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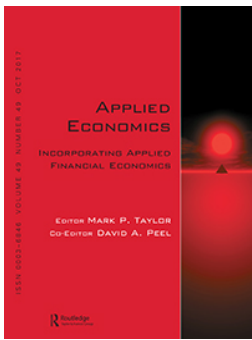
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Return to work after cancer and pre-cancer job dissatisfaction

Eskil Heinesen^a, Christophe Kolodziejczyk^b, Jacob Ladenburg^b, Ingelise Andersen ^c and Karsten Thielen^c

^aRockwool Foundation Research Unit, Copenhagen K, Denmark; ^bKORA, Danish Institute for Local and Regional Government Research, Copenhagen K, Denmark; ^cUniversity of Copenhagen, Department of Public Health, Copenhagen K, Denmark

ABSTRACT

We investigate the association between pre-cancer job dissatisfaction and return-to-work probability 3 years after a cancer diagnosis. We use a Danish data set combining administrative data and a survey to breast and colon cancer survivors. We find that the return-to-work probability has a negative correlation with pre-cancer job dissatisfaction with mental demands (where the correlation is driven by the high-educated) and with physical demands and the superior (where the correlation is driven by the low-educated). Educational gradients in the probability of returning to work after cancer are not significantly affected by controlling for pre-cancer job dissatisfaction and pre-cancer ability to work.

KEYWORDS

Health shock; job satisfaction; employment; educational gradient; ability to work; desire to work

JEL CLASSIFICATION

I14; J24; J28

I. Introduction

To get cancer is an example of a major health shock which may have important effects on various economic outcomes (e.g. Lee and Kim 2008; García-Gómez et al. 2013). Many people of working age get cancer each year, and due to better screening and treatment increasing numbers survive cancer (Cutler 2008) and live with cancer as a chronic health condition. Most cancer survivors of working age return to work, but previous studies find that cancer has a significant negative effect on the probability of employment (Bradley, Bednarek, and Neumark 2002a, 2002b, 2005, 2007; Steiner et al. 2004; Moran, Short, and Hollenbeak 2011; Short, Vasey, and Moran 2008; Datta Gupta, Kleinjans, and Larsen 2011; Candon 2015; Cabus, Groot, and van den Brink 2016; Barnay, 2016) with a significant educational gradient so that the negative effect of cancer is larger for the low-educated (Heinesen and Kolodziejczyk 2013). We know only little about mechanisms which may explain differences in return to work among different groups of cancer survivors, for example, education groups. Results in Thielen et al. (2015) indicate that the educational gradient in the effect of cancer is not explained by differences between education groups in comorbidity or cancer stage at diagnosis.

This article explores a potential mechanism which might explain part of the heterogeneity in return-to-work probability of cancer survivors, namely pre-cancer job satisfaction or dissatisfaction. Thus, one hypothesis might be that cancer survivors who were highly satisfied with the jobs they had before they were diagnosed with cancer may be more inclined to return to work after cancer in spite of the possible negative long-term effects of the cancer treatment and the disease itself on ability to work and health in general. Similarly, cancer survivors with high pre-cancer job dissatisfaction might be less likely to return to work and instead, for example, apply for disability pension or pursue other early retirement options. If, for instance, cancer survivors with a further or higher education were in general more satisfied with their job before they had cancer than those with a lower education this might explain some of the differences between education groups in the probability of being employed after cancer (i.e. it might explain part of the educational gradient). To our knowledge, no previous study has focused on whether pre-cancer job (dis)satisfaction is associated with the long-term return-to-work probability of cancer survivors or whether it can explain part of the social gradients in the return-to-work probability, although a few papers consider job satisfaction of

employed cancer survivors after the diagnosis (Amir et al. 2007; Mehnert and Koch 2013a, 2013b).

In this article, we investigate the importance of pre-cancer job dissatisfaction for the probability of returning to work 3 years after cancer using a survey to breast and colon cancer survivors in Denmark who were 30–60 years of age at the time of diagnosis. It is interesting to focus on this rather long-term outcome, since for most cancer survivors the negative side effects of cancer treatment affecting ability to work are much smaller 3 years after diagnosis than earlier. The survey was conducted 2–4 years after the cancer diagnosis. The survey data contain recall information on pre-cancer job dissatisfaction as well as self-perceived ability to work before and after cancer and whether the respondent desired to work after cancer treatment. Possible recall bias is a major concern when using retrospective survey information, but we conduct tests which indicate that recall bias is not a major problem in our data.

The survey data are merged with longitudinal administrative data containing information on employment, education, demographics, health, and so on. The survey contains information on six dimensions of pre-cancer job dissatisfaction. These are dissatisfaction with mental demands in the job, physical demands, the superior, colleagues and tasks, as well as information on whether the respondent searched for a new job. The latter dimension is related to the literature which considers quit propensity to be an indicator of job dissatisfaction, for example, Weiss (1984, 1985). Of course, searching for another job may be related to dissatisfaction with various more specific aspects of the job (including the first five dimensions listed above) and, in this sense, it is related to measures of overall job (dis)satisfaction which are used in several papers in labour economics; see, for example, Hamermesh (2001), Lalive and Stutzer (2010), Booth and van Ours (2013), Chaudhuri, Reilly, and Spencer (2015) and Busk, Jahn, and Singer (2015). The five more specific dimensions of pre-cancer job dissatisfaction are all potentially important for return-to-work probability. Thus, since cancer survivors are often plagued by reduced ability to work because of effects of the disease itself and late complications of the treatment, those who were already dissatisfied with mental or physical job demands before cancer (in the sense that the demands were becoming too hard

or with job tasks may be expected to be more at risk of not returning to work. Thus, the probability of returning to work is associated with pre-diagnosis physical workload (Spelten, Sprangers, and Verbeek 2002, 2003; Fantoni et al. 2010; Torp et al. 2011) and pre-diagnosis psychosocial work environment (Fantoni et al. 2010; Torp et al., 2011). Also, dissatisfaction with colleagues and the superior may be important, since previous studies indicate that cancer survivors find the roles played by co-workers and employers to be important for a successful return to work (Maunsell et al. 2004; Taskila et al. 2006, 2007; Bouknight, Bradley, and Lou 2006; Pryce, Munir, and Haslam 2007; Torp et al. 2011).

When exploring the association between pre-cancer job dissatisfaction and the probability of being employed after cancer, it may be important to consider confounding mechanisms. Apart from controlling for standard baseline variables (including demographics, education, cancer type, cancer stage at diagnosis, comorbidity and the local unemployment rate), we consider in this article three confounding mechanisms. First, some of the variation in pre-cancer job dissatisfaction may be explained by variation in pre-cancer ability to work. Second, post-cancer ability to work may be important for post-cancer employment probability, and it may also be correlated with pre-cancer ability to work and job dissatisfaction. Third, given pre- and post-cancer ability to work, pre-cancer job dissatisfaction may affect post-cancer employment probability via both the desire to work in general and the desire to return to the pre-cancer job. Thus, even controlling for the desire to work in general after cancer treatment, one may expect negative effects of pre-cancer job dissatisfaction on the probability of post-cancer employment if it is difficult for cancer survivors to obtain new jobs in other firms.

II. Data

We use a combination of survey and administrative data. The survey was conducted in the fall of 2010. The survey population includes all persons who were diagnosed with breast, colon or melanoma skin cancer in 2006–2008 (according to the Danish Cancer Registry), who did not have any cancer before 2006 (according to the Cancer Registry and the hospital registry), who were employed (most of the year) 2

years before the year of diagnosis, who were 30–60 years of age at the time of diagnosis and who were alive and living in Denmark in the fall of 2010. From the survey we use primarily data on pre-cancer job dissatisfaction but also information on self-assessed ability to work and whether individuals desired to work after cancer treatment. The survey data were merged with register data at Statistics Denmark (using a unique link between the questionnaire serial numbers and the personal identification numbers). From the registers we obtain information on the specific cancer diagnosis, year of diagnosis, gender, age (at the end of the year of diagnosis), education (in the year of diagnosis) and employment in each year before and after diagnosis.

Table 1 shows the selection of the sample. The questionnaire was sent to 4804 cancer survivors, and the response rate was 75.2%. This article does not use observations for people who had melanoma skin cancer, since the effects on labour market participation of this type of cancer are very small and significantly different from the effects of breast and colon cancer; see Heinesen and Kolodziejczyk (2013). Since the questions about job dissatisfaction in the questionnaire were only asked to persons who were employed just before they were diagnosed with cancer, we condition on being employed (most of the year) in the year before diagnosis. We exclude from the sample those who emigrate or die before the end of the third year after diagnosis since we

need to observe their employment status in the third year after diagnosis (which is the outcome in the analysis). Among the 3480 cancer survivors meeting these three sample restrictions, the response rate was 77.8%, that is, 2707 participated. Of these, 2457 answered at least 1 of the 7 job dissatisfaction questions (i.e. the response rate for these questions is 70.6%), and 1803 answered all the job dissatisfaction questions (with answers in other categories than ‘don’t know’).

