

Riphahn, Regina T.

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Older Workers' Responses to Health Shocks

By Regina T. Riphahn*

Summary

This study examines older German workers' employment responses to sudden deteriorations in health. Possible responses includes continued full-time employment, fewer hours worked, unemployment, or dropping out of the workforce. The empirical specification applies a multinomial logit estimator to determine the central correlates of labor force transitions of older workers. Simulation experiments indicate that a health shock triples the probability of dropping out of the labor force and increases the risk of unemployment by 90 percent. We find significantly different transition patterns for men and women, strong effects of the unemployment rate, and interesting impacts of firm size.

1. Introduction

Between 1984 and 1993, the labor force participation (LFP) of older male workers in West Germany fell by 9.5 percent for those aged 55 to 59 and by 14.2 percent for those aged 60 to 64. The 1993 LFP of those aged 60 to 64 was 32 percent lower than that of 1980. This development creates a major financial strain for the social insurance system. Instead of earning their income through gainful employment, a large fraction of workers rely on early retirement, unemployment insurance, or disability retirement. Since these modes of labor force exit are frequently prompted by a decline in older workers' health¹, it is worthwhile to study the effect of health deterioration on older workers' employment status.

To draw a connection between changes in health and LFP, and to be able to distinguish the effects of health from those of other environmental factors, it is helpful to concentrate on sudden health changes. Health shocks are sudden deteriorations in a person's health that might be brought about by accidents or by acute diseases. As such, health shocks are clearly distinct from the health effects of a person's work environment, which typically take time to develop and are slow to affect labor supply decisions. This study investigates the evidence on health shocks and their labor market effects as found in the first 11 waves of the German Socio-Economic Panel. It considers the impact of health shocks on labor force participation in subsequent years, paying particular attention to the effects of these shocks and other correlates on the transition from full-time work to part-time work and unemployment.

The paper proceeds as follows: Section 2 reviews the relevant literature. Theoretical issues are outlined briefly in Section 3. Section 4 describes the data and empirical methods, and Section 5 presents estimation and simulation results. Section 6 concludes the paper.

2. Review of the Literature

There is little in the German, or even international, literature examining workers' labor market responses to health shocks. However, three strands of related studies appear to be relevant to the problem. One is the microeconomic retirement literature that considers health as a determinant of labor force exit. The second group of studies investigates the interdependencies between health and the transition into unemployment. Most relevant, however, appear those United States studies that look at labor market consequences of the onset of health impairments.

The studies on older workers' labor force exit differ in their methodological approaches and in their definitions of the retirement event, but they find consistently that the state of a worker's health is an important determinant of LFP. Wagner (1991) finds a negative effect of good health on the probability of leaving one's last employment. Börsch-Supan (1992) finds that a variety of health measures are significant in predicting cases where individuals reduce their work hours to below 15 hours per week. The conclusion of Siddiqui's (1995) study of the decision not to return to paid employment is that health-related factors play a key role. Similarly, Schmidt (1995) finds a strong impact of disability on the hazard of a transition from employment out of the labor force.

The literature on unemployment and health agrees on the correlation of unemployment with poor health (see, for example, Westcott et al. 1985), but there is little discussion on the effects of health shocks on employment. Instead, the focus is on whether unemployment causes poor health (causation hypothesis) or whether those in poor health are negatively selected into unemployment (selection hypothesis). Using German data, Elkeles and Seifert (1993) find that health remains stable before and after the loss of employment and that re-employment itself does not improve the person's health. Thus, they conclude that there is no evidence supporting the causation hypothesis. Instead they find support for the selection hypothesis, since those formerly unemployed who found employment enjoyed better health than those who remained unemployed. Arrow (1994) does not find evidence for the selection hypothesis since, in his study, health problems do not always cause a higher risk of unemployment.

