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Employment Status Among Self-Employed Cancer Survivors: A 5-Year Registry-Based Study from Norway

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Abstract

Background: Compared to salaried people, self-employed people have received considerably less research attention regarding health, working conditions, and rehabilitation. **Objective**: To examine the long-term effects (up to five years) of cancer on employment among self-employed cancer survivors (CSs). Employment outcomes were compared with those of self-employed cancer-free controls, salaried CSs, and salaried cancer-free controls. Additionally, the relationship between sociodemographic variables and employment was explored. **Methods**: Data from the Cancer Registry of Norway and Statistics Norway were obtained for information on cancer diagnoses, employment status, and sociodemographic characteristics for 725 self-employed CSs, 725 matched self-employed controls, and 10,463 salaried CSs and 10,463 salaried matched controls. All participants were aged 30–55, employed at the time of diagnosis (T0) (2004–2008), and alive five years later (T5) (2009–2014). Logistic regression analyses were performed. **Results**: At T5, 83% of male and 85% of female self-employed CSs were employed. Among salaried CSs, the likelihood of being employed at T5 was significantly lower than among salaried controls [adjusted odds ratio (ORadj) = 0.53 (95% confidence interval (CI) = 0.49–0.58)], whereas no significant difference was observed between self-employed CSs and their controls [ORadj = 0.86 (95% CI = 0.64–1.16)]. Compared to salaried controls, both self-employed CSs and controls were less likely to be employed. Income level was the most important sociodemographic factor predicting employment at T5 for all groups. This was particularly evident for the self-employed CSs [ORadj = 6.91 (95% CI = 3.48–13.67)]. **Conclusions**: Cancer showed a significant association with T5 employment among salaried workers, but not among the self-employed. Low income was particularly important for not being employed at T5 among self-employed CSs.

Keywords: neoplasm; labor market participation; entrepreneur; register; longitudinal

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1. Introduction

1.1. Background

Self-employed people are important for all countries' economies. They are innovative and entrepreneurial and thereby provide and create new jobs. Therefore, governments often encourage self-employment [1]. Today, the self-employed constitute approximately 13 percent of the people in the European Union labor market (ranging from 6% in Denmark to 27% in Greece) [2]. Self-employed people have received much less attention compared

to the salaried when it comes to research on health and working conditions [3]. In most of the available research, they report higher job satisfaction and better mental and physical health than salaried individuals [3,4]. The reason for this is often attributed to being one's own boss and thus having more freedom and decision autonomy in work [3,5]. It has also been shown that they have better options to learn and develop their skills [6].

A possible reason why the self-employed have received less attention in health-related research than those who are salaried is that the self-employed are regarded as a resourceful group of workers. This is only partly true. As a group, the self-employed are very heterogeneous when it comes to, for instance, type of work and occupation, work schedules, education, income and age. Compared to salaried people, the self-employed are on average older, more often male, and have lower education and lower income [2]. In addition, they work longer hours, perform more heavy and dangerous work tasks, report higher work-related stress and more work-family conflicts, and perhaps most importantly, their income is volatile [2,7]. It can be hypothesized that the better job satisfaction and health among the self-employed compared to the salaried can partly be explained by a selection effect whereby workers with a positive mindset and high general life satisfaction are attracted to self-employment and/or that self-employed people who do not cope with the challenges of being self-employed convert to salaried work [3,8–11].

The incidence of cancer is increasing in the Western world and, due to earlier diagnosis and advances in treatment, the survival rate is also increasing [12]. Today, 70–75 percent of cancer patients survive the first five years after diagnosis [13]. Almost 50 percent of cancer patients are of working age (15–69 years) [13], and the number of working cancer survivors (CSs) can be expected to increase due to rising incidence and survival, and also due to increased retirement age. The burden of cancer treatment is rather high, and common side and late effects include fatigue, pain, anxiety, depression, physical disorders (e.g., musculoskeletal disorders and oedema) and cognitive dysfunction [14]. All such treatment-related effects negatively influence quality of life and work ability. A systematic review showed that return to work two years after a cancer diagnosis ranged from 39 to 77 percent [15]. Another review and meta-analysis showed that the pooled estimate of being employed two years or more after diagnosis was 73 percent [16].

