109)** | (0.057)** | |
| Δscale2 | -1.344 | -0.209 | -1.798 | 0.1128 |
| | (0.709)* | (1.010) | (1.002)* | |
| Δscale<0 | -0.775 | 0.190 | -0.930 | 0.0000 |
| | (0.219)** | (0.550) | (0.242)** | |
| d_scale<0 | -0.151 | 0.112 | -0.113 | 0.1444 |
| | (0.138) | (0.340) | (0.154) | |
| d_scale1 | -0.070 | -0.209 | -0.049 | 0.0001 |
| | (0.035)* | (0.078)** | (0.041) | |
| d_scale2 | -0.184 | -0.461 | -0.124 | 0.0000 |
| | (0.047)** | (0.151)** | (0.053)** | |
| d_scale3 | -0.090 | -0.652 | -0.024 | 0.0000 |
| | (0.062) | (0.349)* | (0.068) | |
| Promotion | -0.123 | -0.068 | -0.143 | 0.3455 |
| | (0.074)* | (0.208) | (0.080)* | |
| prom_Δwage | -0.007 | 0.013 | -0.001 | 0.3478 |
| | (0.014) | (0.040) | (0.015) | |
| Degree | 0.427 | -0.016 | 0.512 | 0.0003 |
| | (0.133)** | (0.450) | (0.145)** | |
| degr_Δwage | -0.027 | 0.079 | -0.087 | 0.0008 |
| | (0.046) | (0.168) | (0.050)* | |
| Observations | 125465 | 73771 | 61118 | |

Standard errors in parentheses
* significant at 5% level; ** significant at 1% level

Table 6.2e

## Marital Status , gender and work status

| | Blue-Collar Workers | | | |
|---|---|---|---|---|
| | 1987-1996 | 1987-1991 | 1991-1996 | p-value |
| married | -0.289 | -0.521 | -0.159 | 0.0000 |
| | (0.027)** | (0.047)** | (0.033)** | |
| divorced | -0.314 | -0.939 | -0.042 | 0.0000 |
| | (0.115)** | (0.254)** | (0.130) | |
| male | -0.048 | -0.492 | 0.217 | 0.0000 |
| | (0.038) | (0.062)** | (0.050)** | |
| part_time | 0.444 | 0.534 | 0.438 | 0.1131 |
| | (0.049)** | (0.088)** | (0.061)** | |
| rehire | -0.354 | -0.076 | -0.418 | 0.0021 |
| | (0.098)** | (0.208) | (0.111)** | |
| scale_2 | -0.255 | 0.727 | -0.387 | 0.0040 |
| | (0.269) | (0.367)* | (0.387) | |
| scale_3 | -0.293 | -0.106 | -0.387 | 0.1648 |
| | (0.149)* | (0.230) | (0.202)* | |
| scale_4 | -0.036 | -0.123 | 0.031 | 0.2436 |
| | (0.100) | (0.159) | (0.132) | |
| scale_5 | 0.050 | 0.032 | 0.059 | 0.8308 |
| | (0.096) | (0.150) | (0.127) | |
| scale_6 | -0.012 | -0.030 | -0.035 | 0.9706 |
| | (0.094) | (0.147) | (0.125) | |
| scale_7 | -0.084 | 0.034 | -0.199 | 0.0613 |
| | (0.093) | (0.143) | (0.124) | |
| scale_8 | -0.082 | -0.057 | -0.167 | 0.3642 |
| | (0.091) | (0.141) | (0.121) | |
| scale_9 | -0.097 | -0.040 | -0.151 | 0.3809 |
| | (0.096) | (0.150) | (0.127) | |
| scale_10 | -0.117 | 0.102 | -0.289 | 0.0048 |
| | (0.104) | (0.161) | (0.139)* | |
| Observations | 125465 | 73771 | 61118 | |

Standard errors in parentheses
* significant at 5% level; ** significant at 1% level

## Table 6.2f

Location

| | Blue-Collar Workers | | | |
|---|---|---|---|---|
| | 1987-1996 | 1987-1991 | 1991-1996 | p-value |
| location1 | 1.431 | 1.276 | | - |
| | (0.503)** | (0.509)** | | |
| location2 | 0.132 | 0.238 | 0.035 | 0.0000 |
| | (0.033)** | (0.061)** | (0.040) | |
| location3 | -0.415 | 0.186 | -0.742 | 0.0026 |
| | (0.131)** | (0.186) | (0.185)** | |
| location4 | -0.290 | -0.182 | -0.291 | 0.1098 |
| | (0.056)** | (0.098)* | (0.068)** | |
| location5 | -0.147 | -0.323 | -0.141 | 0.0102 |
| | (0.061)** | (0.124)** | (0.071)* | |
| location6 | 0.000 | 0.172 | -0.082 | 0.0000 |
| | (0.039) | (0.081)* | (0.046)* | |
| location7 | -0.734 | -0.024 | -1.127 | 0.0000 |
| | (0.060)** | (0.098) | (0.077)** | |
| Observations | 125465 | 73771 | 61118 | |

## Table 6.3a

Tenure

| | White-Collar Workers | | | |
|---|---|---|---|---|
| | 1987-1996 | 1987-1991 | 1991-1996 | p-value |
| ten3m | 3.199 | 3.107 | 3.110 | 0.9926 |
| | (0.213)** | (0.353)** | (0.297)** | |
| ten6m | 1.676 | 1.557 | 1.853 | 0.3358 |
| | (0.228)** | (0.373)** | (0.308)** | |
| ten9m | 1.346 | 1.357 | 1.291 | 0.8479 |
| | (0.232)** | (0.363)** | (0.342)** | |
| ten12m | 1.702 | 1.735 | 1.725 | 0.9712 |
| | (0.204)** | (0.349)** | (0.268)** | |
| ten1 | 1.501 | 1.488 | 1.545 | 0.7805 |
| | (0.163)** | (0.300)** | (0.204)** | |
| ten2 | 1.599 | 1.628 | 1.642 | 0.9416 |
| | (0.158)** | (0.297)** | (0.193)** | |
| ten3 | 1.433 | 1.636 | 1.400 | 0.2132 |
| | (0.156)** | (0.297)** | (0.189)** | |
| ten4 | 1.251 | 1.392 | 1.272 | 0.5295 |
| | (0.159)** | (0.306)** | (0.190)** | |
| ten5_9 | 1.259 | 1.490 | 1.223 | 0.1040 |
| | (0.139)** | (0.275)** | (0.164)** | |
| ten10_14 | 0.586 | 0.602 | 0.566 | 0.8310 |
| | (0.148)** | (0.306)* | (0.170)** | |
| ten20_24 | 0.294 | 0.328 | 0.237 | 0.6541 |
| | (0.172)* | (0.338) | (0.202) | |
| ten25_29 | 0.108 | 0.558 | -0.076 | 0.0037 |
| | (0.183) | (0.346) | (0.219) | |
| ten30_34 | 0.418 | 0.355 | 0.293 | 0.7558 |
| | (0.163)** | (0.307) | (0.198) | |
| ten35_39 | 0.704 | 0.348 | 0.686 | 0.0936 |
| | (0.166)** | (0.312) | (0.201)** | |
| ten40 | 1.214 | 0.815 | 1.417 | 0.0068 |
| | (0.180)** | (0.328)** | (0.223)** | |
| Observations | 47027 | 24035 | 26374 | |

Standard errors in parentheses
* significant at 5% level; ** significant at 1% level

## Table 6.3b

Age

| | White-Collar Workers | | | |
|---|---|---|---|---|
| | 1987-1996 | 1987-1991 | 1991-1996 | p-value |
| old17 | | | | |
| | | | | |
| old18 | | | | |
| | | | | |
| old19 | | | | |
| | | | | |
| old20 | 1.892 | | 1.919 | - |
| | (0.754)** | | (0.785)** | |
| old21 | 1.856 | 2.051 | | - |
| | (1.040)* | (1.091)* | | |
| old22 | 0.426 | 1.122 | | - |
| | (0.728) | (0.773) | | |
| old23 | 1.126 | 1.622 | 0.477 | 0.0189 |
| | (0.277)** | (0.400)** | (0.488) | |
| old24 | 0.641 | 0.812 | 0.600 | 0.4739 |
| | (0.226)** | (0.379)* | (0.296)* | |
| old25 | 0.398 | 0.765 | 0.133 | 0.0210 |
| | (0.202)* | (0.340)* | (0.274) | |
| old26 | 0.692 | 1.134 | 0.395 | 0.0006 |
| | (0.172)** | (0.312)** | (0.216)* | |
| old27 | 0.482 | 0.749 | 0.315 | 0.0334 |
| | (0.168)** | (0.316)** | (0.204) | |
| old28 | 0.502 | 0.739 | 0.364 | 0.0515 |
| | (0.161)** | (0.311)** | (0.193)* | |
| old29 | 0.553 | 1.013 | 0.282 | 0.0002 |
| | (0.158)** | (0.297)** | (0.193) | |
| old30 | 0.419 | 0.677 | 0.306 | 0.0461 |
| | (0.157)** | (0.303)* | (0.186)* | |
| old31 | 0.269 | 0.832 | -0.014 | 0.0000 |
| | (0.158)* | (0.297)** | (0.192) | |
| old32 | 0.489 | 0.914 | 0.313 | 0.0008 |
| | (0.151)** | (0.294)** | (0.179)* | |
| old33 | 0.107 | 0.224 | 0.079 | 0.4443 |
| | (0.164) | (0.328) | (0.190) | |
| old34 | 0.079 | 0.505 | -0.106 | 0.0021 |
| | (0.166) | (0.314) | (0.199) | |
| old36 | -0.142 | 0.169 | -0.258 | 0.0435 |
| | (0.179) | (0.344) | (0.212) | |
| old37 | -0.153 | -0.373 | -0.076 | 0.1596 |
| | (0.186) | (0.398) | (0.211) | |
| old38 | 0.008 | 0.072 | -0.020 | 0.6662 |
| | (0.184) | (0.365) | (0.214) | |
| old39 | -0.069 | -0.074 | -0.046 | 0.8993 |
| | (0.193) | (0.397) | (0.222) | |
| old40 | -0.353 | 0.160 | -0.517 | 0.0101 |
| | (0.213)* | (0.379) | (0.263)* | |

(continued on next page)

Table 6.3b (continued)

| | | | | |
|---|---|---|---|---|
| old41 | -0.201 | -0.186 | -0.180 | 0.9812 |
| | (0.210) | (0.411) | (0.246) | |
| old42 | -0.321 | 0.315 | -0.619 | 0.0014 |
| | (0.226) | (0.381) | (0.292)* | |
| old43 | -0.151 | -0.064 | -0.176 | 0.6507 |
| | (0.215) | (0.442) | (0.248) | |
| old44 | -0.478 | -0.199 | -0.557 | 0.2374 |
| | (0.256)* | (0.489) | (0.303)* | |
| old45 | -0.325 | -0.177 | -0.354 | 0.5407 |
| | (0.252) | (0.520) | (0.290) | |
| old46 | -0.332 | 0.004 | -0.444 | 0.1512 |
| | (0.262) | (0.490) | (0.312) | |
| old47 | -0.839 | -0.805 | -0.823 | 0.9586 |
| | (0.310)** | (0.757) | (0.343)** | |
| old48 | -0.468 | 0.161 | -0.590 | 0.0197 |
| | (0.273)* | (0.523) | (0.322)* | |
| old49 | -0.521 | 0.426 | -0.973 | 0.0007 |
| | (0.302)* | (0.467) | (0.414)** | |
| old50 | -1.689 | -1.244 | -1.813 | 0.4338 |
| | (0.595)** | (1.039) | (0.727)** | |
| old51 | -1.343 | -0.623 | -1.597 | 0.1053 |
| | (0.469)** | (0.763) | (0.601)** | |
| old52 | -1.333 | -1.464 | -1.199 | 0.5859 |
| | (0.440)** | (1.042) | (0.487)** | |
| old53 | -1.823 | -1.554 | -1.919 | 0.6166 |
| | (0.596)** | (1.042) | (0.729)** | |
| old54 | -0.930 | -0.758 | -0.979 | 0.6195 |
| | (0.383)** | (0.770) | (0.445)* | |
| old55 | 1.732 | | 2.138 | - |
| | (0.187)** | | (0.213)** | |
| old56 | 1.027 | 0.058 | 1.491 | 0.0000 |
| | (0.222)** | (0.584) | (0.252)** | |
| old57 | 1.381 | 0.188 | 1.793 | 0.0000 |
| | (0.205)** | (0.587) | (0.233)** | |
| old58 | 1.403 | 0.349 | 1.931 | 0.0000 |
| | (0.209)** | (0.541) | (0.239)** | |
| old59 | 0.702 | 0.706 | 0.917 | 0.4636 |
| | (0.245)** | (0.488) | (0.288)** | |
| old60 | 3.313 | 3.987 | 3.099 | 0.0000 |
| | (0.166)** | (0.320)** | (0.204)** | |
| old61 | 1.777 | 2.781 | 1.126 | 0.0000 |
| | (0.245)** | (0.388)** | (0.366)** | |
| old62 | 2.059 | 2.671 | 1.791 | 0.0115 |
| | (0.261)** | (0.433)** | (0.348)** | |
| old63 | 1.860 | 3.290 | 0.966 | 0.0000 |
| | (0.318)** | (0.479)** | (0.486)* | |
| Old64 | 1.952 | 3.651 | 1.344 | 0.0000 |
| | (0.243)** | (0.433)** | (0.309)** | |
| Observations | 47027 | 24035 | 26374 | |

Standard errors in parentheses
* significant at 5% level; ** significant at 1% level