Within the third group of papers, the study by Burkhauser, Butler, and Kim (1995) investigates the role of employer-provided accommodation for the subsequent job duration of individuals who experience a work-limiting

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¹ Out of all men aged 60 in 1991, about 26.9 percent had already retired due to disability (Riphahn forthcoming). Of the unemployed in the age group 55 to 60, around 50 percent report health limitations (Bundesminister 1993).

health impairment. They apply data from the 1978 Survey of Disability and Work, which recorded the employees' labor market activity following the onset of a health condition. They find that employer accommodation can significantly reduce the risk of leaving a particular job. Similarly, the study by Daly and Bound (1995) investigates the labor market consequences of health impairments using the first wave of data from the Health and Retirement Survey. First, they regress the discrete consequences of a health shock, such as remaining with an employer, changing employers, or leaving the labor force, on individual and employer characteristics. Then, they focus on only those workers who remained attached to the labor force after a health shock. The core findings are that employers often accommodate workers who suffer a health impairment and that among workers who are not accommodated, changes in employers and job duties occur more frequently. Those two papers are most similar to this study, since they focus on labor market transitions. Several other studies concentrate on the financial consequences of suffering a disability or health impairment (see, for example, Haveman and Wolfe 1990; Baldwin, Zeager, and Flacco 1994; or Burkhauser and Daly 1995).

3. Theoretical Aspects of Labor Force Transitions after Health Shocks

The theoretical foundation for the empirical analysis is the standard labor market framework. The individual derives his labor supply function from a utility function in which health is an immediate argument [$U = U(\text{consumption, health, leisure})$]. After optimizing over consumption and leisure subject to a budget constraint, the person chooses to work if the market wage exceeds his reservation wage. The first order conditions imply that the real reservation wage is equal to the marginal rate of substitution of leisure for consumption goods evaluated at zero hours of working. Since the marginal rate of substitution is a function of the arguments in the utility function, health and health shocks can affect the reservation wage: *Ceteris paribus* an increase in the marginal disutility of work (i.e., an increase in the marginal utility of leisure) as well as a decrease in the marginal utility of consumption cause an increase in the individual's reservation wage, and both of these changes may reasonably be connected with a health shock. Within this framework and with given market wages, we thus expect on average a reduction in labor force participation after a health shock.

On the labor demand side, the human capital and the marginal productivity of a worker suffering a health decline are likely to decrease. If workers are indeed paid according to their marginal productivity, the health shock may reduce an individual's labor earnings. Thus, even if the health shock does not cause an increase in the reservation wage, an individual may drop out of the labor force because the potential labor market wage falls below his reservation wage². Thus, both standard labor supply and labor

demand analysis suggest that labor force participation may decline after a shock to a worker's health.

The empirical model presented below evaluates the impact of a health shock and of other factors on labor force participation. The range of possible outcomes includes continued full-time work, a drop to part-time work, unemployment, minor or irregular employment, or complete withdrawal from the labor force.

Obviously, demographic factors and the stock of human capital are person-specific factors that influence the adjustment behavior. The number of employment options open to an individual after a health shock is likely to depend on the level and breadth of the individual's training and stock of abilities. Thus, we expect that individuals with more diversified and a higher level of human capital may be more likely to remain in the labor force than those workers whose productivity hinges exclusively on their physical health. Further, the flexibility with which the individual is willing and able to respond to the situation after a health shock can be assumed to vary with demographic factors. For example, the remaining number of working years determines the payoff to adjustment efforts, such as seeking different employment or investing in human capital, so the worker's age is an important factor to consider.

Besides the person-specific factors, there may be firm and job characteristics that affect the outcome of the adjustment to a health shock. Employers' efforts to accommodate workers (see Burkhauser, Butler, and Kim 1995) appear particularly relevant. Finally, a wide literature confirms the procyclical correlation of absenteeism and sick leave with macroeconomic trends and aggregate unemployment (see, for example, Leigh 1985; Schnabel 1991; or Kruse and Kruse 1983). While the cause of this correlation remains disputed — some argue that workers are indeed stressed by overtime work in boom times, others take the position that workers feel safe to take more time off when the economy is doing well — this suggests that labor force responses to health shocks may be affected by the economic situation of the employee's industry or by aggregate macroeconomic developments.

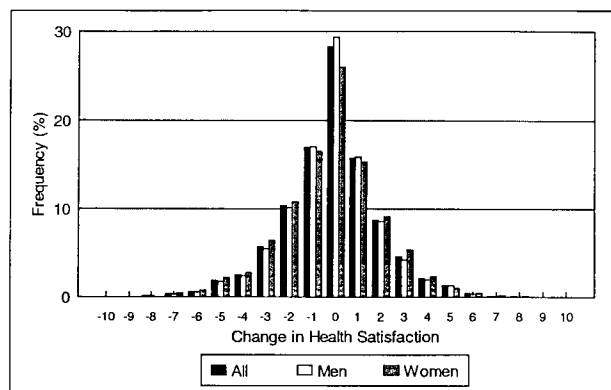
In sum, this discussion suggests that the empirical analysis should control for the individual's demographic characteristics and human capital, firm and job characteristics, as well as industry and macroeconomic effects.