Keeping as many people as possible in work is advantageous for national productivity. In addition, work is important for most people as it is a means of earning income and maintaining good living conditions; it is also important for self-respect, identity, learning and development [17]. For cancer patients, returning to work after treatment is of particular importance as it is regarded as a marker of normalcy and having beaten the cancer [17,18]. At the same time, continued employment after cancer is not universally positive; some survivors may remain in work primarily because of financial necessity or limited social protection, and may experience substantial strain if their work demands are not compatible with reduced health and work capacity resulting from cancer.

There is a considerable amount of research on return to work and labor force participation among CSs in general, but research focusing on self-employed CSs is rather limited [19,20]. Available research from several European countries shows that self-employed CSs report less sick leave and earlier return to work after treatment compared to salaried survivors [20]. This may be because the self-employed have more personal resources, are used to tackling unforeseen events in work, and have more decision autonomy [3,10,21,22]. Another explanation may be that they are forced to prematurely return to work after illness because of financial reasons: that is, they cannot afford to be away from work for longer periods in case they lose customers and face bankruptcy [19,23–25]. Across European countries, the self-employed receive less financial compensation post-cancer and report more financial changes due to cancer compared to salaried workers [20]. In line with the

European multi-country study of Torp et al. [20], a Norwegian study showed that self-employed CSs reported more occupational changes, poorer health and quality of life, and lower work ability than salaried workers [26]. Additionally, the lower work ability among the self-employed was primarily explained by negative financial changes caused by cancer.

More men than women are self-employed, and their work tasks differ [2]. In past studies among salaried workers, differences in employment post-cancer between men and women have been reported [27] but it is unclear whether this effect is also seen among self-employed people.

In Europe, cancer patients do not have to pay for their cancer treatment, and this is not dependent on employment status [20]. However, social security provisions (e.g., sick pay and disability pension) for self-employed CSs are, overall, poorer than for salaried survivors [2,20]. The provisions, however, differ between countries, ranging from no statutory payments when ill (e.g., the UK and the Netherlands) to the same provisions as for the salaried in some professions (France) [20]. Compared to other European countries, the statutory payments for self-employed individuals are rather good in Norway [20]. However, a qualitative study among CSs and social welfare counsellors in Norway showed that the self-employed were very dissatisfied with the quality of support from the social welfare administration [28]. Self-employed people can buy private insurance securing their income if they become ill, but many do not, or they buy a less costly policy with poor coverage [2,29]. In Norway, only 11 percent of the self-employed buy insurance that gives them the same provisions when ill as salaried workers get from the public insurance [30].

1.2. Conceptual Framework

Many of the factors mentioned above regarding self-employment, health, and cancer can be related to the four dimensions of the Sherbrooke Work Disability Prevention (WDP) Model [31,32]: (1) the personal system, (2) the healthcare system, (3) the workplace system, and (4) the compensation system. This model can be used as an overarching conceptual framework for understanding why employment outcomes after cancer may differ between self-employed and salaried people.

First, at the level of the personal system, it has been suggested that self-employed people, on average, differ from salaried workers in personality traits and resources that may be beneficial for coping with stress related to both health and finances (e.g., higher internal locus of control, optimism, and persistence) [9,11]. Such characteristics may influence how they handle the threat to income, identity, and future plans that a cancer diagnosis represents.

Second, within the healthcare system, a qualitative study of self-employed CSs in Norway documented that they feel health personnel often do not understand their specific needs for tailored information about treatment and side effects, nor the seriousness of being absent from work, both financially and personally [28]. This lack of recognition of work-related concerns during treatment may influence how self-employed survivors plan and carry out their return to work.