The basic estimation sample consists of the 2457 observations with information on at least one of the job dissatisfaction questions. There may be several reasons why rather many respondents did not answer (all) the job dissatisfaction questions. Even if the respondents were employed the year before the year of diagnosis (and 2 years before), some may have been unemployed in the months before they were told they had cancer, some may have had two different jobs and some of the questions may have been considered irrelevant, or the questions may have been difficult to answer for other reasons. Based on the data for the 7 job dissatisfaction questions, we construct 6 dummy variables. 5 of these indicate dissatisfaction with respect to mental demands, physical demands, the superior, colleagues and tasks, whereas the sixth variable (based on 2 survey questions) indicate whether the respondent was searching for a new job. We also construct 6 dummy variables for missing information on each variable (including ‘don’t know’ answers). The Appendix contains details on the job dissatisfaction questions and the definition of the dummy variables.

Table 2 shows descriptive statistics. The outcome variable is a dummy for being employed (for most of the year) in the third year after the year of diagnosis; 82.5% of the participating cancer survivors are employed.¹ The proportions stating dissatisfaction with the job they had before they were diagnosed with cancer vary a lot depending on the specific type of dissatisfaction. Among those who answered the individual job dissatisfaction questions 25% were dissatisfied with the mental demands in the job, 16% with physical demands, 9% with their superior, 7% with tasks and only 3.5% with their colleagues;

Table 1. Sample selection and survey response rate.

Population restrictions	<i>N</i>	Response rate
Survey population (breast, colon or skin cancer) ^a	4804	.752
Breast or colon cancer	3640	.769
Employed the year before diagnosis	3528	.773
Survived third year after diagnosis (and did not emigrate)	3480	.778
Participated in survey	2707 ^b	
Answered job dissatisfaction questions (at least one)	2457	.706 ^c
Answered job dissatisfaction questions (all)	1803	.518 ^d

^aThe survey population consists of 30–60 year olds who were diagnosed with breast, colon or skin cancer in 2006–2008, who were employed 2 years before diagnosis and who survived and were living in Denmark at the time of the survey (in the fall of 2010).

^b0.778 × 3480.

^c2457/3480.

^d1803/3480.

¹The drop in employment probability relative to the pre-cancer situation by 17.5% is not a causal effect of cancer. Many of these workers who were all employed the year before they were diagnosed with cancer are rather old and many would have become unemployed or have left the labour force (due to, e.g. sickness, disability or early retirement) during this 4-year period even if they did not have cancer. The causal effect of cancer on employment for a similar group of cancer survivors is ‘only’ about 7%; see Heinesen and Kolodziejczyk (2013, Appendix Table A11).

Table 2. Summary statistics.

	N	Mean	SD	Min	Max
Employed third year after diagnosis	2457	0.825	0.380	0	1
Compulsory education (ninth grade)	2457	0.188	0.391	0	1
Vocational education (upper secondary education)	2457	0.358	0.480	0	1
Further education (2–4 years of tertiary education)	2457	0.369	0.483	0	1
Higher education (5 years of tertiary education)	2457	0.084	0.278	0	1
<i>Pre-cancer job dissatisfaction</i>					
Mental demands	2067	0.247	0.431	0	1
Physical demands	2064	0.163	0.369	0	1
Superior	2211	0.087	0.282	0	1
Colleagues	2276	0.035	0.184	0	1
Tasks	2361	0.072	0.259	0	1
Searched for a new job	1987	0.132	0.338	0	1
Mental demands missing	2457	0.159	0.365	0	1
Physical demands missing	2457	0.160	0.367	0	1
Superior missing	2457	0.100	0.300	0	1
Colleagues missing	2457	0.074	0.261	0	1
Tasks missing	2457	0.039	0.194	0	1
Search for a new job missing	2457	0.191	0.393	0	1
<i>Ability and desire to work</i>					
Ability to work before diagnosis	2417	9.239	1.524	0	10
Ability to work 1 year after treatment	2390	7.296	2.832	0	10
Ability to work 3 years after diagnosis	2379	8.037	2.757	0	10
Ability to work before diagnosis missing	2457	0.016	0.127	0	1
Ability to work 1 year after treatment missing	2457	0.027	0.163	0	1
Ability to work 3 years after diagnosis missing	2457	0.032	0.175	0	1
Desired to work after treatment	2241	0.930	0.255	0	1
Desired to work after treatment missing	2457	0.088	0.283	0	1
<i>Other covariates</i>					
Breast cancer	2457	0.861	0.346	0	1
Colon cancer	2457	0.139	0.346	0	1
Localized cancer	2457	0.459	0.498	0	1
Regional spread	2457	0.347	0.476	0	1
Metastatic	2457	0.028	0.164	0	1
Stage missing	2457	0.166	0.373	0	1
Charlson comorbidity index	2457	0.042	0.251	0	3
Male	2457	0.070	0.255	0	1
Age	2457	51.282	6.708	30	61
Age 57	2457	0.055	0.227	0	1
Age 58	2457	0.075	0.263	0	1
Age 59	2457	0.056	0.230	0	1
Age 60–61	2457	0.091	0.287	0	1
Married	2457	0.716	0.451	0	1
Cohabiting	2457	0.085	0.280	0	1
Single	2457	0.199	0.399	0	1
Local unemployment rate third year after diagnosis (%)	2457	5.636	0.813	4.0	9.3
Diagnosis in 2006	2457	0.289	0.453	0	1
Diagnosis in 2007	2457	0.311	0.463	0	1
Diagnosis in 2008	2457	0.400	0.490	0	1

13% searched for a new job. The correlation coefficients between the job dissatisfaction variables are all positive and vary from 0.09 to 0.51; see [Appendix Table A2](#).

Ability to work for each individual is assessed relative to when it was highest. Respondents report a value between 0 and 10, where 10 is the highest ability to work experienced by the respondent during her work career. Ability to work is reported for

different points in time: just before the respondent had cancer; 1 year after cancer treatment; and at the time of the survey (2010), which is 2–4 years after diagnosis (depending on whether the respondent was diagnosed with cancer in 2006, 2007 or 2008). For convenience, we will refer to the last variable as ability to work 3 years after diagnosis. The average ability to work before diagnosis is 9.2; 1 year after cancer treatment it has fallen to 7.3; and 3 years after diagnosis it is 8.0 indicating substantial recovery. The vast majority of the respondents, 93%, state that they desired to work after the cancer treatment.

The majority has breast cancer; 14% have colon cancer (half of them are males). Cancer stage at diagnosis is measured by dummy variables for localized cancer (46%), regional spread (35%) and metastatic cancer (3%), whereas this (register-based) information is missing for 17%. Comorbidity at baseline is measured by the Charlson index (Charlson et al. 1987; Sundararajan et al. 2004) based on hospitalization diagnoses 1–10 years before the year of diagnosis. The average age at the end of the year of diagnosis is 51 years. In the analysis we control for age by including four dummy variables for older workers (age 57, 58, 59 and 60–61). Initial estimations showed no significant differences in age effects within the group of 30–56 year olds, whereas the 58–61 year olds have considerably lower employment probability 3 years later, mainly due to an early retirement scheme which made it possible to retire from age 60 (although with an economic incentive to wait to age 62 or later). To adjust for employment opportunities in the local labour market, we control for the unemployment rate 3 years after diagnosis in the commuting area of the municipality where the cancer survivor lived in the year of diagnosis.

[Table 3](#) presents means of the outcome and the survey-based variables by the level of education of the respondents. There are large differences between education groups in the probability of being employed 3 years after diagnosis: This probability is 74.3% for those with no education beyond compulsory (lower secondary) school, and 95.7% for those with a higher education. Educational differences in pre-cancer job dissatisfaction are also rather large, especially regarding physical demands and whether the person searched for a new job. Compared to individuals with compulsory or vocational education, a larger

Table 3. Means of outcome and survey-based variables by level of education.

	Compulsory education	Vocational education	Further education	Higher education	Total
<i>Outcome variable</i>					
Employed 3 years after diagnosis	0.743	0.786	0.875	0.957	0.825
<i>Pre-cancer job dissatisfaction</i>					
Mental demands	0.245	0.221	0.271	0.249	0.247
Physical demands	0.246	0.164	0.145	0.086	0.163
Superior	0.087	0.058	0.111	0.108	0.087
Colleagues	0.032	0.025	0.042	0.056	0.035
Tasks	0.054	0.056	0.095	0.079	0.072
Searched for a new job	0.114	0.098	0.155	0.192	0.132
<i>Ability and desire to work</i>					
Ability to work before diagnosis	9.174	9.366	9.155	9.210	9.239
Ability to work 1 year after treatment	6.900	7.313	7.380	7.723	7.296
Ability to work 3 years after diagnosis	7.574	7.924	8.262	8.532	8.037
Desire to work after treatment	0.903	0.916	0.944	0.985	0.930

share of the groups with further or higher education tend to be dissatisfied with the superior, colleagues and tasks, and a larger share were searching for a new job. Contrary, a larger share of individuals with compulsory education were dissatisfied with physical demands in the job they had before they had cancer. Educational differences in self-assessed ability to work before diagnosis are small, but individuals with further education, and especially those with higher education, tend to have higher ability and desire to work after cancer compared to those with compulsory or vocational education.