## Table 6.3c

Education

| | White-Collar Workers | | | |
|---|---|---|---|---|
| | 1987-1996 | 1987-1991 | 1991-1996 | p-value |
| school_mis | 0.118 | 0.311 | 0.050 | 0.1345 |
| | (0.149) | (0.309) | (0.175) | |
| school_1 | | | | - |
| | | | | |
| school_2 | 0.134 | 0.105 | 0.128 | 0.9215 |
| | (0.187) | (0.360) | (0.236) | |
| school_3 | 0.018 | -0.079 | -0.023 | 0.8224 |
| | (0.198) | (0.365) | (0.249) | |
| school_5 | 0.019 | 0.078 | -0.011 | 0.7232 |
| | (0.215) | (0.432) | (0.251) | |
| school_6 | -0.310 | -0.503 | -0.316 | 0.3176 |
| | (0.163)* | (0.352) | (0.187)* | |
| school_7 | -0.142 | -0.020 | -0.208 | 0.3516 |
| | (0.169) | (0.339) | (0.202) | |
| school_8 | -0.229 | -0.171 | -0.285 | 0.5217 |
| | (0.151) | (0.313) | (0.178) | |
| school_9 | -0.095 | -0.069 | -0.152 | 0.6492 |
| | (0.155) | (0.319) | (0.183) | |
| Observations | 47027 | 24035 | 26374 | |

Standard errors in parentheses
* significant at 5% level; ** significant at 1% level

## Table 6.3d

Performance evaluation and career paths

| | White-Collar Workers | | | |
|---|---|---|---|---|
| | 1987-1996 | 1987-1991 | 1991-1996 | p-value |
| eval_mis | -0.300 | -0.233 | | - |
| | (0.391) | (0.408) | | |
| eval_1 | 3.021 | 3.202 | 2.757 | 0.1127 |
| | (0.191)** | (0.286)** | (0.281)** | |
| eval_2 | 0.655 | 0.589 | 0.714 | 0.2953 |
| | (0.090)** | (0.141)** | (0.119)** | |
| eval_4 | -0.075 | -0.039 | -0.086 | 0.5933 |
| | (0.072) | (0.125) | (0.089) | |
| eval_5 | -0.633 | -1.260 | -0.698 | 0.2248 |
| | (0.343)* | (0.541)** | (0.463) | |
| eval_6 | | | | - |
| | | | | |
| Δscale1 | -0.385 | -0.153 | -0.351 | 0.1417 |
| | (0.116)** | (0.248) | (0.135)** | |
| Δscale2 | -0.395 | -0.327 | -0.372 | 0.7957 |
| | (0.147)** | (0.304) | (0.174)* | |
| Δscale<0 | -0.115 | -39.435 | -0.276 | 0.0000 |
| | (0.436) | (6.34e) | (0.445) | |
| d_scale<0 | 0.291 | 0.014 | 0.502 | 0.1577 |
| | (0.321) | (1.020) | (0.345) | |
| d_scale1 | 0.004 | -0.143 | -0.027 | 0.1932 |
| | (0.077) | (0.186) | (0.089) | |
| d_scale2 | 0.048 | 0.403 | -0.131 | 0.0000 |
| | (0.091) | (0.232)* | (0.104) | |
| d_scale3 | 0.081 | 0.226 | -0.073 | 0.0127 |
| | (0.103) | (0.257) | (0.120) | |
| promotion | -0.062 | -0.536 | -0.024 | 0.0000 |
| | (0.071) | (0.237)* | (0.075) | |
| prom_Δwage | 0.017 | 0.019 | 0.021 | 0.8415 |
| | (0.010)* | (0.030) | (0.010)* | |
| degree | 0.180 | 1.404 | -0.171 | 0.0276 |
| | (0.543) | (0.894) | (0.715) | |
| degr_Δwage | 0.025 | 0.032 | 0.016 | 0.8010 |
| | (0.047) | (0.079) | (0.063) | |
| Observations | 47027 | 24035 | 26374 | |

Standard errors in parentheses
* significant at 5% level; ** significant at 1% level

<u>Table 6.3e</u>

Marital Status , gender and work status

| | White-Collar Workers | | | |
|---|---|---|---|---|
| | 1987-1996 | 1987-1991 | 1991-1996 | p-value |
| Married | -0.261 | -0.385 | -0.218 | 0.0114 |
| | (0.051)** | (0.083)** | (0.066)** | |
| Divorced | -0.292 | -0.364 | -0.263 | 0.7618 |
| | (0.269) | (0.462) | (0.334) | |
| Male | -0.279 | -0.250 | -0.313 | 0.5323 |
| | (0.083)** | (0.155) | (0.100)** | |
| part_time | 0.204 | -0.128 | 0.290 | 0.0003 |
| | (0.103)* | (0.257) | (0.115)** | |
| Rehire | -0.226 | -0.055 | -0.377 | 0.1280 |
| | (0.183) | (0.409) | (0.212)* | |
| scale_12 | -0.214 | -0.049 | -0.254 | 0.0381 |
| | (0.079)** | (0.147) | (0.099)** | |
| scale_14 | 0.035 | 0.143 | 0.032 | 0.3146 |
| | (0.088) | (0.153) | (0.110) | |
| scale_15 | 0.228 | 0.503 | 0.064 | 0.0004 |
| | (0.093)** | (0.154)** | (0.124) | |
| scale_16 | 0.203 | 0.460 | 0.024 | 0.0021 |
| | (0.105)* | (0.172)** | (0.142) | |
| scale_17 | 0.358 | 0.585 | 0.230 | 0.0455 |
| | (0.136)** | (0.226)** | (0.177) | |
| scale_18 | 0.158 | 0.710 | -0.246 | 0.0000 |
| | (0.140) | (0.220)** | (0.190) | |
| scale_19 | -0.061 | 0.697 | -0.505 | 0.0002 |
| | (0.233) | (0.350)* | (0.321) | |
| Observations | 47027 | 24035 | 26374 | |

Standard errors in parentheses
* significant at 5% level; ** significant at 1% level

## Table 6.3f

Location

| | White-Collar Workers | | | |
|---|---|---|---|---|
| | 1987-1996 | 1987-1991 | 1991-1996 | p-value |
| location1 | 0.779 | 0.668 | | - |
| | (0.324)** | (0.335)* | | |
| location2 | 0.429 | 0.332 | 0.459 | 0.2671 |
| | (0.092)** | (0.163)* | (0.115)** | |
| location3 | -0.486 | -0.088 | -0.785 | 0.0000 |
| | (0.095)** | (0.141) | (0.131)** | |
| location4 | 0.043 | 0.295 | -0.014 | 0.1308 |
| | (0.161) | (0.271) | (0.205) | |
| location5 | 0.319 | 0.459 | 0.216 | 0.0859 |
| | (0.114)** | (0.197)** | (0.142) | |
| location6 | 0.549 | 0.669 | 0.516 | 0.1862 |
| | (0.095)** | (0.173)** | (0.116)** | |
| location7 | -0.008 | -0.059 | -0.031 | 0.8394 |
| | (0.117) | (0.243) | (0.138) | |
| Observations | 47027 | 24035 | 26374 | |

Standard errors in parentheses
* significant at 5% level; ** significant at 1% level

Figure 5.1

Number of workers of workers employed at the 14th of each month during the period from January 1987 until April 1996

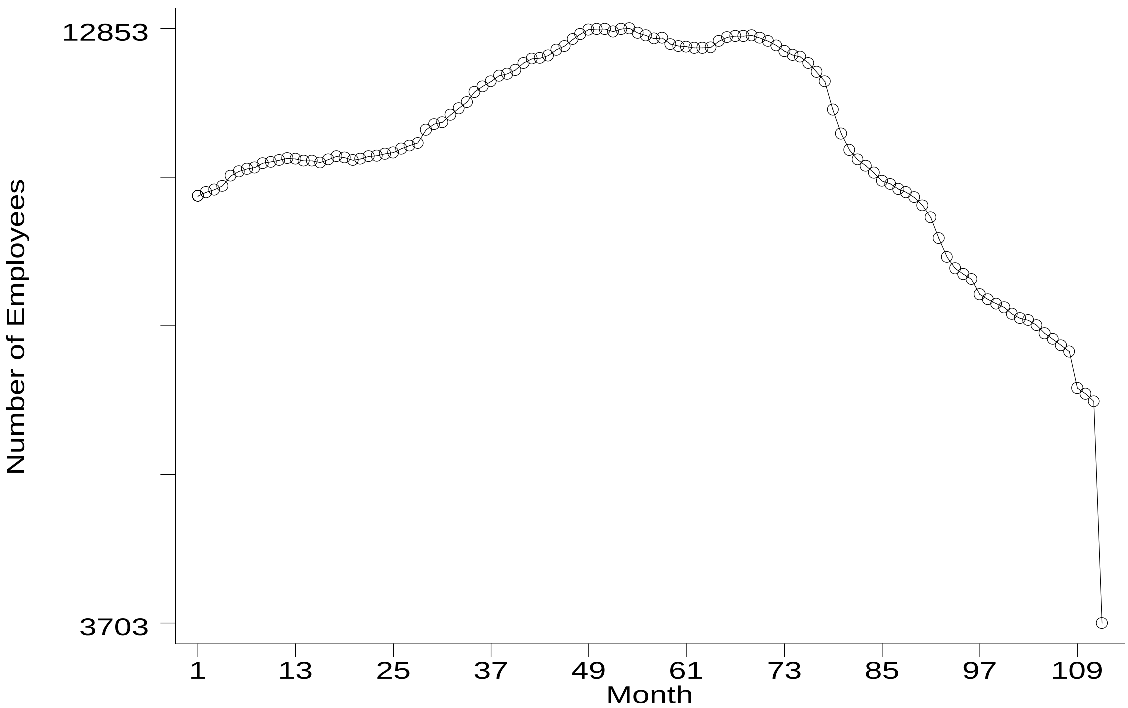
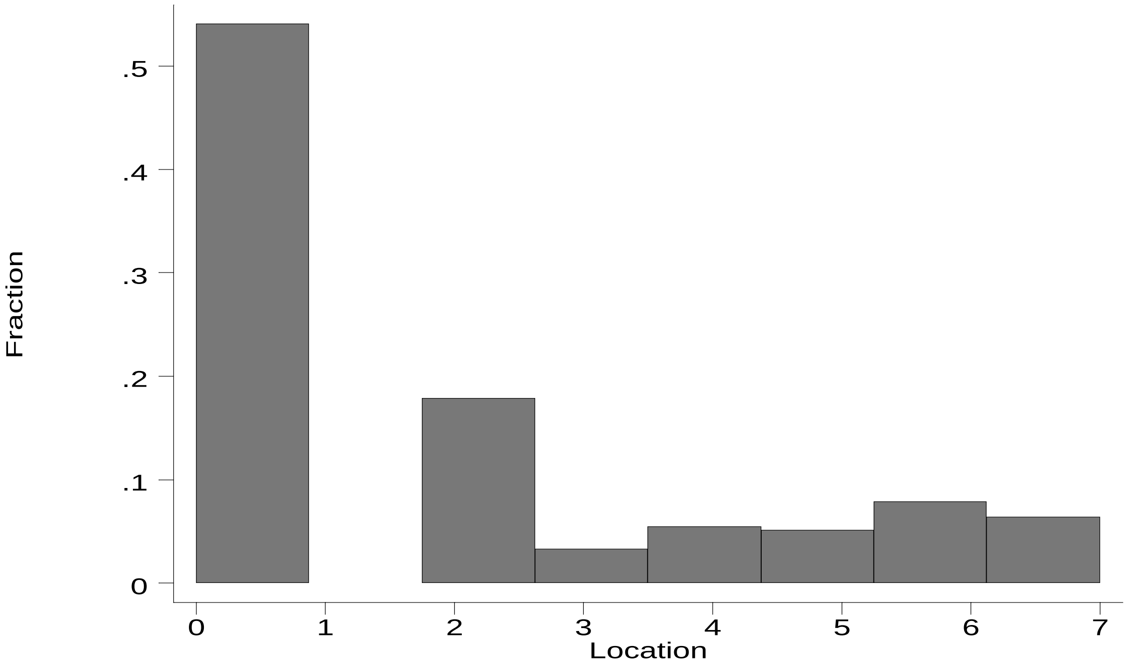


Figure 5.2

Panel a) Proportions of workers employed at the different locations on March 1st 1991




0 Fokker Aircraft (Schiphol) and Fokker Administration (Amsterdam)
1 Aerostructures (Schiphol)
2 Fokker Aircraft (Papendrecht/Dordrecht)
3 Fokker Space and Systems (Leiden)
4 Fokker ELMO (Woensdrecht)
5 Fokker Special Products (Hoogeveen)
6 Fokker Aircraft (Ypenburg)
7 Fokker Aircraft Services (Woensdrecht)