Third, the workplace system likely constitutes the most fundamental difference between self-employed and salaried people. For example, self-employed people often work in different sectors, are engaged in smaller enterprises, work longer hours, and experience higher job demands than salaried employees [3]. In addition, self-employed people do not have the same formal protection under the Working Environment Act, and they may have limited social, emotional, and instrumental support at the workplace, as they are often either the employer or solo workers. At the same time, they usually have a higher degree of decision authority and job autonomy than most salaried workers and frequently report higher job satisfaction and a strong drive or "urge" to work [3]. For CSs, this combination of

high autonomy and limited formal protection and support may shape both the possibilities and the pressures related to staying in or returning to work.

Fourth, the compensation system is particularly salient for self-employed workers. Although financial concerns are important for all CSs, they are often more critical for the self-employed, whose income is closely tied to their work performance and who may risk losing customers or facing bankruptcy if they are away from work for extended periods [3,23]. In line with this, self-employed workers in many countries, including Norway, generally receive lower statutory benefits when ill than salaried workers, and many do not purchase private insurance with adequate coverage [20]. Moreover, social welfare counsellors in Norway have reported that they lack sufficient competence regarding the specific needs of self-employed CSs and that the Labor and Welfare Administration has few instruments tailored to support this group during long-term sickness absence [28].

Taken together, the Sherbrooke WDP Model highlights how differences between self-employed and salaried workers across personal, healthcare, workplace, and compensation systems may jointly contribute to different return-to-work patterns after cancer. This framework informs the current study's aims and the interpretation of the observed similarities and differences in long-term employment between self-employed and salaried CSs and their controls.

1.3. Aims

In general, studies focusing particularly on employment among self-employed CSs have used self-report survey data with a cross-sectional design. Studies following the employment of CSs more than two years after diagnosis are rather rare [3]. In this study, we use registry data that include salaried and self-employed people with and without cancer, and data on their employment status for five years. To our knowledge, no other study has investigated the employment of self-employed CSs in depth as we do in this study, where we compare their employment trajectory with that of self-employed controls, salaried CSs, and salaried controls. With sociodemographic data collected from the registries, we are also able to investigate factors that are important for the employment of all the different groups. The aim of this study was fourfold:

(a) To investigate employment status among self-employed CSs for five years post-diagnosis.
(b) To investigate whether sociodemographic factors predict employment status at five years post-diagnosis among self-employed CSs.
(c) To compare the results of self-employed CSs (a and b) with matched self-employed controls.
(d) To compare the results of self-employed CSs with salaried CSs and controls.

To address these aims, we used registry data spanning 2004–2014, where participants were diagnosed with cancer between 2004 and 2008, and employment was recorded between 2009 and 2014.

2. Materials and Methods

2.1. Setting

Under the Norwegian Social Security Act [33], a self-employed person is defined as anyone who, at their own expense and risk, operates a business capable of generating net income. Self-employed people may structure their enterprises as sole proprietorships or limited liability companies. The definition of a freelancer differs only slightly from that of a self-employed person, but they are regarded as salaried individuals (but not employees) in Norway. Approximately 87 percent of all private enterprises in Norway have fewer than five employees, and 60 percent are sole proprietorships [34]. The proportion of self-

employed persons in Norway's total labor force has fallen from about 8 percent in 2008 [35] to 4.6 percent in 2023 [36].

For salaried workers in Norway, sick leave is available from the first day of absence and extends up to one year, with compensation equivalent to their regular salary, capped at six times the national insurance base amount per year (in 2025: €106,161 per year) [37]. Consequently, most salaried workers experience no reduction in income while on sick leave. After one year, employees are transitioned to disability pensions (very few) or receive rehabilitation benefits, both of which provide lower income than their original salary [37]. Self-employed people are eligible for sick leave compensation from day 17 of absence onwards, for a duration of up to one year, at 65 percent of their calculated income (based on an average of the previous three years) [37]. They are also subject to the same upper compensation limit as salaried employees. In general, the regulations regarding sick leave, unemployment, rehabilitation benefits, and disability pensions are similar for self-employed and salaried people.