III. Methods

We estimate linear probability models (LPMs) using OLS with employment in the third year after diagnosis as the dependent variable. We include different sets of explanatory variables. All estimations include variables for education and controls for cancer type, cancer stage at diagnosis, comorbidity, gender, age, family type, the local unemployment rate and year of diagnosis. We focus on whether pre-cancer job dissatisfaction is associated with the probability of employment after cancer and whether including job dissatisfaction variables affects the educational gradient in return to work after cancer. As we discussed in Section I, we control in some of the estimations for possible confounding mechanisms by including additional explanatory variables: pre-cancer ability to work, post-cancer ability to work and post-cancer desire to work. Since self-assessed ability

to work after cancer and especially whether the respondent desired to work after cancer treatment may be affected by job dissatisfaction before cancer, inclusion of these variables as extra controls means that the estimated coefficients of the pre-cancer job dissatisfaction variables should be interpreted as the ‘effects’ of pre-cancer job dissatisfaction over and above the effects via post-cancer ability and desire to work.

All reported estimation results are based on the sample of 2457 respondents who answered at least 1 of the job dissatisfaction questions. We include as controls dummy variables for missing values of all the survey-based variables included in each regression.² Our main specifications are supplemented with a series of robustness checks.

We use LPMs since we are interested in the marginal effects on return-to-work probability of explanatory variables, especially the job dissatisfaction variables, and OLS parameter estimates may be interpreted as approximate marginal effects (Wooldridge 2010; Angrist and Pischke 2009). LPM residuals are heteroscedastic, and therefore we report heteroscedasticity-robust SEs. One disadvantage of LPMs is that they may generate predictions outside the unit interval. As a robustness check, we estimate the main specifications using logistic regression and report results in the form of both odds ratios and average marginal (or partial) effects (which may be compared to the OLS parameter estimates).

Possible recall bias is a major concern when using retrospective survey information. For instance, cancer survivors who do not return to work after cancer

²In the regressions, the variables for job dissatisfaction and desire to work are set equal to zero if missing, and variables for ability to work are set equal to 8 (close to the overall mean).

might tend to report that they were more dissatisfied with their pre-cancer job in order to 'justify' their status as non-employed. If post-cancer employment status systematically affects responses to pre-cancer job dissatisfaction questions, one would expect that job dissatisfaction variables were correlated with 'objective' factors affecting post-cancer employment status such as cancer stage at diagnosis (obtained from administrative data) and the local unemployment rate. Therefore, we report test statistics of such correlations. We cannot reject a hypothesis of no correlation, which indicates that recall bias is not a major problem in our data.

IV. Results

Main results

Table 4 reports the main results. In all the regressions the dependent variable is a dummy variable for whether the person was employed (for most of the year) in the third year after the year of diagnosis. All six regression models include controls for cancer type, cancer stage at diagnosis, comorbidity, gender, age, family type and year of diagnosis, and in addition indicators of missing information on the included variables for job dissatisfaction (models (2)–(6)), ability to work (models (4)–(6)) and desire to work (model (6)); see Table 2 and the full estimation results for models (3), (4) and (6) in Appendix Table A3.

The first column of Table 4 shows results when we do not include job dissatisfaction variables or other variables from the survey in the regression. There are significant educational gradients: Compared to the reference group with no education beyond compulsory school (ninth grade), the probability of return to work is 4.4, 10.5 and 15 percentage points larger for those with vocational, further and higher education, respectively, and these differences between groups are all statistically significant.

Model (2) of Table 4 includes the 6 pre-cancer job dissatisfaction variables. The return-to-work probability is 7 and 8 percentage points smaller, respectively, in case of dissatisfaction with physical demands and the superior. Dissatisfaction with mental demands is associated with a reduction in the probability of return to work by about 4 percentage points, but the effect is only marginally significant at the 10% level. Dissatisfaction with colleagues and tasks and the

indicator for whether the person searched for a new job are not statistically significant. It is surprising that the point estimate for dissatisfaction with colleagues is positive, but it seems to be due to the fact that only very few (3.5%; see Table 2) report dissatisfaction with colleagues and to collinearity with the other job dissatisfaction variables. When the 6 job dissatisfaction variables are included separately in 6 different regressions, their point estimates are all negative, 4 are statistically significant at the 0.1% level (mental demands, physical demands, superior, and searched for a new job), 1 is significant at the 5% level (tasks) and 1 is clearly insignificant (colleagues); see Appendix Table A4. Column (3) in Table 4 shows that exclusion of the variables for dissatisfaction with colleagues and tasks does not affect the other estimates in any significant way. The remaining models in Table 4 only include this more parsimonious specification in terms of job dissatisfaction variables.

Model (4) of Table 4 includes self-assessed ability to work before the cancer diagnosis as an additional control, since this variable may be correlated with pre-cancer job dissatisfaction. Thus, one potential reason for higher job dissatisfaction, especially regarding mental and physical demands, may be lower ability to work. However, our measure of ability to work before the cancer diagnosis is correlated with cancer stage at diagnosis and cancer type. Cancer survivors were asked about ability to work immediately before the diagnosis where some respondents with metastatic cancer and colon cancer may have had serious symptoms affecting their ability to work. Thus, for some respondents, the variable for ability to work before diagnosis may actually capture effects of cancer. In model (4) of Table 4, ability to work before diagnosis is clearly significant, and the point estimate indicates that an increase by 1 SD (i.e. by 1.5; see Table 2) in the ability-to-work index is associated with an increase in the probability of returning to work after cancer by 3 percentage points. Inclusion of ability to work before diagnosis tends to reduce the point estimates of dissatisfaction with mental and physical demands, as expected, whereas the point estimates of dissatisfaction with the superior and job search are not affected.

Model (5) of Table 4 is identical to model (4) except that ability to work 1 year after cancer treatment and 3 years after diagnosis are included as extra controls. Both of these variables have statistically significant coefficients, whereas ability to work

Table 4. Estimation results (OLS). Dependent variable: Employed 3 years after diagnosis.

	(1)	(2)	(3)	(4)	(5)	(6)
Vocational education	0.044** (0.022)	0.036* (0.021)	0.035 (0.021)	0.031 (0.021)	0.022 (0.020)	0.022 (0.019)
Further education	0.105**** (0.020)	0.101**** (0.020)	0.100**** (0.020)	0.100**** (0.020)	0.069**** (0.019)	0.064**** (0.018)
Higher education	0.152**** (0.023)	0.145**** (0.023)	0.147**** (0.023)	0.146**** (0.023)	0.109**** (0.022)	0.100**** (0.022)
<i>Job dissatisfaction</i>						
Mental demands		-0.043* (0.022)	-0.041* (0.021)	-0.026 (0.021)	-0.007 (0.020)	0.002 (0.020)
Physical demands		-0.067** (0.026)	-0.073*** (0.026)	-0.057** (0.026)	-0.021 (0.024)	-0.022 (0.024)
Superior		-0.081*** (0.030)	-0.077*** (0.030)	-0.077** (0.030)	-0.071** (0.028)	-0.058** (0.028)
Colleagues		0.052 (0.042)				
Tasks		-0.004 (0.034)				
Searched for a new job		-0.034 (0.025)	-0.035 (0.022)	-0.035 (0.022)	-0.042** (0.020)	-0.045** (0.020)
<i>Ability and desire to work</i>						
Ability to work before diagnosis				0.020**** (0.006)	-0.004 (0.005)	-0.006 (0.005)
Ability to work 1 year after treatment					0.010*** (0.004)	0.006 (0.004)
Ability to work 3 years after diagnosis					0.041**** (0.004)	0.040**** (0.004)
Desired to work after treatment						0.249**** (0.034)
Observations	2457	2457	2457	2457	2457	2457
Adjusted R ²	0.223	0.243	0.242	0.248	0.356	0.379

Robust SEs in parentheses.

Controls include dummies for cancer type, cancer stage at diagnosis, comorbidity, gender, age, family type, local unemployment rate 3 years after diagnosis, and year of diagnosis, and in addition indicators of missing information on the included variables for job dissatisfaction (models (2)–(6)), ability to work (models (4)–(6)) and desire to work (model (6)) (see Table 2). Full estimation results for models (3), (4) and (6) are shown in Appendix Table A.3.