4. Data and Estimation Procedure

The data are taken from the first 11 waves of the German Socio-Economic Panel (1984 to 1994). To determine workers' responses to health shocks, we consider all spells

² The study by Burkhauser and Daly (1994) looks into the income effects of suffering a health impairment. Using a longitudinal data they find small effects of the health impairment on household income but a substantial drop in the contribution of the health impaired person to household income.

Figure 1
Distribution of Changes in Health Satisfaction by Sex



Source: Author's calculations based on GSOEP (1984-1994).

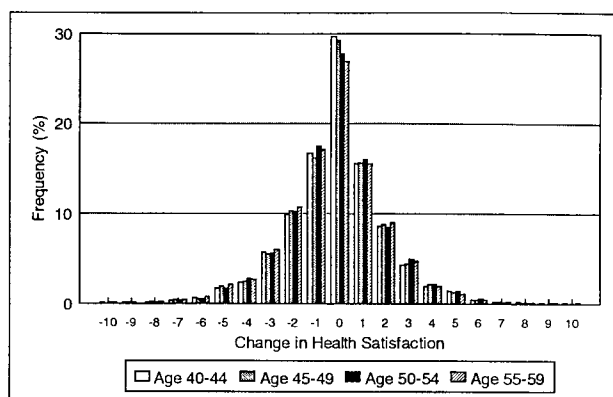
of full employment that occur for individuals aged 40 to 59³. We drop all observations after age 59 since the individual may be eligible for retirement programs. The sample includes West Germans and foreign guest workers. Beginning in 1990, data on East German employees is available as well. However, since the labor force participation of East Germans in the first years of the labor market transition was to a large degree influenced by aggregate shocks and labor market programs, the East German sample is omitted here. All observations with missing values for health satisfaction or other relevant explanatory variables are omitted from the sample. Pooling the remaining annual observations of individuals in full-time employment, we obtain a sample of 19,509 observations. The average age is age 49 and 24 percent of the sample is female.

Health Shocks

In each survey, respondents were asked to evaluate their health satisfaction on a scale between zero and ten. A sudden drop from one year to the next in health satisfaction by at least five points on the scale indicates a health shock⁴. Given that such a large change in health satisfaction occurs within just one period, whereas endogenously generated health deteriorations can be expected to follow a more continuous development, the event may well be regarded as an exogenous shock.

Figures 1 and 2 present the frequency distribution of changes in health satisfaction between consecutive surveys. Figure 1 depicts the health changes separately for men and women, whereas Figure 2 looks at different age groups. Since answers between 0 and 10 are possible, the interperiod differences range from -10 to 10. The fraction of individuals who experience no change or only minor changes in health satisfaction from period to period is sizable. Women tend to indicate slightly larger changes in health satisfaction than men. The differences across age groups are small but one notices a larger tendency for health declines in the oldest group. Differences in the

Figure 2
Distribution of Changes in Health Satisfaction by Agegroup



Source: Author's calculations based on GSOEP (1984-1994).

average response between Germans and foreigners are not found, but foreigners are more heavily represented in

³ This sampling frame is very similar to Daly and Bound (1995). They investigate the employment situation of individuals who were employed at the onset of a health impairment.

⁴ By this definition individuals with low health satisfaction (less than 5) are excluded from the sample of persons who experience a health shock. This censoring mechanism affects 14.5 percent of the observations.