Panel b) Distribution of job tenure among employed workers on March 1st 1991

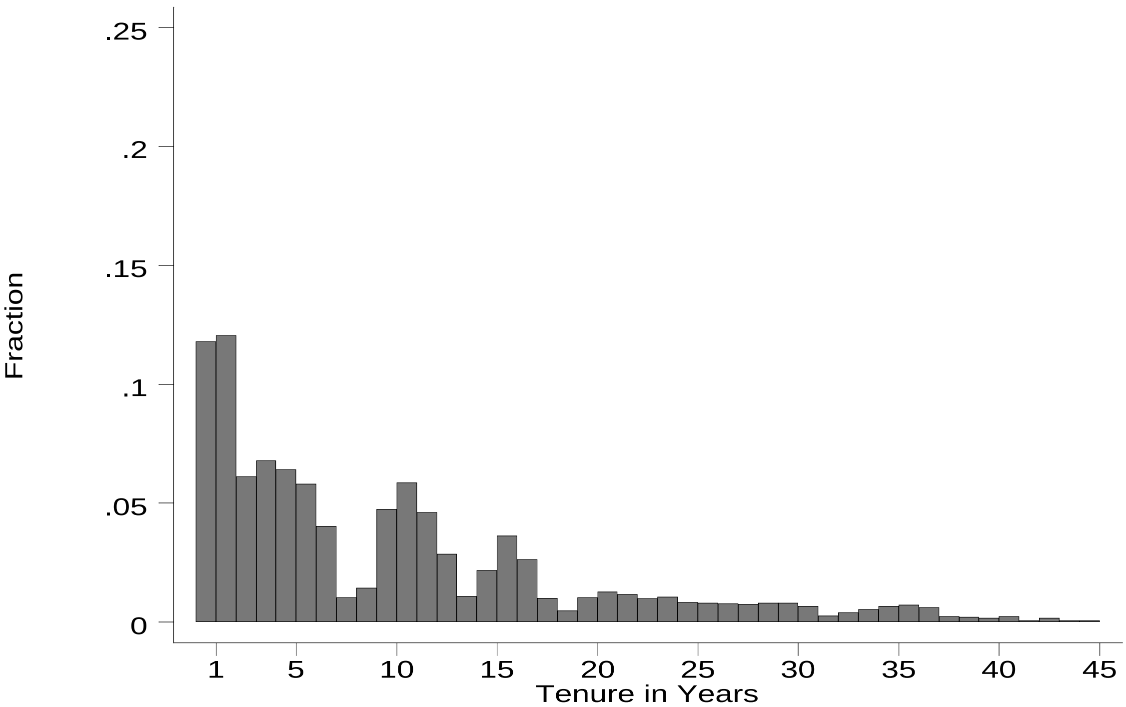
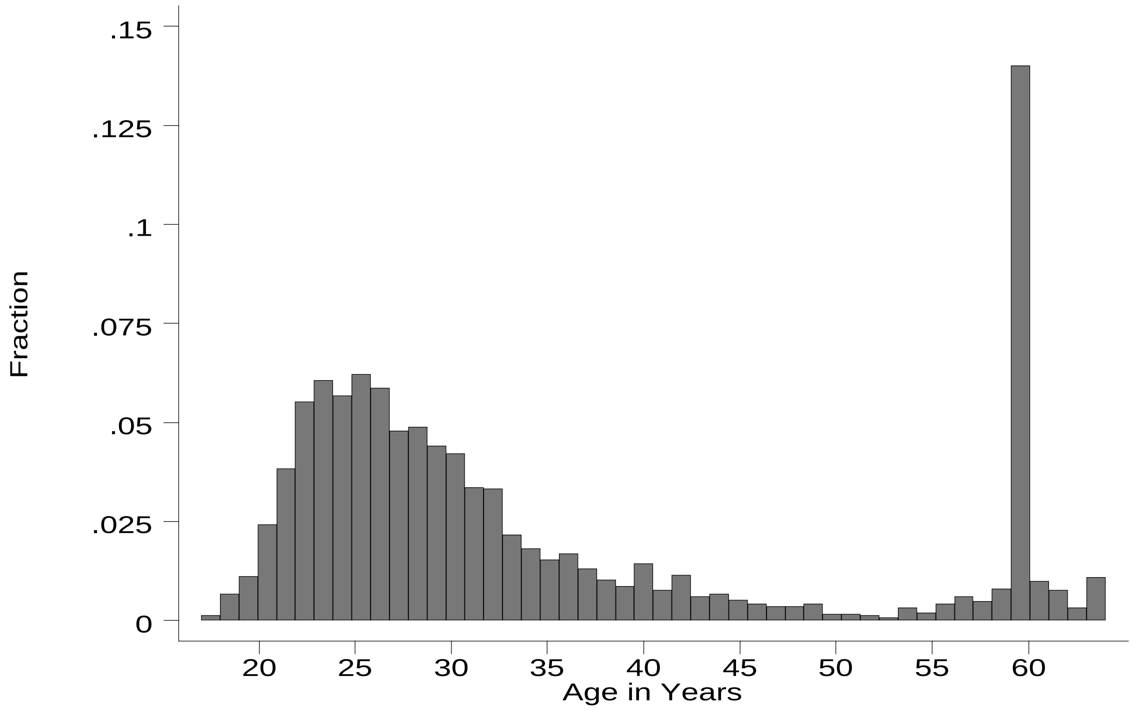


Figure 5.3

Panel c) Distribution of age among workers separating in the period January 1st 1987-March 1st 1991




Panel d) Distribution of schooling degrees among workers separating in the period January 1st 1987-March 1st 1991

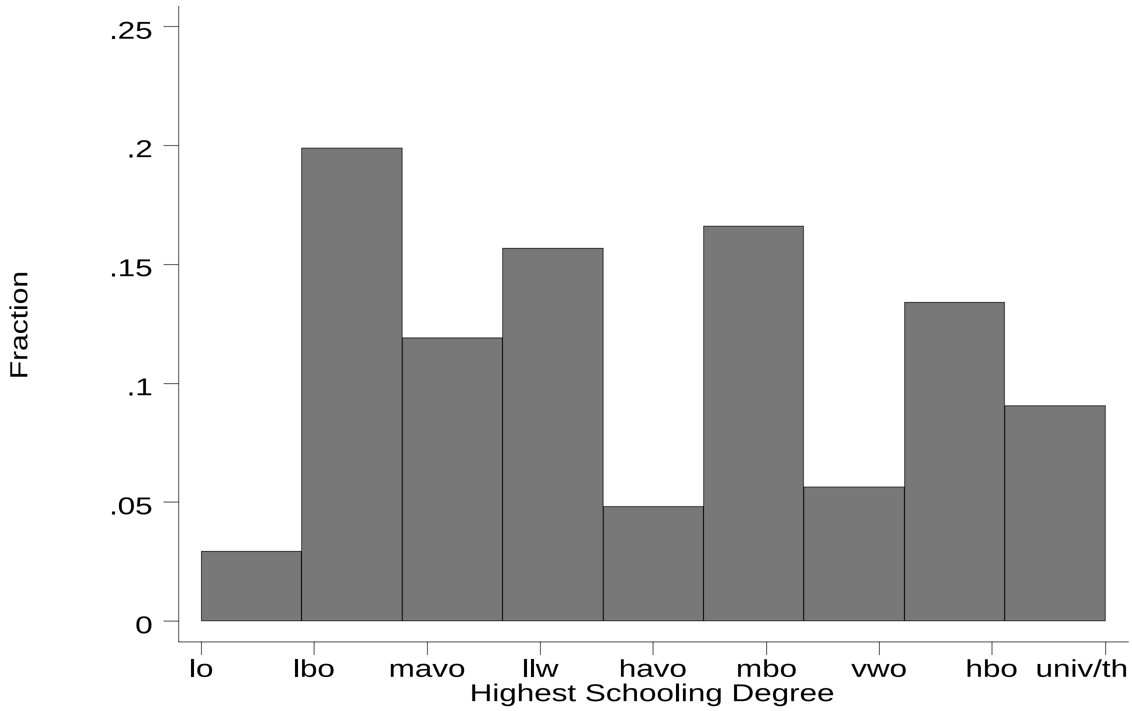
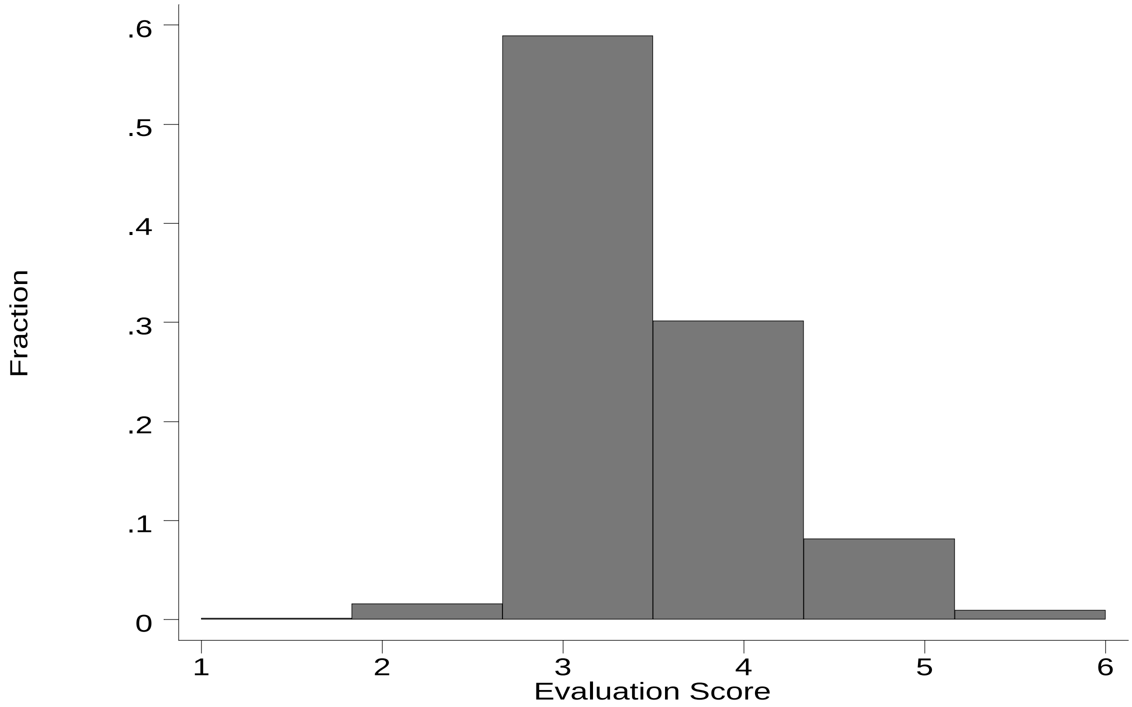


Figure 5.2

Panel e) Distribution of performance evaluation scores among employed workers on March 1st 1991




Panel f) Distribution of employed workers in wage scales on March 1st 1991

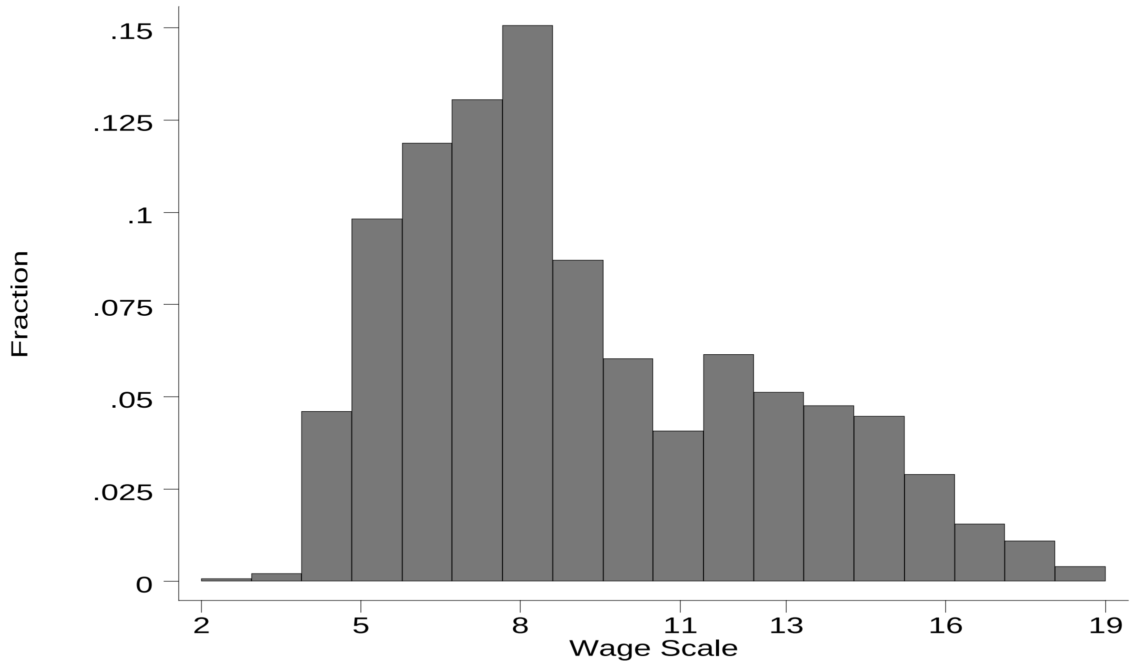
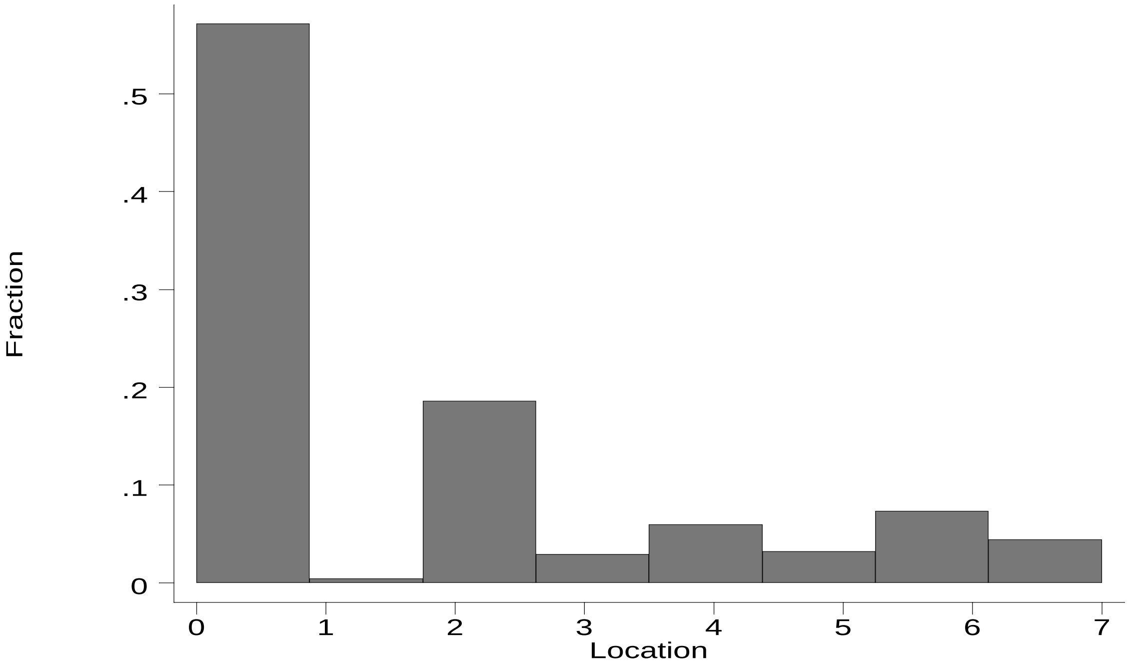