* $p < .10$, ** $p < .05$, *** $p < .01$, **** $p < .001$

before diagnosis becomes insignificant.³ An increase in ability to work 1 year after cancer treatment and 3 years after diagnosis by 1 SD (i.e., by 2.8, see Table 2) are associated with an increase in the probability of returning to work by about 14 percentage points ($0.010 \times 2.8 + 0.041 \times 2.8 \approx 0.14$). The point estimates for pre-cancer job dissatisfaction with respect to mental and physical demands become smaller numerically (compared to model (4)), and they are both statistically insignificant. However, the coefficient of dissatisfaction with the superior is not much affected and remains significant, and the coefficient of the indicator for whether the person searched for a new job becomes significant at the 5% level; pre-cancer job search is associated with 4 percentage points lower return-to-work probability.

Model (6) of Table 4 adds the extra explanatory variable of whether the person desired to work after

cancer treatment, which has a large positive and significant coefficient, as expected. This variable may be endogenous to pre-cancer job dissatisfaction (i.e. high pre-cancer job dissatisfaction may reduce the desire to work after cancer), but surprisingly, adding this variable to the model does not significantly change the parameter estimates of the other variables. Specifically, pre-cancer dissatisfaction with the superior remains significant (although the size of the effect is a little smaller) and so does the variable for whether the cancer survivor searched for a new job before she was diagnosed with cancer.

Educational gradients in the probability of returning to work are significant in all six models of Table 4. When pre-cancer job dissatisfaction and pre-cancer ability to work variables are included (models (2)–(4)), the coefficients of the education variables are only reduced slightly compared to

³If we had included the changes in ability to work from before cancer to after cancer (1 year after cancer treatment and 3 years after diagnosis) instead of the levels of ability to work at these two post-cancer points in time, the pre-cancer ability to work coefficient would have remained large and significant (its size would be equal to the sum of the three ability to work coefficients in model (5)), while the two coefficients of the changes would be equal to the post-cancer 'levels estimates' of model (5). Thus, the estimates of the ability to work variables in model (5) may be interpreted as indicating that both the pre-cancer ability level and the change from pre-cancer to post-cancer ability to work are important for employment probability after cancer.

model (1), but the coefficient of vocational education becomes statistically insignificant implying no significant difference in employment probability between those having a vocational education and those having no education beyond compulsory school. Having a further or higher education compared to having only compulsory schooling, are associated with about 10 and 14–15 percentage points higher probability of returning to work, respectively. When post-cancer ability to work is controlled for (in model (5)), these education effects are reduced to about 7 and 11 percentage points, and when, in addition, desire to work after cancer treatment is included as control (in model (6)), they are reduced to about 6.4 and 10 percentage points. This reduction reflects that higher educated cancer survivors have on average higher ability and desire to work after cancer (see Table 3), but the education coefficients remain highly significant (at the 0.1% level). Differences in employment probability between those with further and vocational education, and between those with higher and further education, are significant at the 5% level in all 6 models of Table 4 according to *F*-tests of equality of the corresponding parameters (test statistics not shown).

Results by level of education

In order to investigate whether effects of pre-cancer job dissatisfaction vary by educational level, Table 5 presents estimation results for two subsamples: Those with ‘low’ education (compulsory or vocational) and those with ‘high’ education (further or higher). We use 2 subsamples by educational level instead of 4 in order not to increase SEs of the estimates too much. Models (1)–(2), (3)–(4) and (5)–(6) in Table 5 correspond to models (3), (4) and (6), respectively, in Table 4. The control variables in Table 5 are the same as for the corresponding regressions in Table 4 (except for the education variables). The results in regressions (1) and (2) of Table 5, which do not control for ability to work, indicate that pre-cancer job dissatisfaction with mental demands is associated with a reduction in the probability of returning to work by 6 percentage points for the high-educated, whereas dissatisfaction with physical demands and the superior are associated with a reduction in the probability of

returning to work by 12 and 14 percentage points, respectively, for the low-educated; the other job dissatisfaction estimates are not statistically significant. It is not surprising that pre-cancer job dissatisfaction with physical demands is more important for the low-educated: Many low-educated have jobs requiring a high level of physical strength, and if physical demands were becoming too hard before cancer, it may be more difficult to return to the same type of job after cancer treatment, since physical strength is often reduced as a consequence of cancer treatment and the disease itself. The fact that pre-cancer job dissatisfaction with mental demands is more important for the high-educated might partly reflect job stress which may be even more difficult to cope with after a cancer disease. It is perhaps more surprising that pre-cancer job dissatisfaction with the superior is very important for the return-to-work probability for the low-educated, but not for the high-educated.

Ability to work before diagnosis is clearly significant for the low-educated, but not for the high-educated; see models (3) and (4) of Table 5. Including this control does not significantly change the estimates of the job dissatisfaction variables. In regressions (5) and (6) of Table 5 the variables for ability to work and desire to work after cancer are highly significant for both education groups and not statistically different between the groups (although the estimates of the coefficient of ability to work before diagnosis are different). Including these extra controls implies that pre-cancer job dissatisfaction with mental and physical demands becomes insignificant for both education groups (similar to the result in model (6) of Table 4), whereas dissatisfaction with the superior remains significant for the low-educated, and pre-cancer job search becomes marginally significant at the 10% level for the high-educated.

Robustness checks

The 6 dummy variables representing different dimensions of job dissatisfaction are constructed based on answers to a questionnaire with 4 response options for each dimension of job dissatisfaction, ‘strongly agree’, ‘agree’, ‘disagree’ and ‘strongly disagree’ (in addition to a ‘don’t know’ option), by collapsing the categories ‘strongly agree’ and ‘agree’ into one category, and similarly for ‘strongly disagree’ and ‘disagree’; see the

Table 5. Estimation results by educational level (OLS). Dependent variable: Employed 3 years after diagnosis.

Educational level	(1)	(2)	(3)	(4)	(5)	(6)
	Low	High	Low	High	Low	High
Mental demands	-0.011 (0.037)	-0.062** (0.024)	0.005 (0.036)	-0.059** (0.024)	0.022 (0.033)	-0.022 (0.023)
Physical demands	-0.122*** (0.040)	-0.028 (0.033)	-0.090** (0.039)	-0.025 (0.034)	-0.038 (0.036)	-0.005 (0.031)
Superior	-0.140*** (0.051)	-0.032 (0.034)	-0.142*** (0.051)	-0.031 (0.035)	-0.117** (0.050)	-0.012 (0.031)
Searched for a new job	-0.020 (0.038)	-0.039 (0.026)	-0.017 (0.037)	-0.040 (0.026)	-0.037 (0.035)	-0.043* (0.024)
Ability to work before diagnosis			0.036**** (0.009)	0.003 (0.007)	0.005 (0.009)	-0.017**** (0.006)
Ability to work 1 year after treatment					0.004 (0.005)	0.007 (0.005)
Ability to work 3 years after diagnosis					0.043**** (0.006)	0.036**** (0.006)
Desired to work after treatment					0.248**** (0.043)	0.258**** (0.060)
Observations	1343	1114	1343	1114	1343	1114
Adjusted R ²	0.244	0.190	0.258	0.189	0.386	0.333

Robust SEs in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$, **** $p < .001$

'Low' educational level is compulsory school or vocational education; 'High' is further or higher education.

Controls include indicators of missing information on the job dissatisfaction variables (and the ability to work variables in regressions (3)–(6)), and dummies for cancer type, cancer stage at diagnosis, comorbidity, gender, age, family type, local unemployment rate 3 years after diagnosis, and year of diagnosis (see Table 2 and Appendix Table A3).

Appendix. Although this is a standard procedure, it represents an important simplification. As a robustness check we have run regressions of more general models with 3 dummy variables for each dimension of job dissatisfaction instead of 1, thus utilizing the full information in the data. In these more general specifications, we cannot reject the restrictions implied by our preferred specification with only 1 dummy variable for each dimension of job dissatisfaction. For instance, in a general model corresponding to model (2) of Table 4 with 6 dimensions of job dissatisfaction, the p -value of the F -statistic for a Wald test of the 12 linear restrictions implied by model (2) is 0.43. Similarly, for the general version of the more parsimonious model (3) of Table 4 with only 4 dimensions of job dissatisfaction, the p -value of the F -statistic for the 8 restrictions is 0.35. On the contrary, similar tests reject the restrictions implied by an alternative specification where job dissatisfaction dummies are only equal to unity if respondents were strongly dissatisfied (i.e. if they answered 'strongly agree' or 'strongly disagree' to the relevant survey questions).⁴

The sample used in the analysis includes data from respondents who answer at least one of the

job-dissatisfaction questions (see Sections II and III). Since some respondents do not answer all these questions, we include for each dimension of job dissatisfaction a dummy variable for missing information. This dummy variable is equal to 1 if the respondent answered 'don't know' or did not tick any of the 5 options (see the Appendix). Including 2 missing-information dummy variables for each dimension of job dissatisfaction – one for 'don't know' and one for no answer at all – does not change the results in any significant way, and Wald tests cannot reject equality of the parameters of the 2 sets of dummy variables. For instance, the p -values of the F -tests of these restrictions in models corresponding to (2) and (3) in Table 4 are 0.21 and 0.26.