Table 1
Distribution of Changes in Health Satisfaction Over Time
in percent

Shock ¹⁾	1985	1986	1987	1988	1989
-10/-9/-8	0.35	0.37	0.28	0.18	0.10
-7/-6/-5	4.26	3.14	3.13	3.56	2.86
-4/-3/-2	19.94	20.58	19.96	20.78	17.75
-1/0/1	56.50	57.21	58.86	58.25	61.32
2/3/4	16.24	16.33	15.42	14.33	15.68
5/6/7	2.60	2.10	2.11	2.70	2.13
8/9/10	0.13	0.28	0.23	0.19	0.15
Total	100.00	100.00	100.00	100.00	100.00
	1990	1991	1992	1993	1994
-10/-9/-8	0.20	0.20	0.15	0.31	0.39
-7/-6/-5	2.26	2.31	1.97	2.76	1.84
-4/-3/-2	17.18	15.05	14.05	20.42	17.92
-1/0/1	63.33	64.50	66.23	62.83	63.83
2/3/4	15.09	16.45	15.76	12.41	14.36
5/6/7	1.69	1.45	1.72	1.06	1.56
8/9/10	0.25	0.05	0.10	0.21	0.12
Total	100.00	100.00	100.00	100.00	100.00

¹⁾ Shock is defined as the difference in the category of health satisfaction reported by an individual in adjacent years. A health shock of -10 indicates that a person went from a health satisfaction level 10 in year t to level 0 in year $t+1$. A health shock of 0 indicates constant health satisfaction in consecutive years, and a health shock of 5 indicates an improvement in health satisfaction by five points.

Source: Author's calculations based on GSOEP (1984-1994).

Table 2a

**Distribution of Individual Transitions from Full-Time Employment
in percent**

Transition into:	Full Sample			Individuals Who Experienced a Shock		
	First Year	Second Year	Third Year	First Year	Second Year	Third Year
Full-Time	94.72	92.21	89.77	87.17	82.52	78.90
Part-Time	1.39	1.49	1.59	2.33	1.55	3.56
Unemployment	2.26	3.34	4.29	5.00	6.60	7.12
Minor Employment	0.23	0.23	0.24	0.50	0.19	0.00
OLF	1.40	2.73	4.11	5.00	9.13	10.41
Total	100.00	100.00	100.00	100.00	100.00	100.00
Number of Observations	19,509	16,676	12,516	600	515	365

Source: Author's calculations based on GSOEP (1984-1994).

both tails of the difference distribution. Table 1 presents the frequency distribution of health changes across survey years. Interestingly, the share of individuals reporting nearly constant health satisfaction across survey years increases over time and obversely, the propensity to experience large deviations in health satisfaction decreases. An evaluation of the industry-specific probability of experiencing a health shock shows that health shocks are more likely to occur in the synthetic fiber, traffic systems, construction, and food industries. Among occupational groups, employment in the service, agriculture, and production related fields is most likely to be affected.

Dependent Variable

Given that the sample consists of full-time employed persons, the dependent variable describes the status these individuals enter in the subsequent period. Five labor force categories were coded: full-time employment, part-time employment, unemployment, minor or irregular employment, and out of the labor force.

Table 2a describes the distribution of the sample across the five categories. It distinguishes the full sample from those individuals who suffered a health shock and provides

information on transitions in later years. The sample sizes fall over time due to right censoring in later waves and due in part to missing information. The table shows that the probability of leaving full-time employment increases after experiencing a health shock. Thirteen percent of those whose health satisfaction dropped suddenly were no longer full-time employed in the next period. This fraction grows to 17 percent after one year and to 21 percent after two years. Interestingly, the majority of these individuals leave the labor force altogether. A flow analysis for the consecutive periods reveals that among those who remained full-time employed in the first year after the shock, about 10 percent gave up full-time employment in the second year. In contrast, about one quarter of those who left full-time employment immediately after experiencing a health shock returned in the next year. The size of the flows declines after the second year. Of those who are in full-time employment in year two, 5 percent drop out, while the inflow into full employment after the second year amounts to just 4 percent of the population at risk. The fraction of individuals in minor or irregular employment is sufficiently small to justify combining this group with those out of the labor force for the multivariate analysis.

A comparison of transition probabilities after a health shock by exogenous characteristics (see Table 2b) yields

Table 2b

**Labor Market Transitions in the First Year after a Health Shock by Characteristics
in percent**

Transition into:	Men	Women	Germans	Foreigners	Age			
					40 to 44	45 to 49	50 to 54	55 to 59
Full-Time	90.21	79.53	88.17	85.88	91.03	88.89	85.11	82.11
Part-Time	0.70	6.43	2.07	2.67	1.92	2.22	4.96	0.00
Unemployment	4.43	6.43	4.44	5.73	5.13	4.44	2.13	8.94
Minor Employment	0.47	0.58	0.89	0.00	0.00	0.56	0.00	1.63
OLF	4.20	7.02	4.44	5.73	1.92	3.89	7.80	7.32
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Number of Observations	429	171	338	262	156	180	141	123

Source: Author's calculations based on GSOEP (1984-1994).