Figure 5.3

Panel a) Distribution of locations from which workers separate in the period January 1st 1987 - March 1st 1991




0 Fokker Aircraft (Schiphol) and Fokker Administration (Amsterdam)
1 Aerostructures (Schiphol)
2 Fokker Aircraft (Papendrecht/Dordrecht)
3 Fokker Space and Systems (Leiden)
4 Fokker ELMO (Woensdrecht)
5 Fokker Special Products (Hoogeveen)
6 Fokker Aircraft (Ypenburg)
7 Fokker Aircraft Services (Woensdrecht)

Panel b) Distribution of job tenure of workers separating in the period January 1st 1987 - March 1st 1991

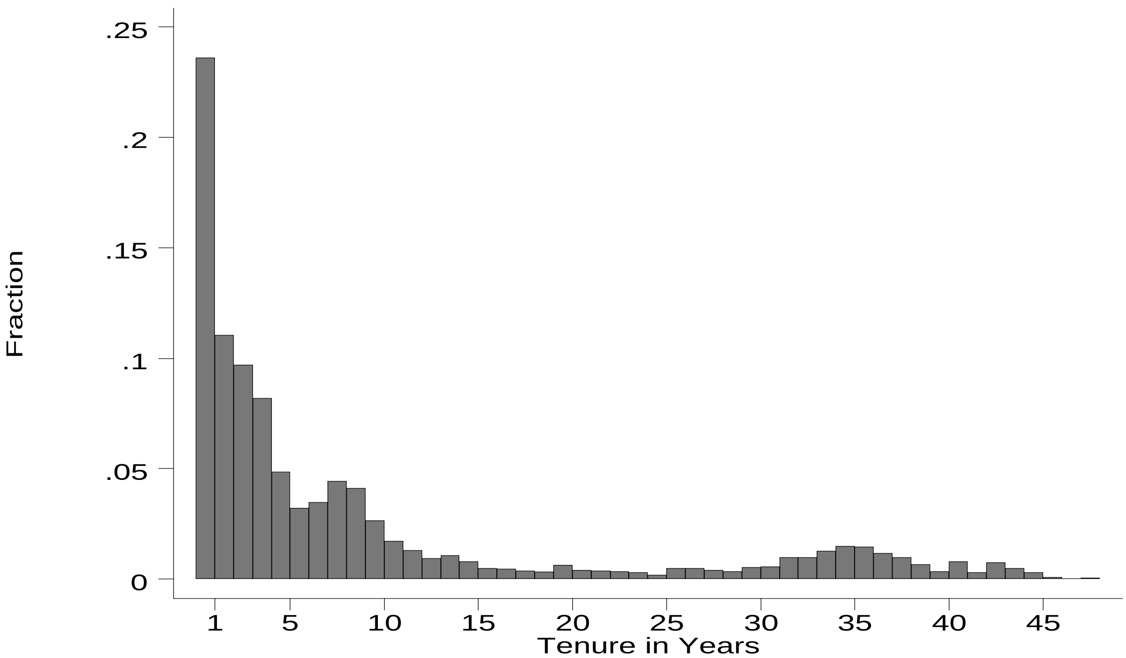
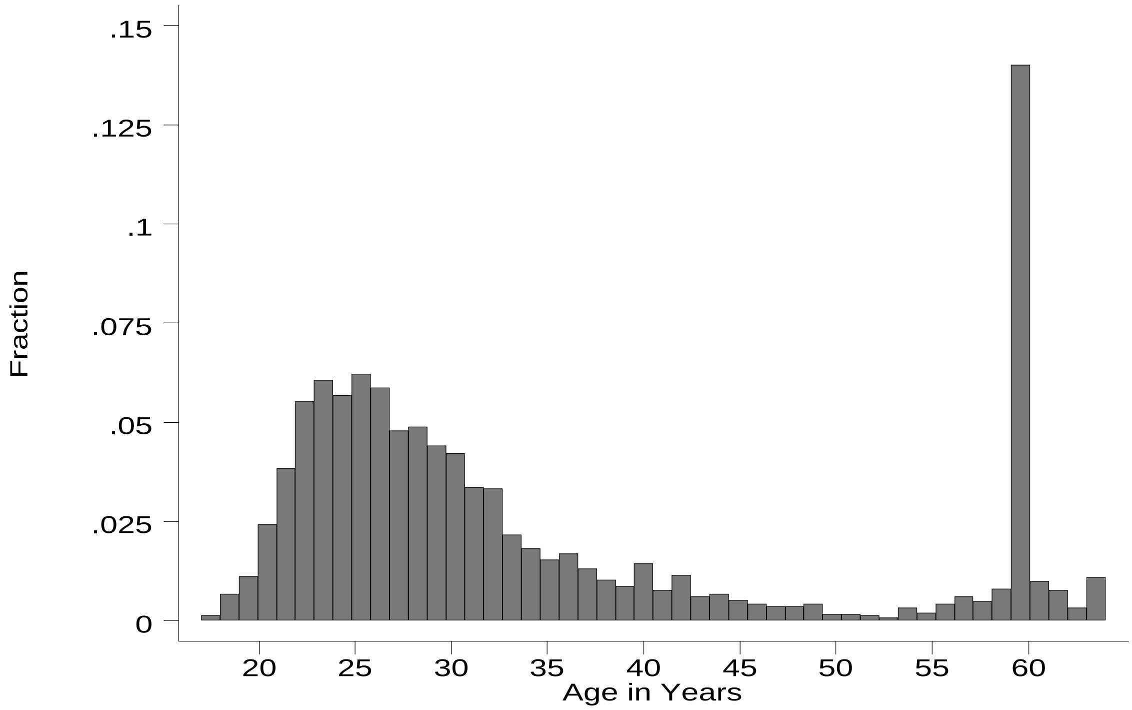
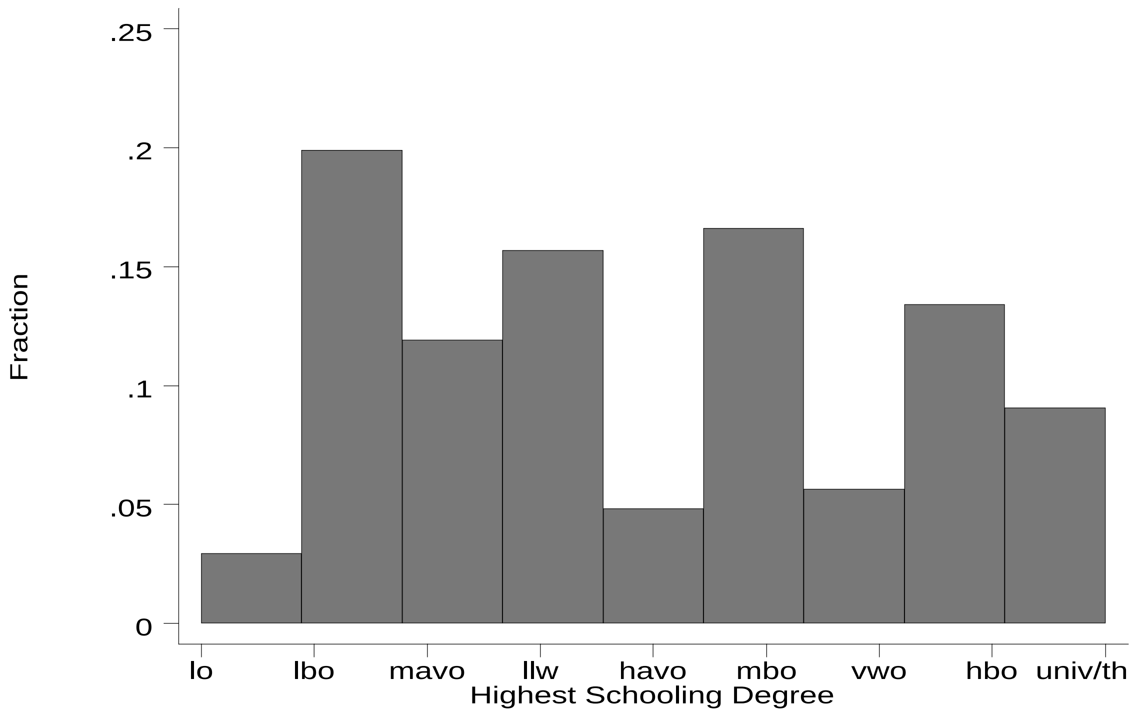


Figure 5.3

Panel c) Distribution of age among workers separating in the period January 1st 1987-March 1st 1991

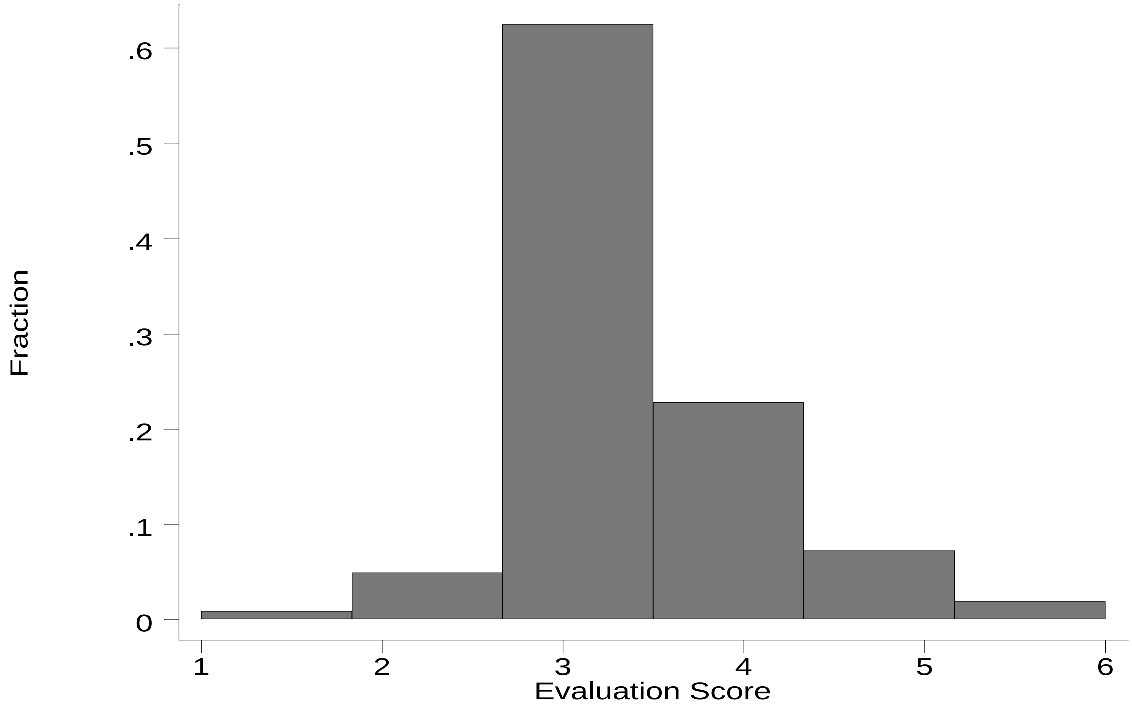



Panel d) Distribution of schooling degrees among workers separating in the period January 1st 1987-March 1st 1991



## Figure 5.3

Panel e) Distribution of performance evaluation scores of workers separating in the period January 1st 1987-March 1st 1991




Panel f) Distribution of wage scales of workers separating in the period January 1st 1987-March 1st 1991