Results are not changed significantly either if we only use observations for which all included job dissatisfaction variables are non-missing (and drop the dummies for missing information). However, SEs tend to be larger, the point estimates of the educational gradients become a little smaller and, when controlling for post-cancer ability and desire to work, the point estimate of job dissatisfaction with the superior becomes smaller, whereas the point estimate of pre-cancer job search becomes larger.

⁴The p -value of the F -statistic for a Wald test of the 12 linear restrictions implied by model (2) in Table 4, but with 'strong dissatisfaction' variables instead of the main specification of these variables, is 0.032; and for model (3) the p -value of corresponding statistic for a test of the 8 linear restrictions is 0.006.

Results are also robust if we restrict the sample to women with breast cancer (representing 86% of the main estimation sample); see [Table A5](#) in the [Appendix](#). For this subsample, the estimated educational gradients and coefficients of pre-cancer job dissatisfaction with mental demands and job search are very similar to the main results in [Table 4](#), whereas the point estimates for dissatisfaction with physical demands and the superior are a little smaller, but not significantly so.

Using logistic regression instead of estimating LPMs by OLS gives substantially very similar results. To illustrate this, [Table A6](#) in the [Appendix](#) shows logistic estimates corresponding to the main regressions in [Table 4](#). The upper panel of [Table A6](#) reports estimated odds ratios, and the lower panel shows average marginal (or partial) effects based on the odds ratios. The marginal effects are very similar to the OLS estimates of [Table 4](#); there are no significant differences.

Tests related to potential recall bias of pre-cancer job dissatisfaction

We conduct tests to assess whether potential recall bias of the job dissatisfaction variables seems to be a major problem for our analysis. Thus, we test whether pre-cancer job dissatisfaction variables are significantly correlated with exogenous determinants of post-cancer employment status, namely cancer stage at diagnosis and the local unemployment rate. Since the job dissatisfaction variables are correlated (see [Appendix Table A2](#)), we use seemingly unrelated regression (SUR) to simultaneously estimate 6 equations, 1 for each job dissatisfaction variable, for the full sample and by educational level. We cannot reject a hypothesis that the coefficients of cancer stage, cancer type and local unemployment rate are zero, neither when we test all coefficients to be zero simultaneously, nor when we split up into tests for cancer stage/type and tests for the local unemployment rate: p -values are between 0.116 and 0.939; see [Appendix Table A7](#). Thus, these tests indicate that recall bias of the job dissatisfaction variables is not an important problem.

V. Conclusion and discussion

The analysis of this article focuses on the probability of being employed in the third year after a diagnosis

of breast or colon cancer (for those who were employed before diagnosis and survived at least to the end of the third year after diagnosis) and how this probability is associated with education and pre-cancer job dissatisfaction. Based on a survey to cancer survivors we construct 6 dummy variables for pre-cancer job dissatisfaction. The main conclusions of our analysis are as follows. First, controlling for education, demographics, cancer type, cancer stage, comorbidity at baseline, the local unemployment rate and including all job dissatisfaction variables in the regression, the probability of returning to work after cancer is 4 percentage points less likely in case of pre-cancer job dissatisfaction with mental demands (where the correlation is driven by the high-educated) and 7–8 percentage points less likely in case of dissatisfaction with physical demands or the superior (where the correlations are driven by the low-educated); dissatisfaction with colleagues and tasks and whether the person searched for a new job before cancer are not statistically significant. Second, when we control for pre-cancer ability to work, job dissatisfaction with mental demands becomes insignificant on average (but stays significant for the high-educated), the coefficient of dissatisfaction with physical demands is reduced (but stays significant), whereas the coefficient of dissatisfaction with the superior is unchanged. Third, controlling in addition for post-cancer ability to work implies small and insignificant coefficients of job dissatisfaction with mental and physical demands, but the coefficient of pre-cancer dissatisfaction with the superior is still large and significant and pre-cancer job search becomes significant (with a point estimate indicating a reduction in employment probability by 4 percentage points). Fourth, educational gradients in the probability of returning to work after cancer are not significantly affected by controlling for pre-cancer job dissatisfaction and pre-cancer ability to work; cancer survivors with a further or higher education are about 10 and 14 percentage points, respectively, more likely to return to work after cancer compared to those with no education beyond compulsory. Thus, differences in pre-cancer job dissatisfaction (and ability to work) between education groups cannot explain the educational gradient in the probability of returning to work after cancer. Fifth, controlling for post-cancer ability to work does reduce the educational gradients (by

about 30%), but they are still large and statistically significant. Sixth, controlling in addition for whether respondents desired to work after cancer treatment does not significantly change the estimated parameters of the variables for education, job dissatisfaction or ability to work, although the extra control becomes highly significant with a large positive coefficient.

The fact that pre-cancer job dissatisfaction with physical and mental demands (in the sense that these demands were becoming too hard) and with the superior are significantly associated with the risk of not returning to work after a health shock such as cancer indicates that flexibility at the workplace in terms of adjusting job demands to workers' ability to work may be an important protective factor in reducing exit from the labour market after serious health shocks. The results point to the importance of human resource management at the individual workplace, and of socio-economic policies such as rehabilitation measures targeting especially persons who already before their health shock were challenged by high job demands relative to their ability to work and persons who suffered significant reductions in ability to work as a consequence of the health shock, and job-assistance measures helping workers change to less demanding jobs, possibly with new employers.

There may be various reasons why pre-cancer dissatisfaction with the superior and pre-cancer job search are significant even after controlling for ability and desire to work after cancer. Thus, even though the cancer survivor desires to work and has a high level of ability to work, it may be difficult to return to the same job, or another attractive job at the same workplace, if she did not have a good relationship with her superior. Also, it may be difficult to return to the same workplace in case the cancer survivor searched for a new job before she had cancer if this reflected serious dissatisfaction with various aspects of the job or it was due to her being marginalized at the workplace, or even asked to seek a new job by the employer. With no or limited opportunity to return to the old workplace, the cancer survivor has to search for a job at another workplace, but it may be difficult to find a job in a new firm after a long period of recent sickness because of a serious disease such as cancer.

We interpret the variable for whether the cancer survivor searched for a new job prior to cancer as an

indicator of overall job dissatisfaction. It is different from the other job dissatisfaction variables, both because these measure dissatisfaction with particular aspects of the job and because it is possible to be dissatisfied with particular aspects of the job and not search for another job (for instance, because of satisfaction with other aspects of the job). In this sense, job search may be indicating more serious overall job dissatisfaction. On the other hand, to search for a new job does not necessarily reflect actual dissatisfaction with the current job, and barriers to job shift, for instance related to firm-specific human capital, may differ across industries and job types. However, if we omit the variable for pre-cancer job search from the model, the estimated coefficients of the other job dissatisfaction variables do not change in any significant way.

This study is based on a survey to cancer survivors and the information on pre-cancer job dissatisfaction is retrospective. Such a study design ensures a large sample of cancer survivors, but a limitation is that the retrospective information may to some extent be affected by post-cancer labour market outcomes and therefore biased. For instance, cancer survivors who do not return to work after cancer treatment might overstate their pre-cancer job dissatisfaction which would cause an upward bias in the size of the estimated effect of pre-cancer job dissatisfaction on return to work. However, our specification tests do not show a significant correlation between pre-cancer job dissatisfaction and exogenous variables (cancer stage at diagnosis and the post-cancer local unemployment rate) affecting post-cancer employment probability, indicating that recall bias is not a major problem in our data. However, we cannot preclude that there is some recall bias, and the job dissatisfaction variables may be endogenous also because of unobserved heterogeneity. For instance, a stronger family support system could increase both job satisfaction and return-to-work probability. We do control for whether an individual is married, cohabiting or single, variables which are only weakly correlated with the job dissatisfaction variables (simple correlation coefficients are below 0.05 in absolute value in all cases) and estimates of coefficients of the job dissatisfaction variables are not affected in any significant way if we omit these family-type variables. However, again, this does not preclude endogeneity with respect to

other aspects of the family support system, or other unobserved covariates. A fundamental limitation of our analysis is that we cannot isolate truly exogenous variation in job dissatisfaction (a problem which would also be present with prospective information on job dissatisfaction). Survival bias may also be present and we only have data on job dissatisfaction for survivors.