Table 3

Definition of Variables and Descriptive Statistics

Variable	Definition	Full Sample	
		Mean	Standard Deviation
AGE	Age of the individual	48.776	5.435
AGE2	Age of the individual squared ($\times 10^{-2}$)	24.086	5.347
AGG_UNEMP.	Aggregate national annual unemployment rate	8.164	1.040
BIGFIRM	1 if employed in firm with more than 2,000 employees, otherwise 0	0.302	0.459
CHRONIC	1 if individual has a chronic disease, otherwise 0	0.274	0.446
CONSTRUCT	1 if employed in construction (or related) industry, otherwise 0	0.085	0.279
ELECTRIC	1 if employed in electrical and engineering industry, otherwise 0	0.059	0.236
FEMALE	1 if female, otherwise 0	0.243	0.429
FOREIGN	1 if not of German nationality, otherwise 0	0.319	0.466
JOBTRAIN	Categorical indicator for level of training required for job	3.879	1.642
MANUFACT	1 if occupation in production or related industry, otherwise 0	0.477	0.499
MARRIED	1 if married, otherwise 0	0.827	0.379
MARR*FEM	1 if married and female, otherwise 0	0.167	0.373
OFFICE	1 if occupation as office worker or related, otherwise 0	0.156	0.363
PUBLICSECT.	1 if employed in public sector, otherwise 0	0.230	0.420
PR_INCOME	Predicted real net monthly income ($\times 10^{-3}$)	2.833	0.937
RETAIL	1 if employed in retailing industry, otherwise 0	0.039	0.195
SCHOOLING	Years of schooling	11.058	2.580
SHOCK	1 if experienced a health shock, otherwise 0	0.031	0.173
SMALLFIRM	1 if employed in firm with less than 20 employees, otherwise 0	0.153	0.340
ST_BERLIN	1 if state is Berlin, otherwise 0	0.041	0.199
ST_SHOLSTEIN	1 if state is Schleswig-Holstein, otherwise 0	0.032	0.176
ST_HAMBURG	1 if state is Hamburg, otherwise 0	0.022	0.148
ST_NSACHSEN	1 if state is Niedersachsen, otherwise 0	0.098	0.298
ST_BREMEN	1 if state is Bremen, otherwise 0	0.007	0.086
ST_NRW	1 if state is Nordrhein-Westfalen, otherwise 0	0.264	0.441
ST_HESEN	1 if state is Hessen, otherwise 0	0.104	0.306
ST_PFALZSAAR	1 if state is Rheinland-Pfalz or Saarland, otherwise 0	0.060	0.237
ST_BADWUERT	1 if state is Baden-Württemberg, otherwise 0	0.196	0.397
ST_BAYERN	1 if state is Bayern, otherwise 0	0.174	0.379

Source: Author's calculations based on GSOEP (1984-1994).

interesting insights. First, women appear to be much more likely to drop out of full-time employment after a health shock than men are. Close to 80 percent of all transitions into part-time employment are completed by women, who make up just 24 percent of the sample. Differences by nationality appear to be minor, with one exception: foreigners are more likely to become unemployed than Germans. The distribution of transitions across age groups is as expected. The fraction of individuals remaining in full-time employment falls with age, and in parallel the fraction that drops out of the labor force increases. The only exception is the oldest age group, where we find a very high probability of unemployment, a finding that corresponds closely to the actual labor market situation of older workers in general.

Specification of the Multivariate Analysis

To investigate the impact of the factors discussed above on labor market transitions, a multinomial logit model is applied to the set of four discrete outcomes. The variables are defined in Table 3⁵. A comparison of group means

indicates that foreigners are more likely to report a health shock than Germans. Those who experience a health shock have on average less schooling and lower incomes; they are more likely to work in manufacturing or in the construction industry and are less likely to be office workers, highly skilled managers, or employed in the public sector. Interestingly, we find some differences between states; for example, the risk of a health shock is relatively high in Bremen and small in Bavaria.