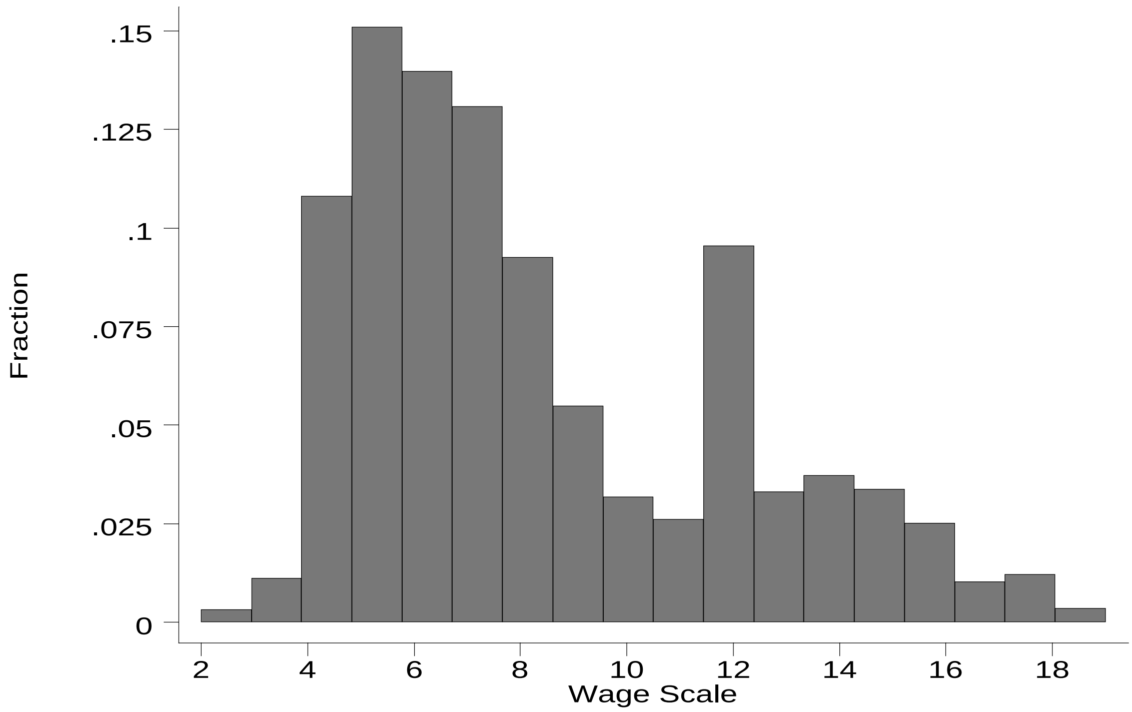
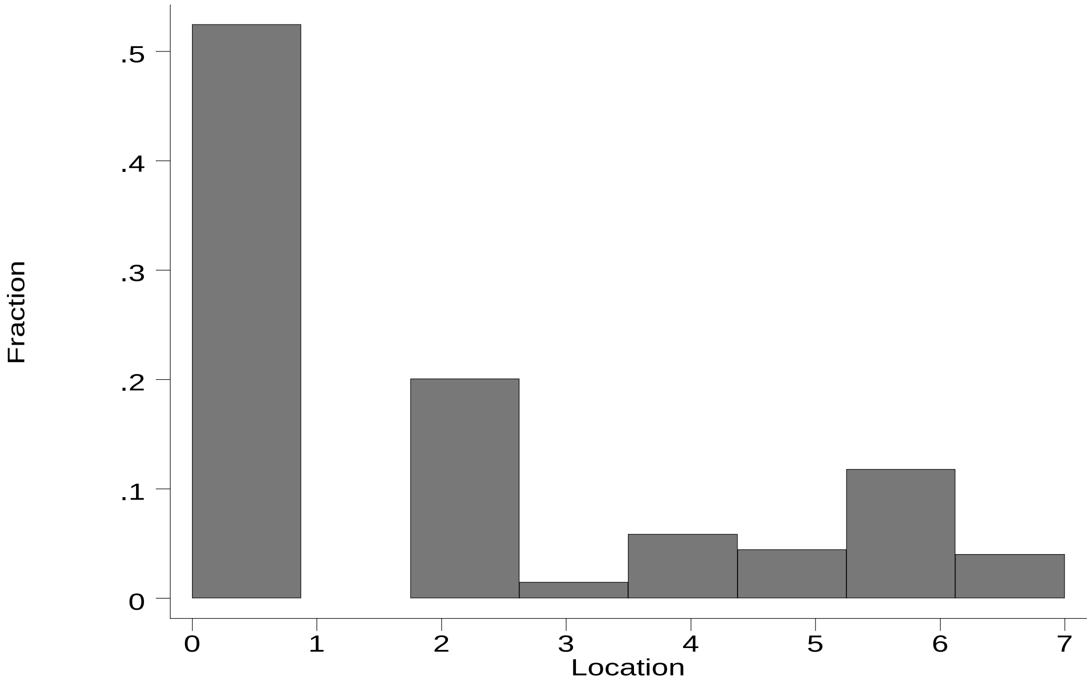


Figure 5.4

Panel a) Distribution of locations from which workers separate in the period March 1st 1991 – March 14th 1996




0 Fokker Aircraft (Schiphol) and Fokker Administration (Amsterdam)
1 Aerostructures (Schiphol)
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3 Fokker Space and Systems (Leiden)
4 Fokker ELMO (Woensdrecht)
5 Fokker Special Products (Hoogeveen)
6 Fokker Aircraft (Ypenburg)
7 Fokker Aircraft Services (Woensdrecht)

Panel b) Distribution of job tenure of workers separating in the period March 1st 1991 – March 14th 1996

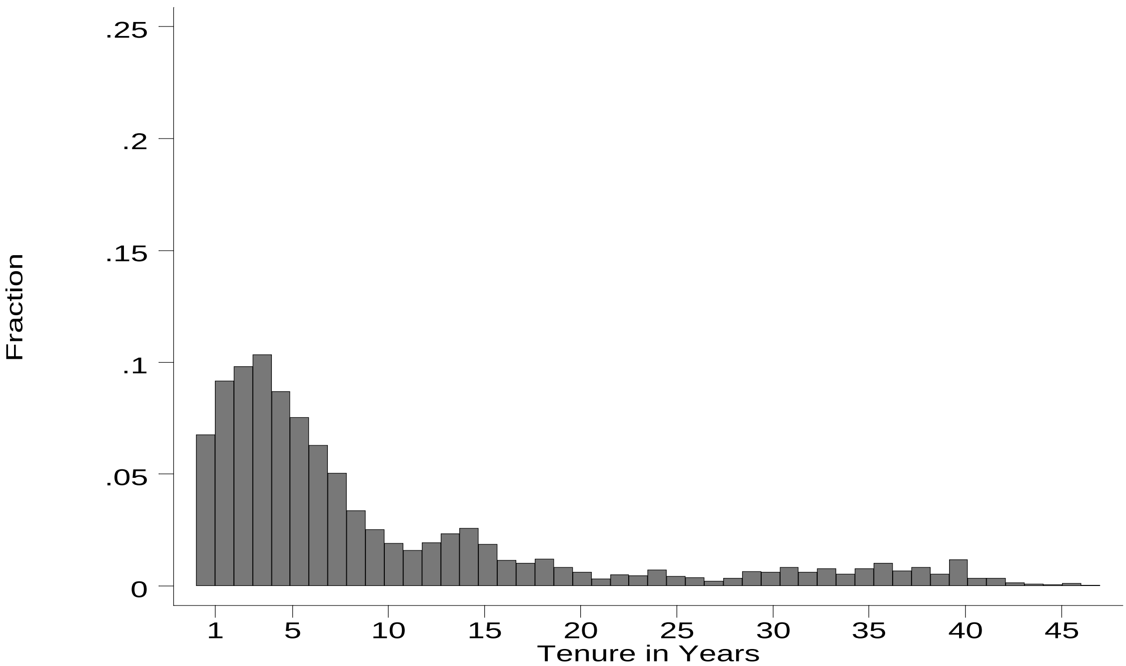
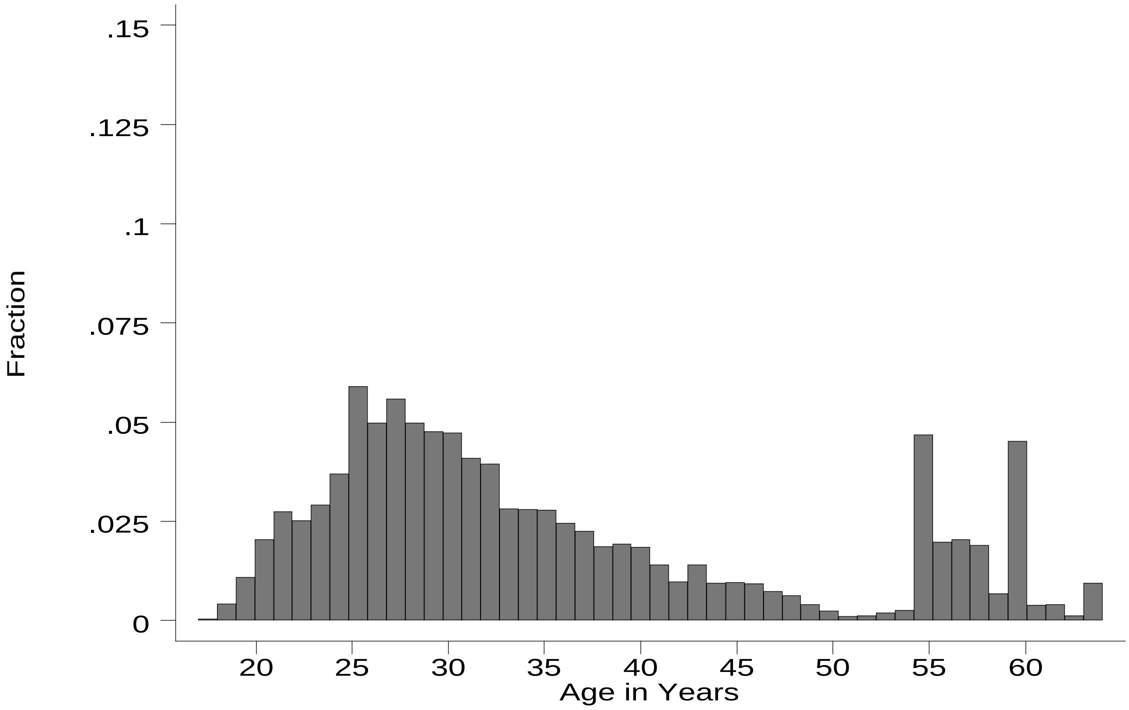


Figure 5.4

Panel c) Distribution of age among workers separating in the period March 1st 1991 – March 14th 1996




Panel d) Distribution of schooling degrees among workers separating in the period March 1st 1991 – March 14th 1996

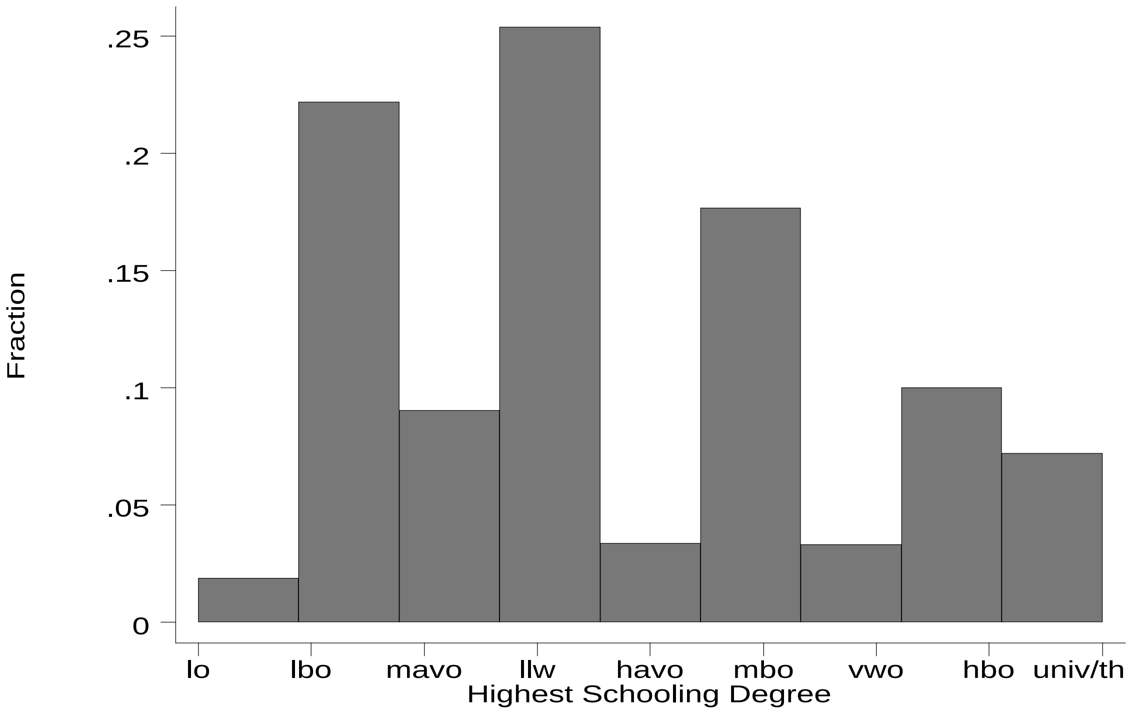
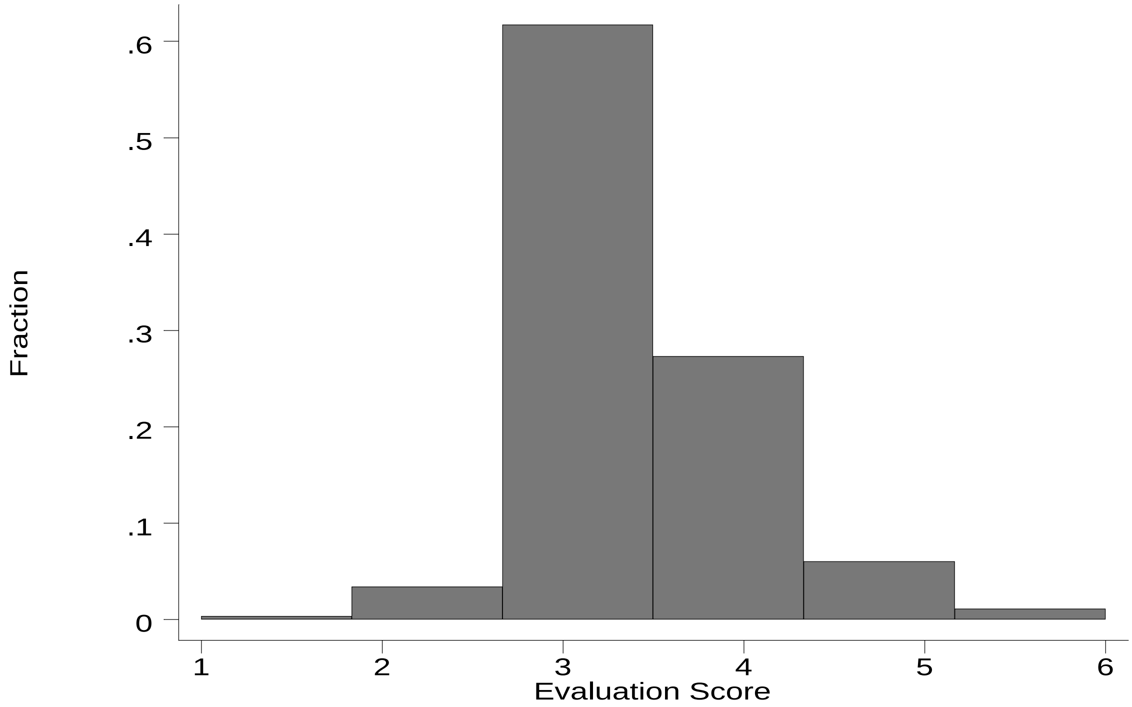


Figure 5.4

Panel e) Distribution of performance evaluation scores of workers separating in the period March 1st 1991 – March 14th 1996




Panel f) Distribution of wage scales of workers separating in the period March 1st 1991 – March 14th 1996