Another limitation is that we do not have job dissatisfaction information for a control group of workers who did not have cancer, so we are not able to estimate how pre-cancer job dissatisfaction is related to the causal effect of cancer on employment probability. Thus, job dissatisfaction in a given year may be associated with an increase in the probability of not working the following years also for workers who do not have cancer (or another serious illness). The limitations related to possible recall bias and lack of a control group could in principle be overcome by using more general population surveys which include questions on current job (dis)satisfaction, but the share of such a survey population being diagnosed with cancer in the following year or two would be small, and the statistical power of the analysis is therefore very weak.

Although we condition on many important covariates affecting return-to-work probability, for example, cancer stage at diagnosis, age (and thereby the duration to acquiring pension rights), education and family structure, it would have been an advantage to be able to include additional covariates, for example, details on treatment and prognosis, and the level of wealth. It is also a limitation that we do not have longitudinal information on job dissatisfaction which may be important since an employee's assessment of the job may change over time. Data on assessments at different points in time before the cancer diagnosis could therefore improve the analysis. Data on assessments after the diagnosis might be used to conduct supplementary analyses of the persistence of employment for those who return to work (e.g. the extent to which job dissatisfaction 1 or 2 years after diagnosis is associated with the probability of still being employed 3 or 4 years after diagnosis).

It would be interesting in future work to investigate the effects on return-to-work probability of other dimensions of pre-cancer job dissatisfaction than those included in our survey data, for example,

overall job dissatisfaction or dissatisfaction with specific job aspects such as pay, job security, hours of work, working time, working conditions and commuting time which are investigated in the literature on job satisfaction and labour market outcomes (e.g. Clark 2001; D'Addio, Eriksson, and Frijters 2007; Booth and Van Ours 2013).

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ORCID

Ingelise Andersen  <http://orcid.org/0000-0002-0076-265X>

References

- Amir, Z., T. Moran, L. Walsh, R. Iddenden, and K. Luker. 2007. "Return to Work after Cancer: A British Experience." *Journal of Cancer Survivorship* 1: 129–136. doi:10.1007/s11764-007-0021-2.
- Angrist, J. D., and J.-S. Pischke. 2009. *Mostly Harmless Econometrics – An Empiricist's Companion*. Princeton: Princeton University Press.
- Barnay, T. 2016. "Health, Work and Working Conditions: A Review of the European Economic Literature." *The European Journal of Health Economics* 17: 693–709. doi:10.1007/s10198-015-0715-8.
- Booth, A. L., and J. C. van Ours. 2013. "Part-Time Jobs: What Women Want?" *Journal of Population Economics* 26: 263–283. doi:10.1007/s00148-012-0417-9.
- Bouknight, R. R., C. J. Bradley, and Z. Lou. 2006. "Correlates of Return to Work for Breast Cancer Survivors." *Journal of Clinical Oncology* 24: 345–353. doi:10.1200/JCO.2004.00.4929.
- Bradley, C. J., H. L. Bednarek, and D. Neumark. 2002a. "Breast Cancer Survival, Work, and Earnings." *Journal of*

- Health Economics* 21: 757–779. doi:10.1016/S0167-6296(02)00059-0.
- Bradley, C. J., H. L. Bednarek, and D. Neumark. 2002b. “Breast Cancer and Women’s Labor Supply.” *Health Services Research* 37 (5): 1309–1328. doi:10.1111/1475-6773.01041.
- Bradley, C. J., D. Neumark, H. L. Bednarek, and M. Schenk. 2005. “Short-Term Effects of Breast Cancer on Labor Market Attachment: Results from a Longitudinal Study.” *Journal of Health Economics* 24: 137–160. doi:10.1016/j.jhealeco.2004.07.003.
- Bradley, C. J., D. Neumark, Z. Luo, and H. L. Bednarek. 2007. “Employment-Contingent Health Insurance, Illness, and Labor Supply of Women: Evidence from Married Women with Breast Cancer.” *Health Economics* 16: 719–737. doi:10.1002/hec.1191.
- Busk, H., E. J. Jahn, and C. Singer. 2015. “Do Changes in Regulation Affect Temporary Agency Workers’ Job Satisfaction?” Discussion Paper No. 8803, IZA. Bonn: IZA.
- Cabus, S. J., W. Groot, and H. M. van den Brink. 2016. “The Short-Run Causal Effect of Tumor Detection and Treatment on Psychosocial Well-Being, Work, and Income.” *The European Journal of Health Economics* 17: 419–433. doi:10.1007/s10198-015-0688-7.
- Candon, D. 2015. “The Effects of Cancer on Older Workers in the English Labour Market.” *Economics & Human Biology* 18: 74–84. doi:10.1016/j.ehb.2015.04.001.
- Charlson, M. E., P. Pompei, K. L. Ales, and C. R. MacKenzie. 1987. “A New Method of Classifying Prognostic Comorbidity in Longitudinal Studies: Development and Validation.” *Journal of Chronic Diseases* 40 (5): 373–383. doi:10.1016/0021-9681(87)90171-8.
- Chaudhuri, K., K. T. Reilly, and D. A. Spencer. 2015. “Job Satisfaction, Age and Tenure: A Generalized Dynamic Random Effects Model.” *Economics Letters* 130: 13–16. doi:10.1016/j.econlet.2015.02.017.
- Clark, A. E. 2001. “What Really Matters in a Job? Hedonic Measurement Using Quit Data.” *Labour Economics* 8 (2): 223–242. doi:10.1016/S0927-5371(01)00031-8.
- Cutler, D. M. 2008. “Are We Finally Winning the War on Cancer?” *Journal of Economic Perspectives* 22 (4): 3–26. doi:10.1257/jep.22.4.3.
- D’Addio, A. C., T. Eriksson, and P. Frijters. 2007. “An Analysis of the Determinants of Job Satisfaction When Individuals’ Baseline Satisfaction Levels May Differ.” *Applied Economics* 39 (19): 2413–2423. doi:10.1080/00036840600707357.
- Datta Gupta, N., K. J. Kleinjans, and M. Larsen. 2011. “The Effect of an Acute Health Shock on Work Behaviour: Evidence from Different Health Care Regimes.” Discussion Paper No. 5843, IZA. Bonn: IZA.
- Fantoni, S. Q., C. Peugniez, A. Duhamel, J. Skrzypczak, P. Frimat, and A. Leroyer. 2010. “Factors Related to Return to Work by Women with Breast Cancer in Northern France.” *Journal of Occupational Rehabilitation* 20: 49–58. doi:10.1007/s10926-009-9215-y.
- García-Gómez, P., H. van Kippersluis, O. O’Donnell, and E. Van Doorslaer. 2013. “Long-Term and Spillover Effects of Health Shocks on Employment and Income.” *Journal of Human Resources* 48 (4): 873–909. doi:10.1353/jhr.2013.0031.
- Hamermesh, D. S. 2001. “The Changing Distribution of Job Satisfaction.” *The Journal of Human Resources* 36 (1): 1–30. doi:10.2307/3069668.
- Heinesen, E., and C. Kolodziejczyk. 2013. “Effects of Breast and Colorectal Cancer on Labour Market Outcomes – Average Effects and Educational Gradients.” *Journal of Health Economics* 32: 1028–1042. doi:10.1016/j.jhealeco.2013.08.004.
- Lalive, R., and A. Stutzer. 2010. “Approval of Equal Rights and Gender Differences in Well-Being.” *Journal of Population Economics* 23 (3): 933–962. doi:10.1007/s00148-009-0257-4.
- Lee, J., and H. Kim. 2008. “A Longitudinal Analysis of the Impact of Health Shocks on the Wealth of Elders.” *Journal of Population Economics* 21 (1): 217–230. doi:10.1007/s00148-007-0156-5.
- Maunsell, E., M. Drolet, J. Brisson, C. Brisson, B. Masse, and L. Deschenes. 2004. “Work Situation after Breast Cancer: Results from a Population-Based Study.” *Journal of the National Cancer Institute* 96: 1813–1822. doi:10.1093/jnci/djh335.
- Mehnert, A., and U. Koch. 2013a. “Predictors of Employment among Cancer Survivors after Medical Rehabilitation – A Prospective Study.” *Scandinavian Journal of Work, Environment & Health* 39 (1): 76–87. doi:10.5271/sjweh.3291.
- Mehnert, A., and U. Koch. 2013b. “Work Satisfaction and Quality of Life in Cancer Survivors in the First Year after Oncological Rehabilitation.” *Work: A Journal of Prevention, Assessment & Rehabilitation* 46: 407–415.
- Moran, J. R., P. F. Short, and C. S. Hollenbeak. 2011. “Long-Term Employment Effects of Surviving Cancer.” *Journal of Health Economics* 30: 505–514. doi:10.1016/j.jhealeco.2011.02.001.
- Pryce, J., F. Munir, and C. Haslam. 2007. “Cancer Survivorship and Work: Symptoms, Supervisor Response, Co-Worker Disclosure and Work Adjustment.” *Journal of Occupational Rehabilitation* 17: 83–92. doi:10.1007/s10926-006-9040-5.
- Short, P. F., J. J. Vasey, and J. R. Moran. 2008. “Long-Term Effects of Cancer Survivorship on the Employment of Older Workers.” *Health Services Research* 43 (1): 193–210. doi:10.1111/j.1475-6773.2007.00752.x.
- Spelten, E. R., M. A. G. Sprangers, and J. H. A. M. Verbeek. 2002. “Factors Reported to Influence the Return to Work of Cancer Survivors: A Literature Review.” *Psycho-Oncology* 11: 124–131. doi:10.1002/pon.585.
- Spelten, E. R., J. H. A. M. Verbeek, A. L. J. Uitterhoeve, A. C. Ansink, J. van der Lelie, T. M. de Reijke, M. Kammeijer, J. C. J. M. de Haes, and M. A. G. Sprangers. 2003. “Cancer, Fatigue and the Return of Patients to Work – A Prospective Cohort Study.” *European Journal of Cancer* 39: 1562–1567. doi:10.1016/S0959-8049(03)00364-2.