As suggested in the theoretical section, we control for the impact of four groups of variables. The group of demographic measures considers age, its squared value, sex, nationality, and marital status. Years of schooling, a categorical variable describing the level of training required

⁵ The only imputation mechanism for missing observations on the variables *bigfirm*, *construct*, *electric*, *jobtrain*, *manager*, *manufact*, *office*, *public sect.*, *retail*, *smallfirm*, and *unskilled* was to set them to their pre-period value if the individual indicated that the employment situation had not changed. Similarly, the variables *schooling* and *chronic* were assigned pre-period values if current period information was missing.

Table 4

Multinomial Logit Estimates for Transitions from Full-Time Employment¹⁾

Variable	Part-Time Employment		Unemployment		Out of the Labor Force	
	Coefficient	Standard Deviation	Coefficient	Standard Deviation	Coefficient	Standard Deviation
AGE	-0.179	0.221**	-0.683	0.165	-1.047	0.195**
AGE2	0.157	0.227	0.737	0.166**	1.144	0.194**
FOREIGN	-0.258	0.172	0.342	0.120**	-0.166	0.143
FEMALE	2.350	0.535**	0.498	0.261	-0.363	0.346
MARRIED	0.342	0.477	-0.420	0.159**	-0.153	0.204
MARRFEM	0.448	0.509	0.434	0.251	0.804	0.309**
PR_INCOME	-0.022	0.253	0.479	0.176**	-0.587	0.263*
SCHOOLING	0.125	0.042**	-0.080	0.037*	0.049	0.047
JOBTRAIN	-0.170	0.064**	-0.250	0.052**	-0.075	0.063
CHRONIC	0.059	0.144	0.630	0.102**	0.509	0.119**
SHOCK	0.595	0.292*	0.759	0.200**	1.267	0.196**
BIGFIRM	-0.388	0.186*	-0.265	0.133*	0.111	0.149
SMALLFIRM	0.668	0.172**	0.602	0.137**	0.089	0.173
OFFICE	-0.444	0.182*	-0.074	0.200	-0.641	0.211**
MANUFACT	-0.450	0.192*	0.433	0.140**	-0.155	0.154
CONSTRUCT	0.244	0.386	0.292	0.157	0.418	0.198*
RETAIL	0.557	0.216	-0.210	0.279**	0.096	0.278
ELECTRIC	-0.878	0.402*	-0.526	0.232*	-0.360	0.291
PUBLICSECT.	0.363	0.169*	-1.009	0.199**	-0.360	0.291
AGG_UNEMPL.	0.143	0.294	0.578	0.199**	-0.116	0.262
ST_BERLIN	-0.236	0.349	0.218	0.253	0.211	0.330
ST_SHOLSTEIN	-0.598	0.422	0.123	0.309	0.434	0.335
ST_HAMBURG	0.505	0.402	0.134	0.332	0.590	0.376
ST_NSACHSEN	-0.125	0.251	0.058	0.193	0.463	0.218*
ST_BREMEN	-0.940	1.030	1.198	0.338**	0.824	0.456
ST_NRW	-0.092	0.195	-0.321	0.155*	0.133	0.191
ST_HESEN	-0.398	0.263	-0.361	0.199	0.372	0.219
ST_PFALZSAAR	-0.522	0.357	-0.064	0.219	-0.500	0.329
ST_BADWUERT	0.081	0.199	-0.445	0.165**	-0.136	0.209
CONSTANT	-2.839	5.980	7.300	4.431	21.539	5.392*

¹⁾ The estimation controlled for a set of year indicators. Log Likelihood = -4,488.75. N = 19,509. — * Significant at 5 percent level of significance. — ** Significant at 1 percent level of significance.

Source: Author's calculations based on GSOEP (1984-1994).

for the job, an indicator for whether the person suffers a chronic disease, and net real monthly income are included as measures of human capital. Since individuals' labor market earnings are possibly endogenous to labor force transitions, we generate a measure of predicted labor market income using a least squares regression. The estimation equation is available from the author upon request. The group of job and firm characteristics controls for firm size using indicators for firms with more than 2,000 and less than 20 employees, for whether the person works as an office worker or in manufacturing, and for whether the job is in the public sector, construction, retailing, or electrical and precision engineering industry. To control for macroeconomic effects, we consider the annual national unemployment rates as well as a set of year and state indicators to account for geographic and time effects.