2.2. Data and Analytic Sample

This study is a registry-based matched cohort study. CSs and cancer-free controls were identified through linkage between the Cancer Registry of Norway and the FD-Trygd database maintained by Statistics Norway and followed for five years with respect to employment outcomes (T0–T5). T0 and T5 refer to the points in time corresponding to "at cancer diagnosis" and "five years following cancer diagnosis," respectively. This research is part of the broader CanWork project [38] which explores employment outcomes and related factors among CSs. Figure 1 outlines the process by which the analytic sample for this study was derived, consisting of 22,376 individuals (n = 11,188 CSs and n = 11,188 controls). The CSs included in the study were diagnosed between 2004 and 2008, were between the ages of 30 and 55 at diagnosis, were employed at T0, and were alive at T5. The age range of 30–55 years was selected to focus on individuals who were likely to be firmly integrated into the workforce, excluding those who were either younger and more likely to be in education or older and nearing retirement or early retirement due to illness or disability.

CSs were matched one-to-one with controls. Our matching variables were as follows: age_T0 (continuous: range 30–55), sex_T0 (1 = female, 0 = male), education_T0 (0 = basic/unknown, 1 = high school, 2 = lower university, 3 = upper university), employment_T0 (1 = self-employed, 2 = salaried).

The categorical matching variables (sex_T0, education_T0, employment_T0) were not coarsened/recoded into larger categories for the matching procedure. The continuous variable, age_T0, was coarsened via cem's (coarsened exact matching) automated algorithm [39]. The matching procedure resulted in matched strata of CSs and controls with: (a) the same age, or very similar age (only a 1-year age difference among strata members, e.g., a stratum with individuals who are ages 32 and 33, or ages 43 and 44), and (b) the same sex, education level/category, and employment category.

The cem procedure was performed without replacement, and it generated 255 strata, of which 244 had matched CSs (11,195) and controls (29,583); 8 CSs and 22 controls were unmatched. Considering that there were different numbers of CSs and controls in the matched strata, weights were generated that could be used in the analyses to account for the aforementioned differences. However, instead of performing weighted analyses, we used cem's option of a k-to-k solution [39] in which each matched strata was pruned, i.e., within each strata, CSs and controls were matched, with those who were unmatched (15 CSs and 18,417 controls total) excluded from the strata. This resulted in strata containing the same number of CSs and controls (11,188 CSs and 11,188 controls total). The k-to-k approach, which removes the need to perform weighted analyses, is acceptable when sample sizes are large [39].

In cem, the extent to which there is an imbalance between CSs and controls (with regard to how well they are matched to one another) is given by the L_1 statistic (Iacus, King, & Porro, 2008, cited in Blackwell et al., 2009 [39]). A value of $L_1 = 0$ indicates perfect balance, with larger values (up to a maximum of 1) indicating larger imbalance [39]. In our cem k-to-k procedure, we had a value of $L_1 = 0.03$, indicating very good balance between CSs and controls in our matched dataset.