- Steiner, J. F., T. A. Cavender, D. S. Main, and C. J. Bradley. 2004. "Assessing the Impact of Cancer on Work Outcomes – What Are the Research Needs?" *Cancer* 101 (8): 1703–1711. doi:10.1002/(ISSN)1097-0142.
- Sundararajan, V., T. Henderson, C. Perry, A. Muggivan, H. Quan, and W. A. Ghali. 2004. "New ICD-10 Version of the Charlson Comorbidity Index Predicted In-Hospital Mortality." *Journal of Clinical Epidemiology* 57: 1288–1294. doi:10.1016/j.jclinepi.2004.03.012.
- Taskila, T., M. L. Lindbohm, R. Martikainen, U. S. Lehto, J. Hakkinen, and P. Hietanen. 2006. "Cancer Survivors Received and Needed Social Support from Their Work Place and the Occupational Health Services." *Support Care Cancer* 14: 427–435. doi:10.1007/s00520-005-0005-6.
- Taskila, T., R. Martikainen, P. Hietanen, and M. L. Lindbohm. 2007. "Comparative Study of Work Ability between Cancer Survivors and Their Referents." *European Journal of Cancer* 43: 914–920. doi:10.1016/j.ejca.2007.01.012.
- Thielen, K., C. Kolodziejczyk, I. Andersen, E. Heinesen, and F. Diderichsen. 2015. "Cancer Stage, Comorbidity and Socioeconomic Differences in the Effect of Cancer on Labour Market Participation – A Danish Register-Based Follow-Up Study." *PLoS One* 10 (6): e0128621. doi:10.1371/journal.pone.0128621.
- Torp, S., S. B. Gudbergsson, A. A. Dahl, S. D. Fosså, and T. Fløtten. 2011. "Social Support At Work And Work Changes Among Cancer Survivors In Norway." *Scandinavian Journal Of Public Health* 39 (Suppl 6): 33–42. doi:10.1177/1403494810395827.
- Weiss, A. 1984. "Determinants of Quit Behavior." *Journal of Labor Economics* 2 (3): 371–387. doi:10.1086/298038.
- Weiss, A. 1985. "The Effect of Job Complexity on Job Satisfaction: Evidence from Turnover and Absenteeism." NBER Working Paper No. 1597. Cambridge: National Bureau of Economic Research.
- Wooldridge, J. M. 2010. *Econometric Analysis of Cross Section and Panel Data*. Cambridge: The MIT press.

Appendix

The job dissatisfaction variables are based on the survey questions reported in Table A1. All the 6 job dissatisfaction variables used in the analysis are dummy variables. The variables for dissatisfaction with tasks, colleagues and the superior are equal to unity if the respondent answers 'disagree' or 'strongly disagree' to questions 2, 3 and 5, respectively (and zero otherwise). The variables for dissatisfaction with physical and mental demands are unity if the respondent answers 'agree' or 'strongly agree' to questions 6 and 7,

respectively. The job dissatisfaction variable 'Searched for a new job' is unity if the respondent answers 'agree' or 'strongly agree' to questions 1 or 4 (or both), which represent within-firm job changes and search for a new job in general, respectively. Using two separate job change variables (for internal and general mobility) does not change results significantly. The variables for missing value of the job dissatisfaction dummies are equal to unity if the respondent answers 'don't know' or does not answer the relevant question at all.

Table A1. The survey questions about job (dis)satisfaction. 'How would you describe your working conditions before you were told you had cancer? Specify whether you agree with the following statements (tick only one box in each line)'.

	Strongly agree	Agree	Disagree	Strongly disagree	Don't know
1. I was on the way to another job /position in the firm					
2. I was satisfied with my tasks					
3. I was fond of my colleagues					
4. I searched for a new job					
5. I had a good relationship with my superior					
6. The physical demands were becoming too hard					
7. The mental demands were becoming too hard					

Table A2. Correlation coefficients between job dissatisfaction variables.

	Mental demands	Physical demands	Superior	Colleagues	Tasks	Searched for a new job
Mental demands	1.00					
Physical demands	.51	1.00				
Superior	.29	.14	1.00			
Colleagues	.24	.10	.26	1.00		
Tasks	.32	.17	.34	.32	1.00	
Searched for a new job	.20	.09	.25	.19	.37	1.00

Table A3. Full estimation results for models (3), (4) and (6) of Table 4 (OLS). Dependent variable: Employed 3 years after diagnosis.

	(1)	(2)	(3)
Vocational education	0.035 (0.021)	0.031 (0.021)	0.022 (0.019)
Further education	0.100**** (0.020)	0.100**** (0.020)	0.064**** (0.018)
Higher education	0.147**** (0.023)	0.146**** (0.023)	0.100**** (0.022)
Job dissatisfaction: Mental demands	-0.041* (0.021)	-0.026 (0.021)	0.002 (0.020)
Job dissatisfaction: Physical demands	-0.073*** (0.026)	-0.057** (0.026)	-0.022 (0.024)
Job dissatisfaction: Superior	-0.077*** (0.030)	-0.077** (0.030)	-0.058** (0.028)
Job dissatisfaction: Searched for a new job	-0.035 (0.022)	-0.035 (0.022)	-0.045** (0.020)
Ability to work before diagnosis		0.020**** (0.006)	-0.006 (0.005)
Ability to work 1 year after treatment			0.006 (0.004)
Ability to work 3 years after diagnosis			0.040**** (0.004)
Desired to work after treatment			0.249**** (0.034)
Job dissatisfaction: Mental demands missing	-0.003 (0.042)	-0.002 (0.041)	-0.015 (0.037)
Job dissatisfaction: Physical demands missing	-0.060 (0.042)	-0.059 (0.042)	-0.029 (0.037)
Job dissatisfaction: Superior missing	-0.092*** (0.030)	-0.080*** (0.030)	-0.071*** (0.027)
Job dissatisfaction: Searched new job missing	0.055* (0.030)	0.056* (0.029)	0.063** (0.026)
Ability to work before diagnosis missing		-0.042 (0.079)	0.045 (0.084)
Ability to work 1 year after treatment missing			0.034 (0.064)
Ability to work 3 years after diagnosis missing			-0.265**** (0.054)
Desired to work missing			0.252**** (0.039)
Colon cancer	0.022 (0.028)	0.033 (0.028)	0.006 (0.024)
Regional spread	-0.030** (0.014)	-0.029** (0.014)	0.004 (0.013)
Metastatic	-0.144*** (0.056)	-0.136** (0.055)	-0.019 (0.044)
Stage missing	-0.060*** (0.021)	-0.057*** (0.021)	-0.022 (0.019)
Charlson comorbidity index	-0.044 (0.033)	-0.042 (0.032)	-0.034 (0.030)
Male	0.000 (0.039)	-0.002 (0.039)	-0.024 (0.035)
Age 57	-0.052* (0.029)	-0.053* (0.029)	-0.071*** (0.026)
Age 58	-0.281**** (0.036)	-0.281**** (0.036)	-0.286**** (0.033)
Age 59	-0.385**** (0.041)	-0.387**** (0.042)	-0.362**** (0.038)
Age 60-61	-0.486**** (0.034)	-0.488**** (0.034)	-0.426**** (0.033)
Cohabiting	0.017 (0.022)	0.020 (0.022)	0.022 (0.021)
Single	0.028 (0.018)	0.032* (0.018)	0.054**** (0.016)
Diagnosis in 2007	-0.011 (0.023)	-0.010 (0.023)	-0.019 (0.021)
Diagnosis in 2008	-0.010 (0.021)	-0.008 (0.021)	-0.025 (0.019)
Local unemployment rate (%)	-0.010 (0.012)	-0.011 (0.012)	-0.005 (0.011)
Constant	0.969**** (0.061)	0.779**** (0.081)	0.385**** (0.081)
Observations	2457	2457	2457
Adjusted R ²	0.242	0.248	0.379

Robust SEs in parentheses.