5. Estimation and Simulation Results

The estimation results are presented in Table 4. The coefficients describe the impact of the variables on the probability of a transition from full-time employment into the categories of part-time employment, unemployment, or out of the labor force. Due to the nonlinear nature of the estimator, it is problematic to interpret the magnitude and sign of the coefficient estimates directly. However, the large coefficients for females in the transition to part-time employment, for the public sector in the transition to unemployment, and for the health shock in the transition out of the labor force are noteworthy. Further, being from the state of Bremen appears to have a sizeable effect on all transition probabilities. We find highly significant effects of suffering a health shock on all three transitions.

Table 5

Marginal Effects from Multinomial Logit Analysis¹⁾

Variable	Transition into			
	Full-Time Employment	Part-Time Employment	Unemployment	Out of Labor Force
AGE	-0.28	-0.04	0.11	0.21
FEMALE	-5.49	3.49	1.69	0.32
FOREIGN	-0.14	-0.34	0.75	-0.27
MARRIED	-0.48	0.90	-0.64	0.22
PR_INCOME	-0.09	-0.03	1.07	-0.95
SCHOOLING	-0.06	0.16	-0.18	0.08
CHRONIC	-2.10	0.04	1.31	0.75
SHOCK	-4.13	0.70	1.52	1.91
BIGFIRM	0.86	-0.50	-0.56	0.20
SMALLFIRM	-2.18	0.84	1.26	0.08
CONSTRUCT	-1.51	0.29	0.58	0.63
ELECTRIC	2.01	-1.13	-1.10	0.21
PUBLICSECT	2.01	0.52	-2.16	-0.37
AGG_UNEMP	-1.19	0.17	1.24	-0.22

1) Calculated using the entire data set and averaging across individuals.
Source: Author's calculations based on GSOEP (1984-1994).

One way to evaluate the relative impact of the covariates is to calculate their marginal effects, which are listed in Table 5. The figures confirm the theoretical hypothesis that a health shock has a negative effect on the probability of remaining in full-time employment. The only other characteristic with a similarly strong impact is the female variable. The impact of the health shock on the propensity to transit into part-time employment is small. Here, only being female has a sizable impact. The health shock significantly increases the risk of unemployment and of labor force exit. It is indeed the strongest determinant of dropping out of the labor force. Other important determinants of the risk of unemployment are the female, small firm, and public sector indicators, as well as the aggregate unemployment measure. Given that employment in the public sector is well known to offer a high degree of job security, the negative effect of public sector on the unemployment risk confirms expectations. Overall, the limited impact of the human capital measures is surprising. Income has a noticeable effect only on the probability of exiting the labor force and of unemployment. As expected, having a chronic disease is correlated with a reduced probability of full-time employment. Working in a small firm clearly increases the probability of transitions out of employment and into unemployment.

Another method to evaluate the impact of the covariates on labor force transitions is simulation experiments. Such experiments were executed by predicting the average transition probabilities for the entire sample after modifying single variables. In the case of continuous variables, these were first set to one standard deviation below and afterwards to one standard deviation above the mean. Dichotomous variables were first set to zero and afterwards to one. The results are summarized in Table 6. For each