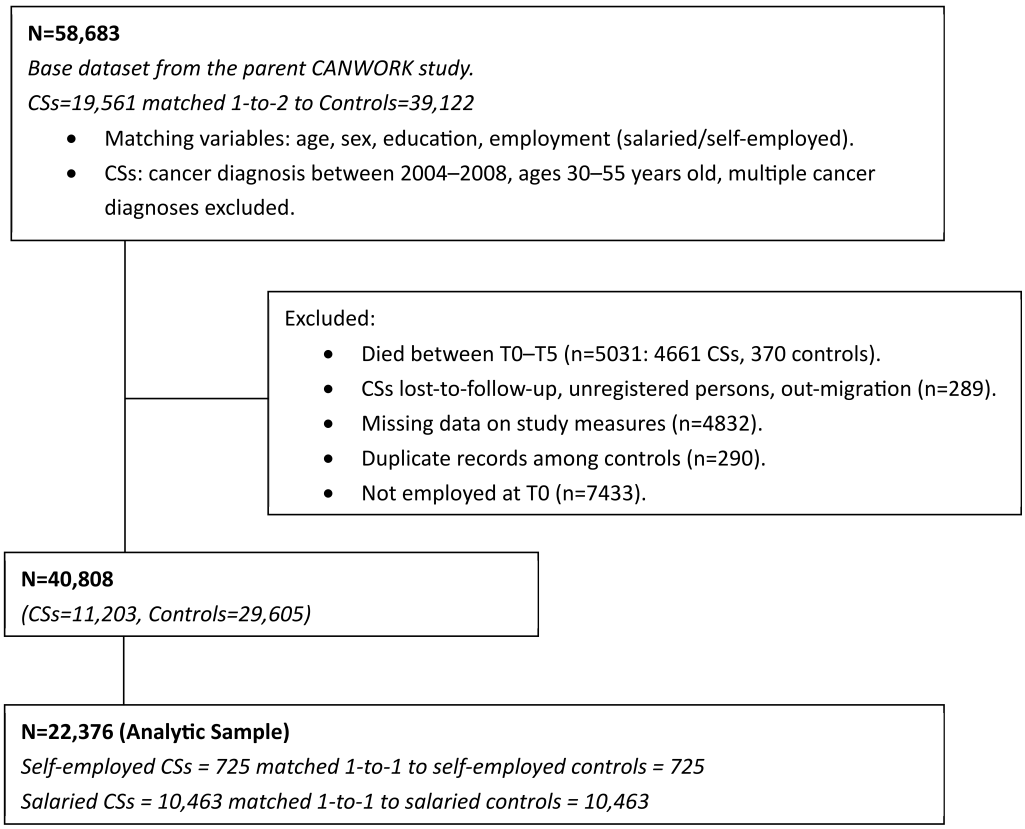

Figure 1. Analytic Sample Derivation.

There were missing values in the following study measures: marital status at T0, income at T0, and employment status from T0 to T5. A higher percentage of CSs (10.4%) than controls (8.5%) had missing values in at least one of these measures. We excluded CSs and controls with missing data from our analyses. This may bias our results if those excluded differ substantially (e.g., in socioeconomic or health characteristics) from those included and if missingness is related to differences in the likelihood of employment at T5 between CSs and controls. Selection bias, therefore, cannot be ruled out, and our results may not be valid for the broader group of CSs and controls, including those who were excluded due to missing data.

Our analyses also excluded CSs and controls who died between T0 (the year of cancer diagnosis) and T5. Consequently, our findings apply to this specific group of CSs and controls (5-year CSs and their matched controls) and not to all patients diagnosed with cancer (and their potential controls) during the study period. This survivorship requirement selects a relatively healthy sample of CSs and controls, and the results may not be generalizable to cancer patients (and their potential controls) with a higher risk of death.

In addition, controls in our study were required to remain cancer-free between T0 and T5, which makes them different from the general population (e.g., in terms of health status and related/underlying factors). We therefore cannot rule out health-related selection bias, whereby controls in this study are healthier than the general population. Comparing

such controls to CSs in the odds of employment at T5 may overestimate differences in T5 employment relative to what might be observed if controls were not required to remain cancer-free.

2.3. Variables

To avoid the risk of overfitting the regression models because of few observations in some of the categories of our study measures, we recoded some of the original socioeconomic variables into fewer categories for the regression analyses.

2.3.1. Cancer Survivor

We define a cancer survivor as an individual who has been diagnosed with an invasive cancer according to the International Classification of Diseases for Oncology (ICD-0-3), excluding basal cell carcinoma, and is alive at T5.