* $p < .10$, ** $p < .05$, *** $p < .01$, **** $p < .001$.**Table A4.** Estimation results including job dissatisfaction variables one at a time (OLS). Dependent variable: Employed 3 years after diagnosis.

	(1)	(2)	(3)	(4)	(5)	(6)
Vocational education	0.039* (0.022)	0.034 (0.022)	0.036* (0.022)	0.040* (0.022)	0.044** (0.022)	0.043** (0.022)
Further education	0.102**** (0.020)	0.091**** (0.020)	0.100**** (0.020)	0.098**** (0.021)	0.106**** (0.020)	0.106**** (0.020)
Higher education	0.148**** (0.023)	0.134**** (0.023)	0.149**** (0.023)	0.145**** (0.023)	0.150**** (0.023)	0.156**** (0.023)
Mental demands	-0.095**** (0.018)					
Physical demands		-0.104**** (0.023)				
Superior			-0.114**** (0.028)			
Colleagues				-0.021 (0.039)		
Tasks					-0.068** (0.028)	
Searched for a new job						-0.077**** (0.022)
Observations	2457	2457	2457	2457	2457	2457

Robust SEs in parentheses.

Controls include an indicator of missing information on the job dissatisfaction variable in each regression, and dummies for cancer type, cancer stage at diagnosis, comorbidity, gender, age, family type, local unemployment rate 3 years after diagnosis, and year of diagnosis (see Tables 2 and A3).

* $p < .10$, ** $p < .05$, *** $p < .01$, **** $p < .001$.

Table A5. Estimation results for women with breast cancer (OLS). Dependent variable: Employed 3 years after diagnosis.

	(1)	(2)	(3)	(4)	(5)	(6)
Vocational education	0.047** (0.023)	0.041* (0.023)	0.040* (0.023)	0.036 (0.023)	0.025 (0.021)	0.026 (0.021)
Further education	0.111**** (0.022)	0.109**** (0.021)	0.108**** (0.021)	0.109**** (0.021)	0.080**** (0.020)	0.074**** (0.020)
Higher education	0.150**** (0.024)	0.145**** (0.025)	0.147**** (0.025)	0.145**** (0.025)	0.110**** (0.023)	0.101**** (0.023)
<i>Job dissatisfaction</i>						
Mental demands		-0.041* (0.024)	-0.041* (0.023)	-0.024 (0.023)	-0.009 (0.021)	-0.003 (0.021)
Physical demands		-0.053* (0.028)	-0.059** (0.028)	-0.045 (0.028)	-0.008 (0.026)	-0.009 (0.025)
Superior		-0.070** (0.033)	-0.069** (0.032)	-0.069** (0.032)	-0.066** (0.030)	-0.054* (0.029)
Colleagues		0.023 (0.043)				
Tasks		0.001 (0.035)				
Searched for a new job		-0.032 (0.025)	-0.034 (0.022)	-0.033 (0.022)	-0.047** (0.021)	-0.049** (0.021)
<i>Ability and desire to work</i>						
Ability to work before diagnosis				0.022**** (0.007)	-0.004 (0.006)	-0.006 (0.006)
Ability to work 1 year after treatment					0.010*** (0.004)	0.007* (0.004)
Ability to work 3 years after diagnosis					0.040**** (0.004)	0.039**** (0.004)
Desired to work after treatment						0.233**** (0.037)
Observations	2116	2116	2116	2116	2116	2116
Adjusted R ²	0.223	0.242	0.241	0.247	0.356	0.376

Robust SEs in parentheses

Controls include dummies for cancer stage at diagnosis, comorbidity, age, family type, local unemployment rate 3 years after diagnosis, and year of diagnosis, and in addition indicators of missing information on the included variables for job dissatisfaction (models 2)–(6)), ability to work (models 4)–(6)) and desire to work (model (6)).

* $p < .10$, ** $p < .05$, *** $p < .01$, **** $p < .001$.**Table A6.** Logistic regression results. Dependent variable: Employed 3 years after diagnosis.

	(1)	(2)	(3)	(4)	(5)	(6)
				<i>Odds ratios</i>		
Vocational education	0.329** (0.155)	0.272* (0.164)	0.256 (0.163)	0.232 (0.164)	0.221 (0.188)	0.223 (0.191)
Further education	0.891**** (0.165)	0.897**** (0.174)	0.882**** (0.173)	0.901**** (0.175)	0.764**** (0.201)	0.737**** (0.206)
Higher education	1.872**** (0.382)	1.832**** (0.391)	1.861**** (0.394)	1.856**** (0.394)	1.758**** (0.461)	1.598**** (0.466)
<i>Job dissatisfaction</i>						
Mental demands		-0.404** (0.198)	-0.399** (0.195)	-0.281 (0.194)	-0.101 (0.220)	-0.006 (0.230)
Physical demands		-0.544*** (0.205)	-0.581*** (0.204)	-0.463** (0.204)	-0.231 (0.235)	-0.251 (0.242)
Superior		-0.675*** (0.241)	-0.652*** (0.231)	-0.651*** (0.235)	-0.833*** (0.275)	-0.705** (0.287)
Colleagues		0.365 (0.403)				
Tasks		-0.053 (0.292)				
Searched for a new job		-0.248 (0.248)	-0.275 (0.224)	-0.258 (0.223)	-0.374 (0.254)	-0.457* (0.258)
				<i>Average marginal effects</i>		
Vocational education	0.036** (0.016)	0.028* (0.016)	0.027* (0.016)	0.024 (0.016)	0.019 (0.015)	0.018 (0.015)
Further education	0.094**** (0.014)	0.091**** (0.014)	0.090**** (0.014)	0.091**** (0.014)	0.064**** (0.014)	0.059**** (0.014)
Higher education	0.141**** (0.014)	0.136**** (0.015)	0.137**** (0.015)	0.136**** (0.015)	0.114**** (0.019)	0.103**** (0.020)
<i>Job dissatisfaction</i>						
Mental demands		-0.045* (0.021)	-0.044* (0.021)	-0.030 (0.021)	-0.009 (0.021)	-0.000 (0.021)

(Continued)

Table A6. (Continued).

	(1)	(2)	(3)	(4)	(5)	(6)
Physical demands		(0.024) -0.062**	(0.023) -0.067**	(0.022) -0.052**	(0.019) -0.020	(0.019) -0.021
Superior		(0.026) -0.080**	(0.026) -0.077**	(0.025) -0.076**	(0.021) -0.080***	(0.021) -0.064**
Colleagues		(0.032) 0.036	(0.031)	(0.031)	(0.029)	(0.029)
Tasks		(0.036) -0.006				
Searched for a new job		(0.031) -0.027	-0.030 (0.026)	-0.028 (0.026)	-0.034 (0.024)	-0.040* (0.024)
<i>Controls</i>						
Ability to work before diagnosis				x	x	x
Ability to work 1 year after treatment					x	x
Ability to work 3 years after diagnosis					x	x
Desired to work after treatment						x
Other controls	x	x	x	x	x	x
Observations	2457	2457	2457	2457	2457	2457

Robust SEs in parentheses

Only estimates for education and job dissatisfaction variables are reported. Covariates are the same as in the corresponding six models of Table 4. The only difference is the use of logistic regression instead of OLS. Average marginal (partial) effects are estimated using the command `margeff` in Stata.

* $p < .10$, ** $p < .05$, *** $p < .01$, **** $p < .001$

Table A7. p -Values for F -tests of zero coefficients of variables for cancer stage and type, and the local unemployment rate in SUR regressions for the 6 job dissatisfaction variables; tests for all observations and by level of education.

Test of zero coefficients for:						
Cancer stage and type	Local unemployment rate	All observations	Compulsory school	Vocational education	Further education	Higher education
X	X	.456	.310	.389	.800	.939
X		.697	.181	.548	.927	.906
	X	.116	.761	.173	.190	.732
<i>N</i>		1803	270	652	715	166

The sample includes respondents who answered all job dissatisfaction questions. The explanatory variables are cancer stage at diagnosis (dummies for regional spread, metastatic and missing information on stage, with localized cancer as reference category); type of cancer (dummy for colon cancer with breast cancer as reference category); the local unemployment rate (3 years after diagnosis based on the municipality of residence in the beginning of the year of diagnosis); and controls for the Charlson comorbidity index, gender, age, family type (2 dummies), year of diagnosis, and (in the first column) education (3 dummies). The Breusch-Pagan test strongly rejects the hypothesis of independence between the residuals of the six equations ($p < 0.0001$).