Table 6

Changes in Transition Probabilities

Variable	Transition into			
	Full-Time Employment		Part-Time Employment	
	(1) ¹⁾	(2) ²⁾	(1) ¹⁾	(2) ²⁾
Sample Average	94.72		1.39	
AGE	95.64	94.25	1.60	1.19
FEMALE	96.25	89.58	0.32	4.51
FOREIGN	94.81	94.64	1.51	1.18
MARRIED	94.74	94.50	0.85	1.63
PR__INCOME	94.35	93.55	1.40	1.32
SCHOOLING	94.82	94.43	1.06	1.93
CHRONIC	95.37	93.07	1.39	1.42
SHOCK	94.93	88.93	1.37	2.19
BIGFIRM	94.53	95.31	1.50	1.04
SMALLFIRM	95.18	92.63	1.19	2.17
CONSTRUCT	94.86	93.17	1.39	1.70
ELECTRIC	94.58	96.72	1.44	0.64
PUBLICSECT	94.50	95.88	1.27	1.82
AGG__UNEMP.	95.53	92.82	1.23	1.58
	Unemployment		Out of Labor Force	
	(1) ¹⁾	(2) ²⁾	(1) ¹⁾	(2) ²⁾
Sample Average	2.26		1.63	
AGE	1.81	2.60	0.95	1.96
FEMALE	1.88	3.99	1.55	1.92
FOREIGN	1.94	2.72	1.74	1.47
MARRIED	2.88	2.16	1.53	1.71
PR__INCOME	1.85	4.34	2.40	0.79
SCHOOLING	2.62	1.73	1.50	1.91
CHRONIC	1.86	3.33	1.38	2.19
SHOCK	2.18	4.16	1.52	4.73
BIGFIRM	2.39	1.86	1.58	1.79
SMALLFIRM	2.02	3.52	1.62	1.69
CONSTRUCT	2.18	2.83	1.57	2.29
ELECTRIC	2.32	1.43	1.66	1.21
PUBLICSECT	2.53	0.95	1.71	1.34
AGG__UNEMP.	1.35	4.19	1.88	1.41

1) Calculated with continuous explanatory variables set to one standard deviation below the mean and dichotomous explanatory variables set to zero. — 2) Calculated with continuous explanatory variables set to one standard deviation above the mean and dichotomous explanatory variables set to one.

Source: Author's calculations based on GSOEP (1984-1994).

possible transition, columns 1 and 2 show the predicted probabilities after the modification of each explanatory variable.

Overall, the findings confirm what we concluded from Table 5. The health shock has a sizable impact on the transition probabilities. It reduces the probability of remaining full-time employed by about 6 percentage points and it increases the probability of entering part-time employment by about 60 percent, the probability of unemployment by 84 percent and of dropping out of the labor force by about 200 percent. Other influential characteristics in the transition to full-time employment are a person's gender, working in a small firm, and the aggregate unemployment situation.

Again, the single most important predictor of part-time employment is being female. It increases the average probability of part-time employment by 220 percent over the sample average. The simulations confirm that employment in small firms is much less stable than in bigger firms. Working in a small firm reduces the probability of continued full-time employment by about 2 percent and increases the risk of unemployment by 56 percent, whereas working in a very large establishment increases the probability of continued full-time employment slightly and reduces the risk of unemployment to 18 percent below the sample average. Generally, the occupation and industry effects are not astonishing. The occupations with the most continued full-time employment and the lowest unemployment are the electrical industry and the public sector. The most volatile jobs appear to be in the construction industry. In preliminary estimations, the effects of working in the chemical, mechanical engineering, iron and steel, and the restaurant industry were tested. Since these industry effects did not appear to be very influential, they were omitted in the final specification for the sake of simplicity. Finally, the simulation results confirm the marginal effects analysis regarding the determinants of unemployment and of leaving the labor force.

6. Conclusions

The analyses lead us to four interesting conclusions. First and foremost, health shocks have sizeable effects on labor force transitions within one year of the shock. Simulation results indicate that the chances of unemployment increase by 84 percent and those of dropping out of the labor force by about 200 percent after a health shock.

These effects do not appear to interact much with other controlled factors. Results not presented here show that a health shock also has a highly significant impact on labor force transitions in the following two years. Second, women appear to have labor force transition patterns that differ clearly from those of men. This was confirmed further by a number of statistically significant interactions which were not included in the final specification⁶. Most striking are the high probabilities of part-time employment and unemployment for women. Third, employment after a health shock in small firms appears to be less stable than in larger firms. Fourth, even the highly aggregated national annual unemployment rate affects individual transition patterns. High unemployment reduces the probability of continued full-time employment and increases the individual's unemployment risk.

There are some methodological shortcomings in this study which will be addressed in future work. First, the sample is selected based on whether the individuals are full-time employed. Pending sample selectivity corrections, the results must be interpreted as conditional on this selection criterion. Second, the panel nature of the data could be utilized to correct for individual-specific unobserved heterogeneity, for example, by using a random effects estimator. Finally, the two stage estimation of a labor earnings equation and labor force transition equations could be improved by explicitly considering their simultaneity in the estimation approach.

⁶ Individually and jointly statistically significant interaction effects were found for the *age*, *foreign*, *schooling*, *construct*, and *public sector* variables.

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