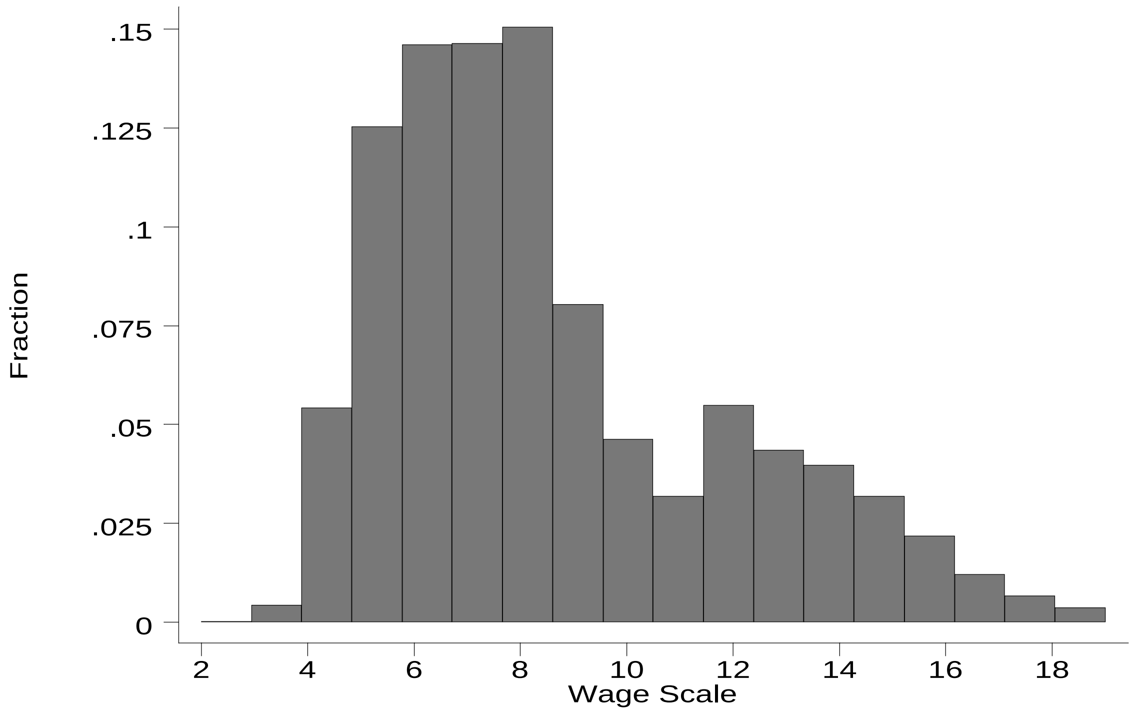
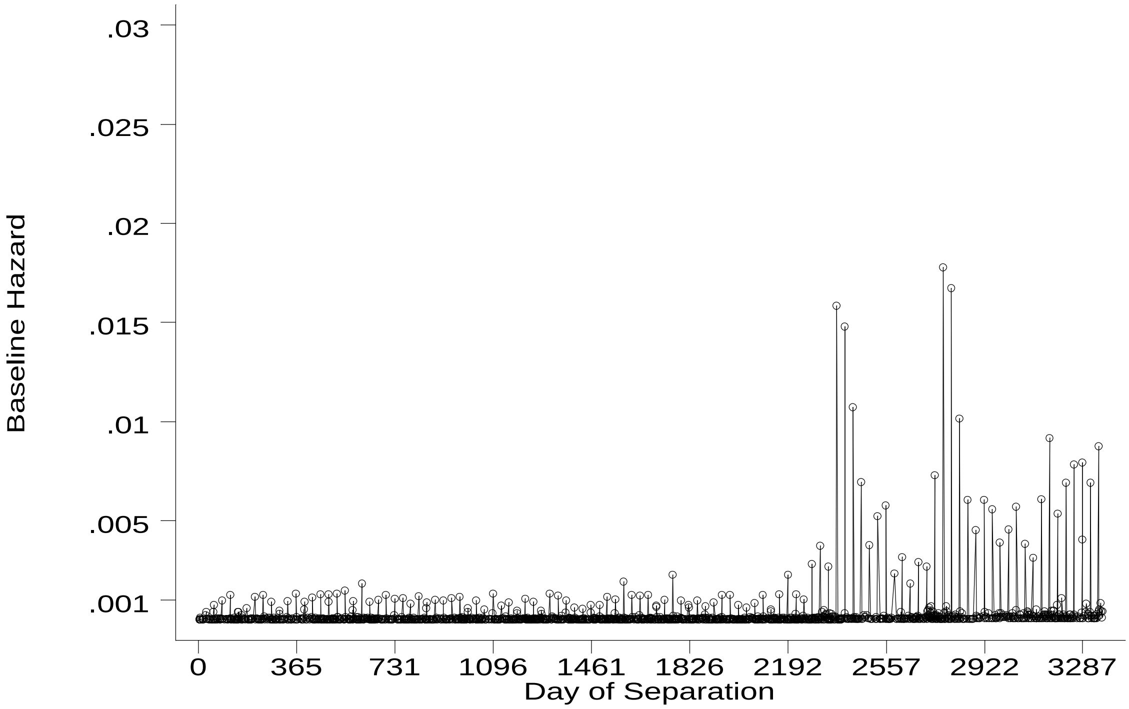


Figure 6.1

Panel a) Baseline Hazard estimated over the period 1987-1996 for the entire sample (corresponding parameter estimates are in Table 6.1, column 1)




Panel b) Baseline Hazards estimated separately over the periods 1987-1991 and 1991-1996 for the entire sample (corresponding parameter estimates are in Table 6.1, column 2 and 3)

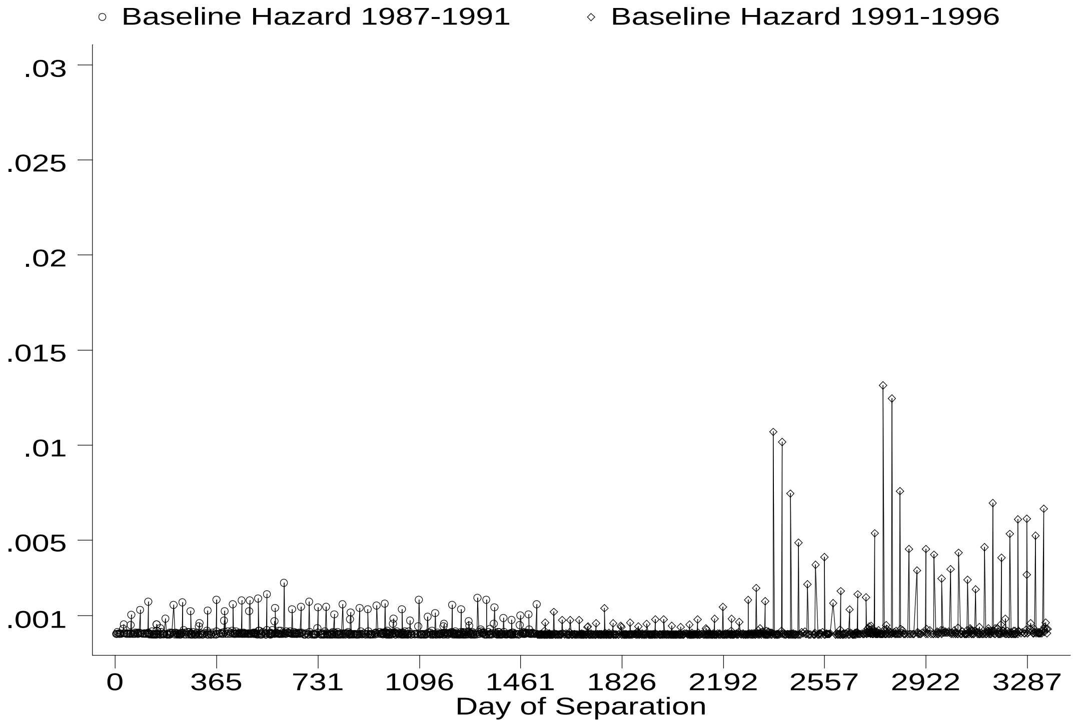
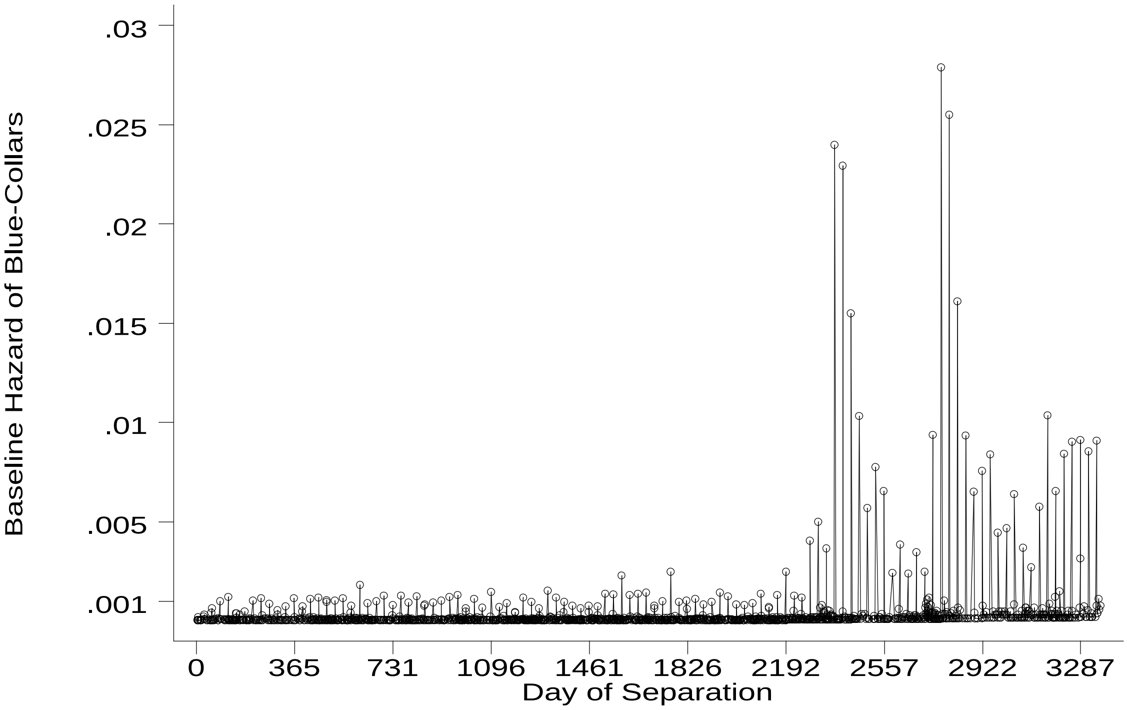


Figure 6.2

Panel a) Baseline hazard for **blue-collar workers** estimated over the period 1987-1996 when baseline hazards are allowed to differ for blue- and white-collar workers while coefficients are restricted to be the same.




Panel b) Baseline hazard for **white-collar workers** estimated over the period 1987-1996 when baseline hazards are allowed to differ for blue- and white-collar workers while coefficients are restricted to be the same.

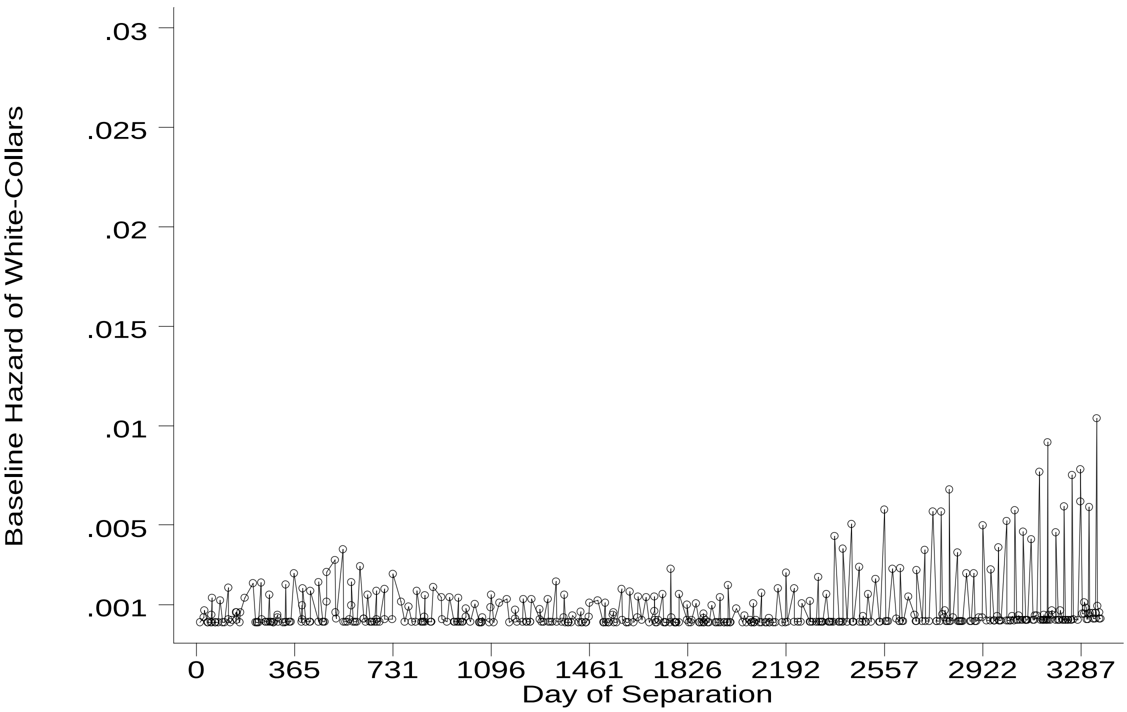
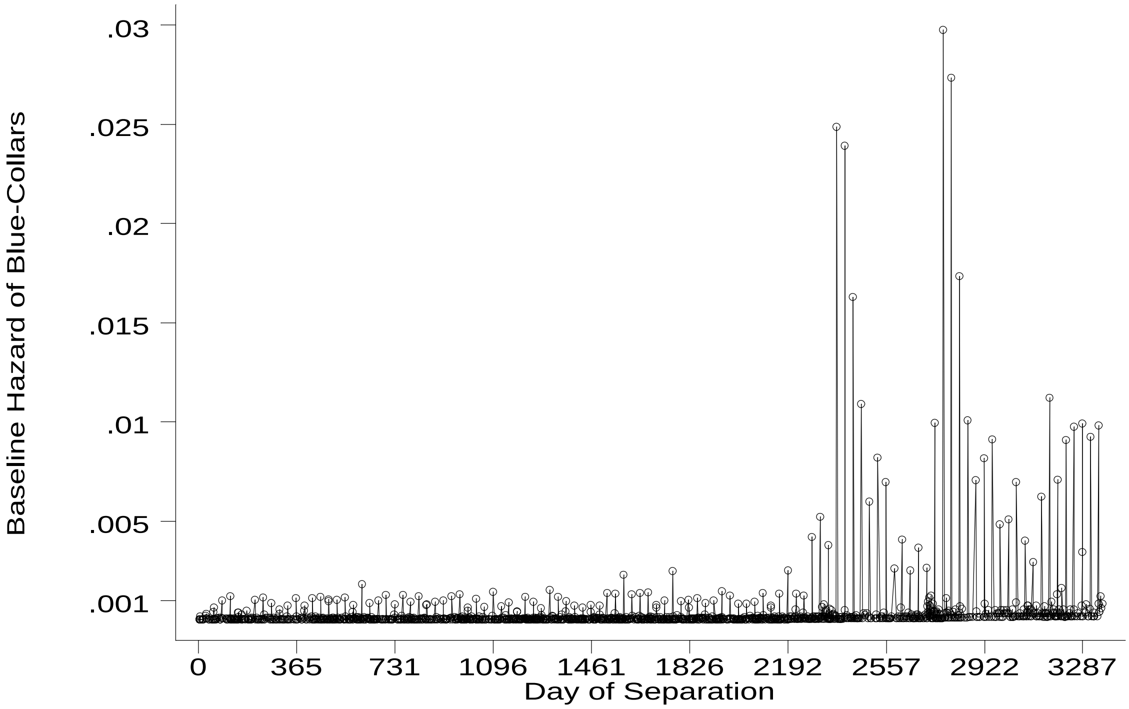