2.3.2. Self-Employed and Salaried

People who receive their income from an employer are defined as *salaried* people. *Self-employed* people are defined as people who, at their own expense and risk, operate a continuous business capable of generating net income. Freelancers are not regarded as self-employed. A person who has a limited liability company is not included as a self-employed person because he or she is registered as an employee in that company. A person who has income from both self-employment and salaried employment is defined as self-employed if net earnings from self-employment exceed those from salaried employment and vice versa for being salaried. All individuals included in this study were classified at T0 as either a salaried employee or self-employed, but income categories (self-employed/salaried) for the years following T0 are not provided. Consequently, individuals classified as salaried or self-employed at T0 may not have derived their primary income from the same source in subsequent years (T1–T5).

2.3.3. Sociodemographic Factors

Sex, age, marital status, child(ren), education, and income level were available at T0. *Sex* was recorded as "man" (0) and "woman" (1). *Age* was recorded as a continuous variable in number of years. *Marital status* was grouped into "single" (single, separated, divorced, widow(er)) (0) and "married/cohabitating" (1). *Child(ren)* was grouped into "no child(ren)" (0) and "yes, having child(ren)" (1). *Education* was grouped into "basic/unknown" (≤9 years) (0), "high school" (10–12 years) (1), and "university" (>12 years) (2). *Income* (the year prior to T0) was registered as the person's annual work income in Norwegian kroner (NOK) and divided into tertiles (1st = 0, 2nd = 1, 3rd = 2). The income tertiles were calculated for the full analytical sample, not separately within subgroups (e.g., men/women or self-employed/salaried). We considered modelling income as a continuous (or log-transformed) variable, but there is little reason to assume a strictly linear association between income and employment probability across the entire income range. Moreover, categorization into tertiles makes the results less sensitive to extreme values at the upper end of the income distribution. Our approach ensures that "low", "medium" and "high" income refer to the same absolute income ranges across all groups, thereby enhancing comparability of income effects and simplifying the presentation of the statistical analyses.

2.3.4. Employment

The primary outcome measure of this study was *employment at T5* with the alternatives "no" (0) and "yes" (1). A person was regarded as employed if she or he was registered as being employed during the 90 days prior to the cancer diagnosis at T0. Employment

at T1–T4 was also measured for descriptive purposes. CSs not employed in a given year were regarded as out of work that year but were later re-included as employed if they were registered as in work another year. The not employed category included people receiving unemployment benefits, disability pension, rehabilitation benefits, old-age pension, and those participating in job creation programmes or who were homemakers in the given year. According to Norway's legislation, people receiving sick leave compensation are defined as being employed.

2.4. Statistics

We performed descriptive analysis for all independent variables for both the self-employed and salaried CS groups and their respective control groups (Table 1) and for employment (Table 1 and Figures 2 and 3). By use of logistic regression analysis, we compared employment at T5 between all groups for men, women, and "all", with odds ratios derived from separate models fitted within subsamples including only the two groups being compared and adjusted for sex, age, marital status, children, education and income level (Table 2). To assess whether the association between cancer and employment at T5 differed between self-employed and salaried workers, we fitted a logistic regression model including all participants, with cancer status (CS vs. control), employment category at T0 (self-employed vs. salaried), and their interaction term as predictors. The model was adjusted for age, sex, marital status, children, education, and income. We then investigated the effects of the sociodemographic factors on employment at T5 for the self-employed and salaried CSs, and for their respective controls, by use of multivariable logistic regressions (Table 3). Finally, in analyses of self-employed CSs and controls, we included an interaction term of group (CSs and cancer-free controls) and income level while adjusting for the six independent variables. The results are presented in Table 4 and Figure 4.

CSs were matched one-to-one with cancer-free controls on age, sex, educational level, and employment category (self-employed or salaried) at T0. This matching procedure was implemented primarily to ensure baseline comparability between survivors and controls and to reduce confounding by these key sociodemographic characteristics at the time of cancer diagnosis. The resulting data structure is therefore closer to a matched cohort design than to a classical matched case–control study.

For the main analyses, we used unconditional logistic regression to estimate odds ratios (ORs) with 95% confidence intervals for being employed at T5. All matching variables (age, sex, educational level, and employment status at T0) were included as covariates in the regression models, together with marital status, children, and income.