Figure 6.3

Panel a) Baseline hazard for **blue-collar workers** only estimated over the period 1987-1996 (corresponding parameter estimates are in Table 6.2, column 1).




Panel b) Baseline hazard for **blue-collar workers** only estimated separately over the periods 1987-1991 and 1991-1996 (corresponding parameter estimates are in Table 6.2, columns 2 and 3).

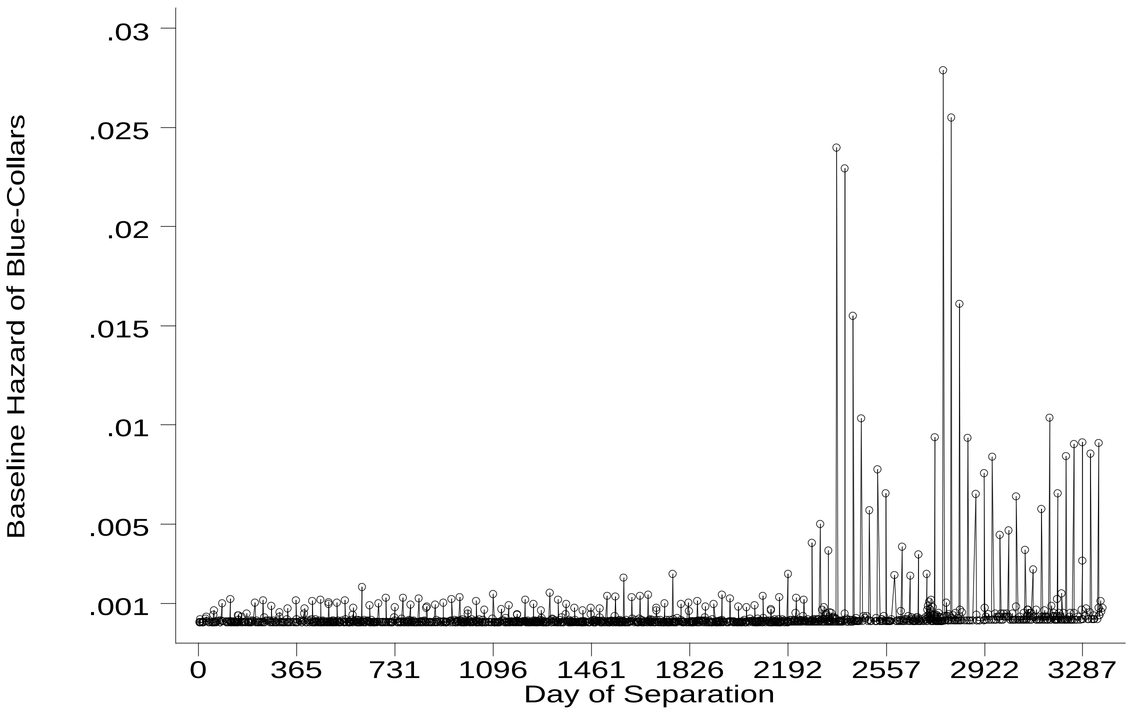
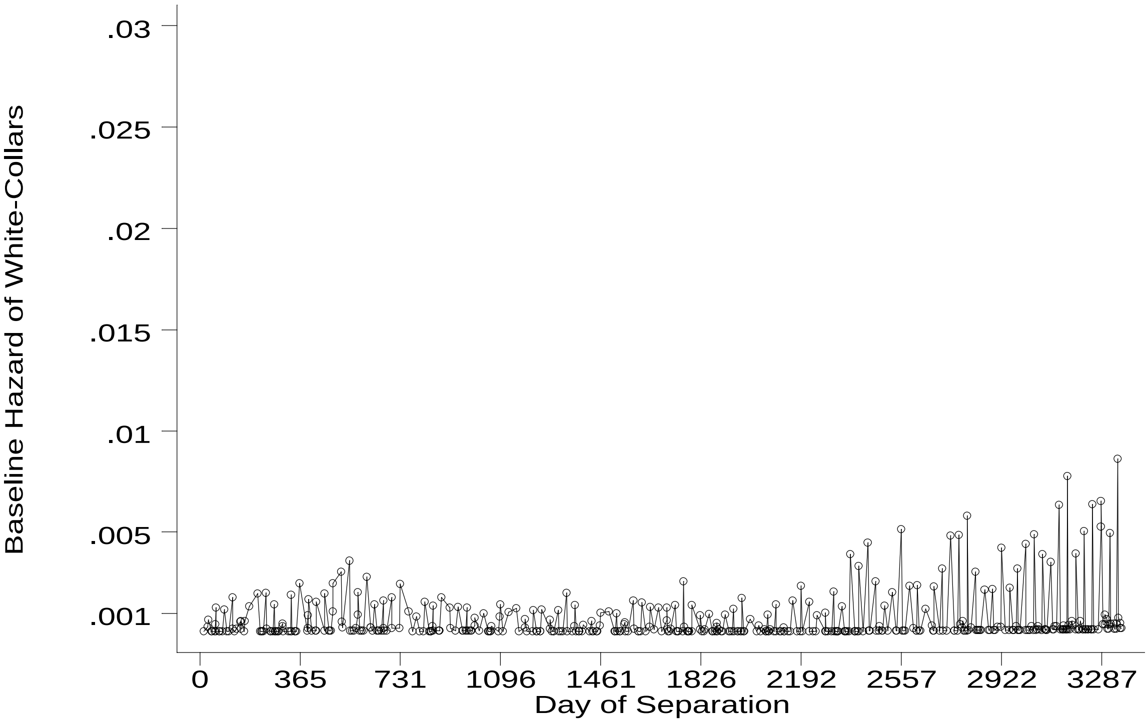


Figure 6.4

Panel a) Baseline hazard for **white-collar workers** only estimated over the period 1987-1996 (corresponding parameter estimates are in Table 6.3, column 1).




Panel b) Baseline hazard for **white-collar workers** only estimated separately over the periods 1987-1991 and 1991-1996 (corresponding parameter estimates are in Table 6.3, columns 2 and 3).

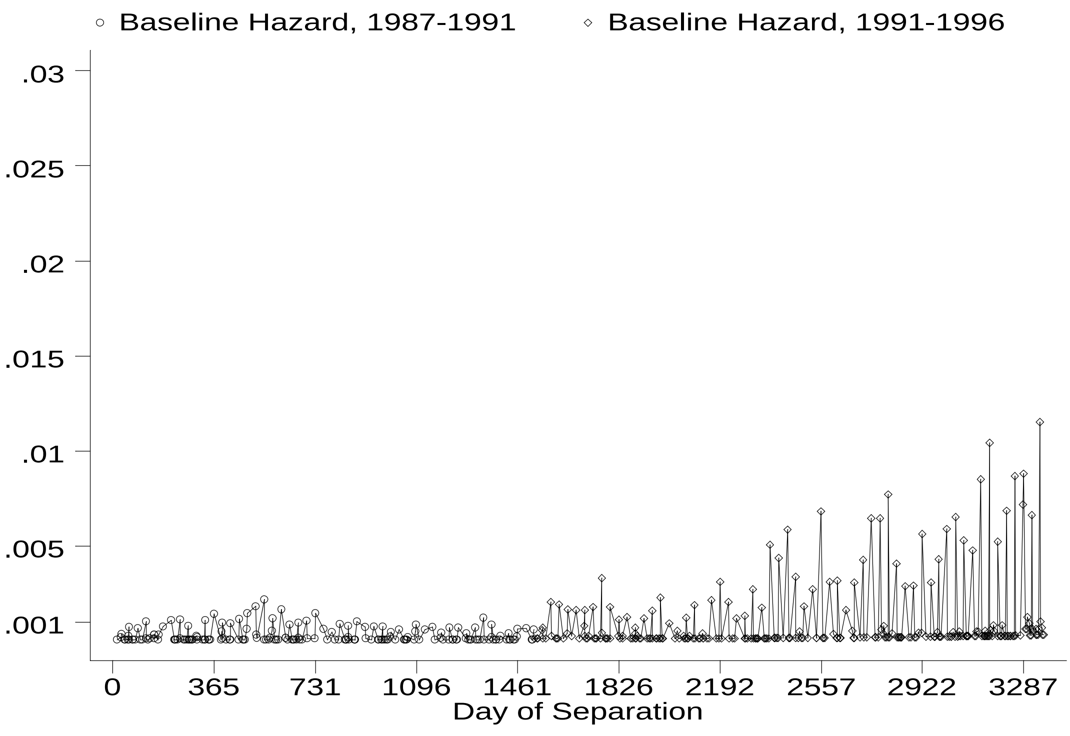


**Figure 6.5a  Age Effects in Different Periods (Coefficient Estimated from Table 6.1)**

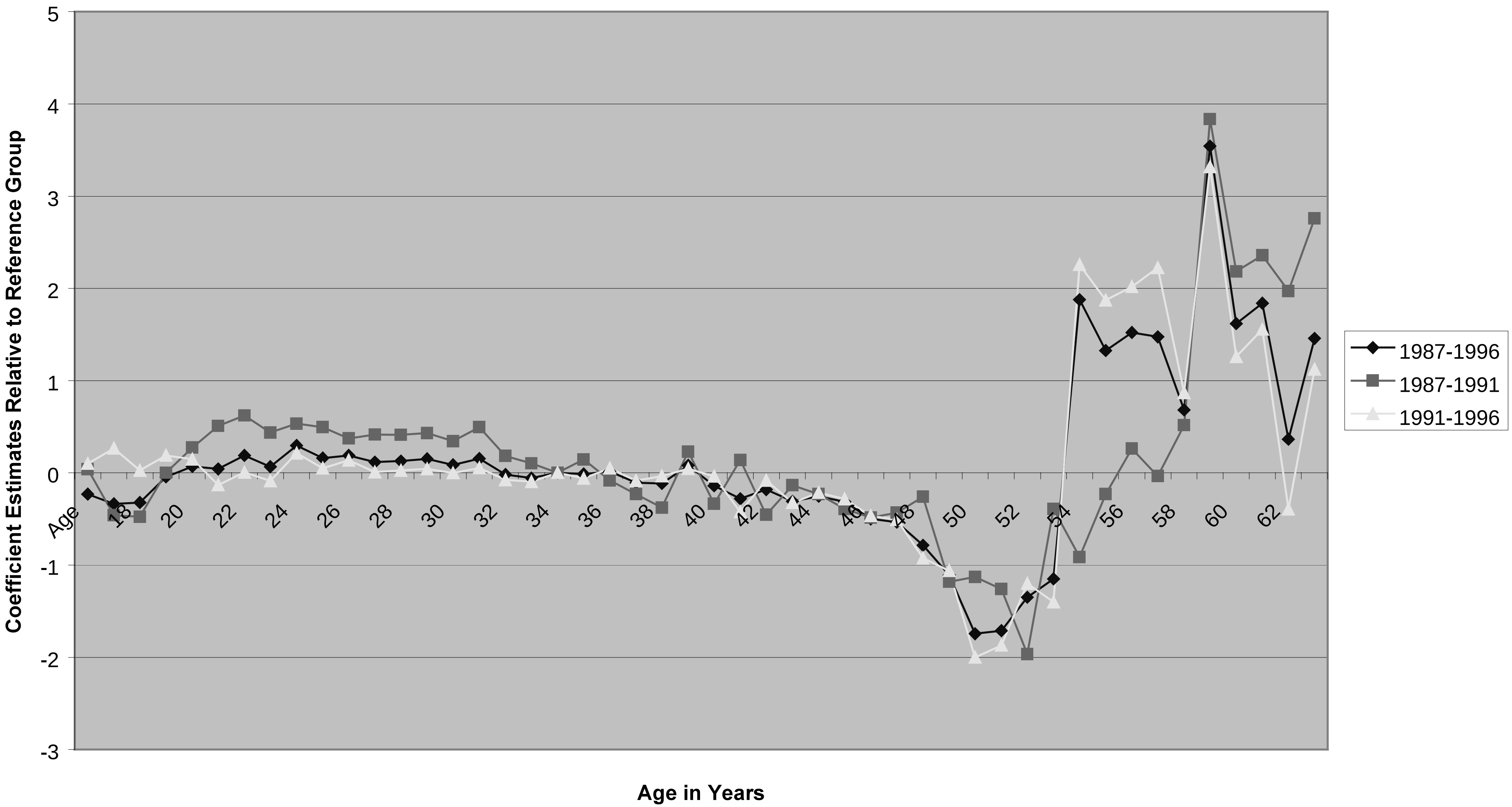


**Figure 6.5b Age Effects for Blue-Collar Workers in Different Periods (Coefficient Estimates from Table 6.2)**

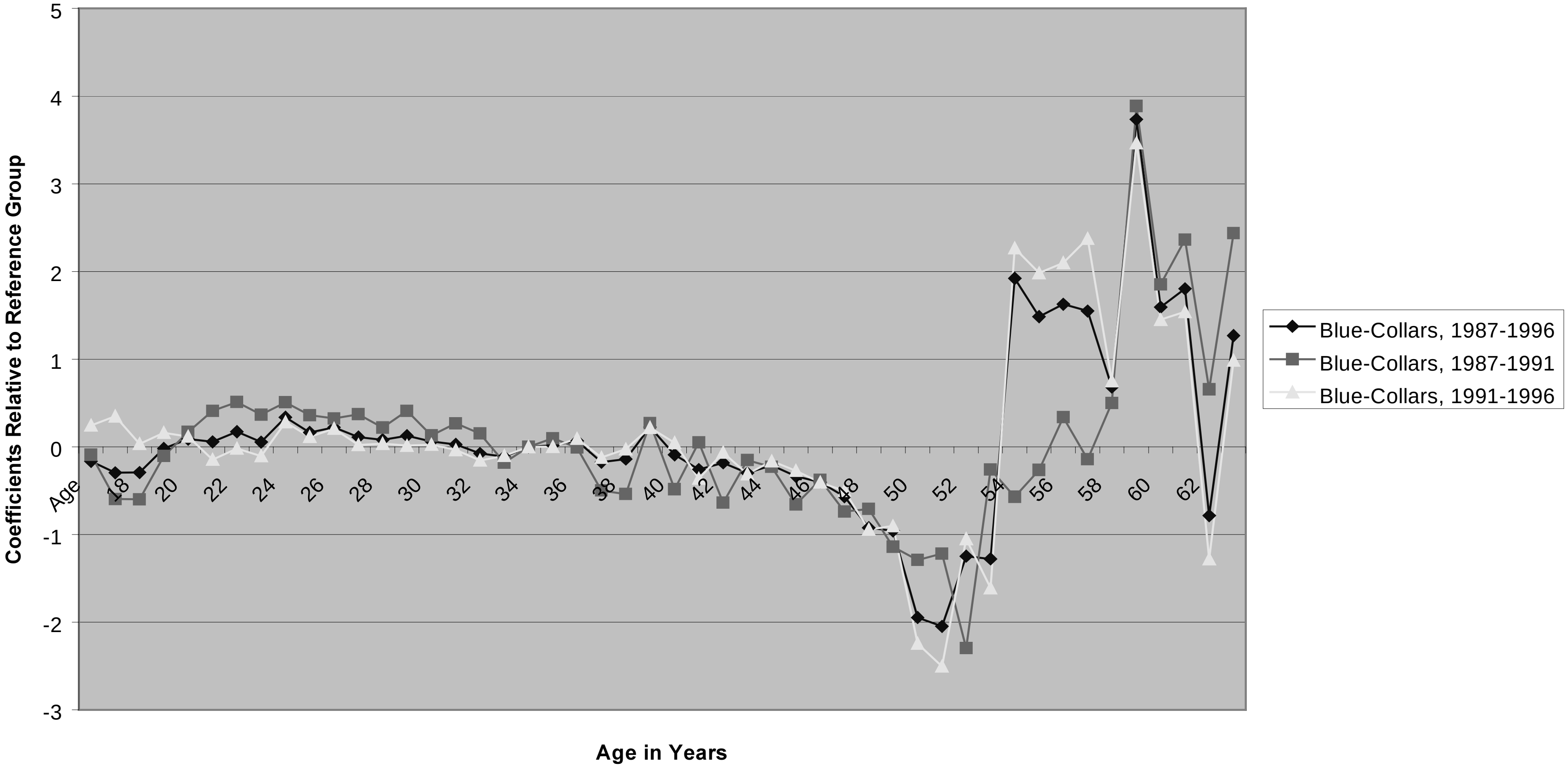
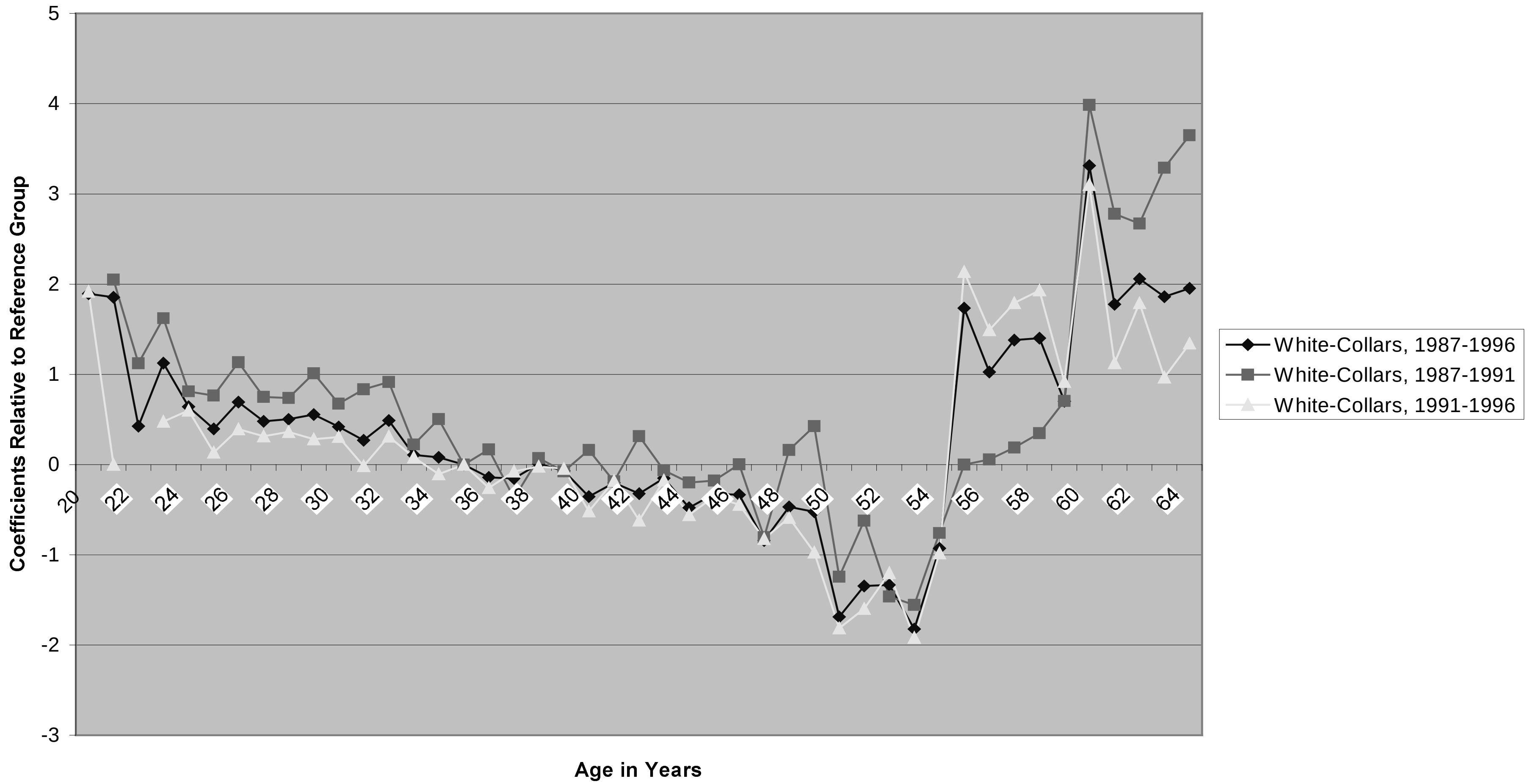


**Figure 6.5c Age Effects for White-Collar Workers in Different Periods**



# Appendix

## Definition of Variables

Location/Subsidiary

We define eight dummy variables that equal 1 if the worker is employed at the respective location and equal 0 else:

| | |
|---|---|
| location0 | Fokker Aircraft (Schiphol) or Fokker Administration (Amsterdam) |
| location1 | Aerostructures (Schiphol) |
| location2 | Fokker Aircraft (Papendrecht/Dordrecht) |
| location3 | Fokker Space and Systems (Leiden) |
| location4 | Fokker ELMO (Woensdrecht) |
| location5 | Fokker Special Products (Hoogeveen) |
| location6 | Fokker Aircraft (Ypenburg) |
| location7 | Fokker Aircraft Services (Woensdrecht) |

Education

The categorical dummy variables we define equal 1 for the highest educational or vocational degree that a worker has completed at the time of observation and 0 else.

| | |
|---|---|
| school_1 | basic education (lo) |
| school_2 | lower vocational schooling degree (lbo) |
| school_3 | intermediate general schooling degree (mbo) |
| school_4 | apprenticeship. (leerlingwezen) |
| school_5 | higher general schooling degree (havo) |
| school_6 | intermediate vocational schooling degree (mbo) |
| school_7 | general schooling degree that qualifies to attend university (vwo) |
| school_8 | higher vocational schooling degree (hbo) |
| school_9 | university |
| school_mis | information on educational and vocational achievement is missing. |

Note that schooling degrees, such as basic and intermediate, higher general schooling degrees or the degree that entitles to attend university (categories 1,3,5 and 7), are prerequisites for pursuing a given vocational or general education in the Dutch educational system. Basic education is a prerequisite for any other degree and one can decide after having completed basic education to either follow a lower vocational schooling course or to attend any of the school forms leading to any other general schooling degree. Intermediate education makes one eligible to follow intermediate vocational training or complete an apprenticeship. An intermediate general schooling degree qualifies for higher vocational schooling, a higher general schooling degree (havo) qualifies for higher vocational schooling (hbo), while the highest level general schooling degree is a prerequisite for pursuing a college or university degree. In addition, it is possible to pursue the next higher schooling level after having obtained a given schooling degree; similarly it is possible to enter the next higher level of vocational schooling after having completed vocational schooling at the level just below, e.g. after having completed intermediate vocational schooling one is eligible to enter higher vocational schooling.

Age

We define dummy variables that equal 1 if the condition is true and 0 else.

| | |
|---|---|
| old 17 | if younger than 18 years of age |
| old'i' for 18≤'i'≤63 | if 'i' years of age |
| old64 | if 64 years of age or older |

Tenure

We define 16 categorical dummy variables that equal 1 if the respective condition is true and zero else.

| | |
|---|---|
| ten3m | if tenure 0-3 months |
| ten6m | if tenure 3-6 months |
| ten9m | if tenure 6-9 months |
| ten12m | if tenure 9-12 months |
| ten1 | if tenure 1-2 years |
| ten2 | if tenure 2-3 years |
| ten3 | if tenure 3-4 years |
| ten4 | if tenure 4-5 years |
| ten5_9 | if tenure 5-10 years |
| ten10_14 | if tenure 10-15years |
| ten15_19 | if tenure 15-20 years |
| ten20_24 | if tenure 20-25 years |
| ten25_29 | if tenure 25-30 years |
| ten30_34 | if tenure 30-35 years |
| ten35_39 | if tenure 35-40 years |
| ten40 | if tenure more than 40 years |

Performance Evaluation

The dummy variables equal 1 if the worker received the respective performance evaluation score, and equal 0 else.

| | |
|---|---|
| eval_1 | unsatisfactory |
| eval_2 | satisfactory |
| eval_3 | good |
| eval_4 | very good |
| eval_5 | outstanding |
| eval_6 | excellent |
| eval_mis | evaluation score is missing |

Wage Scales and Transitions in Wage Scales

| | |
|---|---|
| scale_‘i’ for 2≤i≤19 | if ‘i’ = the first observed wage scale (i.e. the wage scale on 1st January 1987 if employed then or the wage scale at hiring if hired after 1st of January 1987) |
| Δscale1 | 1 if the worker moves up one wage scale (the dummy equals 1 only for the observation at which the change occurs) |
| Δscale2 | 1 if the worker moves up more than one wage scale (the dummy equals 1 only for the observation at which the change occurs) |
| Δscale<0 | 1 if the worker moves down at least one wage scale (the dummy equals 1 only for the observation at which the change occurs) |
| d_scale1 | 1 if the worker has moved up one wage scale since the first recording for that worker |
| d_scale2 | 1 if the worker has moved up two wage scales since the first recording for that worker |
| d_scale3 | 1 if the worker has moved up more than two wage scales since the first recording for that worker |
| d_scale<0 | 1 if the worker has moved up down at least one wage scale since the first recording for that worker |

Promotions, Degree Completion and Additional Wage Growth

| | |
|---|---|
| promotion | counts the number of contract changes because of a promotion from 1st January 1987 onwards. |
| prom_Δwage | adds up percentage points of additional wage growth that was associated with a promotion |
| degree | counts the number of contract changes because of a degree completion from 1st January 1987 onwards |
| degr_Δwage | adds up percentage points of additional wage growth that was associated with a degree completion |

Gender, Marital Status, Worker Status

| | |
|---|---|
| married | 1 if married, 0 if divorced or else |
| divorced | 1 if divorced, 0 else |
| male | 1 if male, 0 else |
| part_time | 1 if the employee works part-time, 0 else |
| rehire | 1 if the worker had previously been employed at the firm and is rehired during the observation period, 0 else |

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