Unconditional logistic regression with adjustment for matching variables is a commonly used and methodologically appropriate approach in matched cohort-type designs, particularly when the aim extends beyond estimating only the within-pair association between exposure and outcome. In our study, the primary objective was to compare employment trajectories and predictors of employment between four groups (self-employed CSs, self-employed controls, salaried CSs, and salaried controls) and to examine the role of sociodemographic factors across these groups. Conditional logistic regression is optimally suited to analyses that focus exclusively on within-pair contrasts (i.e., CS vs. control within each matched pair), but it is less flexible for modelling the effects of several covariates and group differences across the entire sample.

Given the matched design, we additionally examined the robustness of our findings by performing conditional logistic regression for the main CS versus control comparison, both overall and separately for self-employed and salaried participants. These sensitivity analyses produced estimates that were in line with those from the unconditional logistic regression

models (+/− 0.01 in odds ratios and confidence intervals), supporting the robustness of our conclusions.

The strength of associations shown in the regression models is expressed as odds ratios with 95% confidence intervals. The level of significance is set at $p < 0.05$. The main analyses were conducted using SPSS 29.0.1.0. The sensitivity analyses were performed in the statistical software R (version 4.6.1), using conditional logistic regression stratified by cem strata, for the full sample as well as separately for self-employed and salaried people.

2.5. Ethics

This study was approved by the Regional Committees for Medical and Health Research Ethics of Mid-Norway (2016/830) and the Norwegian Data Protection Authority (16/00235). The study used de-identified secondary data from national administrative registries. Individual consent was not required, in accordance with Norwegian data protection regulations and approvals from relevant authorities.

2.6. Use of Artificial Intelligence (AI)

An AI tool provided by the Norwegian Agency for Shared Services in Education and Research (SIKT) was partially used to edit the English language of this article. The graphical abstract was developed with the assistance of ChatGPT 5.6.

3. Results

3.1. Sample Characteristics

A total of 386 male self-employed CSs, 339 female self-employed CSs, 3843 male salaried CSs, and 6620 female salaried CSs were included in the study. The sociodemographic characteristics at T0 of male and female self-employed and salaried CSs and their respective cancer-free controls are presented in Table 1. Overall, the average age was about 46 years for both men and women. There were slightly more married women than men, and more women than men had children. The percentage of self-employed people with university education was lower than that of salaried people. This was most pronounced for men. For both salaried and self-employed people, men had higher incomes than women.

Salaried people had higher incomes than the self-employed. This was particularly evident when looking at the percentage of men in the lowest tertile. For men, there were fewer self-employed people in the highest tertile compared to salaried people; but among women, there were slightly more self-employed people in the highest tertile compared to salaried people.

Table 1. Characteristics of male and female self-employed and salaried cancer survivors (aged 30–55 years) and self-employed and salaried cancer-free controls matched on age, sex and education. All participants were in employment at T0 (time of diagnosis for survivors, and equivalent for matched controls).

	Salaried Controls n (%)	**Salaried Cancer Survivors n (%)**	**Self-Employed Controls n (%)**	**Self-Employed Cancer Survivors n (%)**
MEN	(n = 3843)	(n = 3843)	(n = 386)	(n = 386)
Age T0 [*mean (SD)*] *	*45.5 (7.4)*	*45.5 (7.4)*	*47.3 (6.8)*	*47.3 (6.8)*
Family status T0				
Single	1604 (41.7)	1522 (39.6)	158 (40.9)	144 (37.3)
Married/cohabiting	2239 (58.3)	2321 (60.4)	228 (59.1)	242 (62.7)
Children T0				
No child	698 (18.2)	785 (20.4)	60 (15.5)	57 (14.8)
Child(ren)	3145 (81.8)	3058 (79.6)	326 (84.5)	329 (85.2)

Table 1. *Cont.*

	Salaried Controls n (%)	Salaried Cancer Survivors n (%)	Self-Employed Controls n (%)	Self-Employed Cancer Survivors n (%)
Education T0 *				
Basic/Unknown	617 (16.1)	617 (16.1)	96 (24.9)	96 (24.9)
High school	1909 (49.7)	1909 (49.7)	210 (54.4)	210 (54.4)
University	1317 (34.3)	1317 (34.3)	80 (20.7)	80 (20.7)
Income T0				
1st tertile	606 (15.8)	599 (15.6)	155 (40.2)	165 (42.7)
2nd tertile	1250 (32.5)	1251 (32.6)	85 (22.0)	69 (17.9)
3rd tertile	1987 (51.7)	1993 (51.9)	146 (37.8)	152 (39.4)
Employment T5				
No	263 (6.8)	478 (12.4)	52 (13.5)	65 (16.8)
Yes	3580 (93.2)	3365 (87.6)	334 (86.5)	321 (83.2)
WOMEN	(n = 6620)	(n = 6620)	(n = 339)	(n = 339)
Age T0 [*mean (SD)*] *	*46.2 (6.6)*	*46.2 (6.6)*	*46.8 (6.6)*	*46.8 (6.6)*
Family status_T0				
Single	2595 (39.2)	2636 (39.8)	93 (27.4)	90 (26.6)
Married/cohabiting	4025 (60.8)	3984 (60.2)	246 (72.6)	249 (73.5)
Children_T0				
No child	798 (12.1)	879 (13.3)	28 (8.3)	32 (9.4)
Child(ren)	5822 (87.9)	5741 (86.7)	311 (91.7)	307 (90.6)
Education_T0 *				
Basic/Unknown	1174 (17.7)	1174 (17.7)	61 (18.0)	61 (18.0)
High school	2829 (42.7)	2829 (42.7)	156 (46.0)	156 (46.0)
University	2617 (39.5)	2617 (39.5)	122 (36.0)	122 (36.0)
Income_T0				
1st tertile	2844 (43.0)	2686 (40.6)	194 (57.2)	175 (51.6)
2nd tertile	2323 (35.1)	2415 (36.5)	50 (14.7)	69 (20.4)
3rd tertile	1453 (21.9)	1519 (22.9)	95 (28.0)	95 (28.0)
Employment_T5				
No	561 (8.5)	929 (14.0)	52 (15.3)	50 (14.7)
Yes	6059 (91.5)	5691 (86.0)	287 (84.7)	289 (85.3)

* Age and education were used as matching variables and are therefore expected to have identical distributions between cancer survivors and controls within the self-employed and salaried groups; SD = standard deviation.

3.2. Employment Among the Groups

Table 1 shows the employment rates for all groups at T5, whereas Figures 2 and 3 show the employment rates of the CSs and their cancer-free controls for all five years post-diagnosis for men and women, respectively.

Except for self-employed controls, the male groups had a relatively steady decrease in employment over the five years post-diagnosis (Figure 2). A total of 93.2 percent (95% CI = 92.4–94.0) of the male salaried cancer-free controls were employed at T5, whereas 87.6 percent (95% CI = 86.5–88.6) of the male salaried CSs were employed (grey line). For self-employed cancer-free controls (black dotted line), 86.5 percent (95% CI = 83.1–89.0) were employed compared to 83.2 percent (95% CI = 79.4–86.9) of self-employed CSs (black line).

For women (Figure 3), 91.5 percent (95% CI = 90.9–92.2) of the salaried cancer-free controls and 86.0 percent (95% CI = 85.1–86.8) of the salaried CSs were employed at T5 (grey lines). For female self-employed controls and CSs, the employment rates were about the same at T5 [84.7% (95% CI = 80.8–88.5) and 85.3% (95% CI = 81.5–89.0), respectively].

The pattern of employment from T0 to T5 among women does not differ markedly from that of men, but it is worth noting that, unlike the men, the number of self-employed female CSs increased markedly from T4 to T5 (black line).

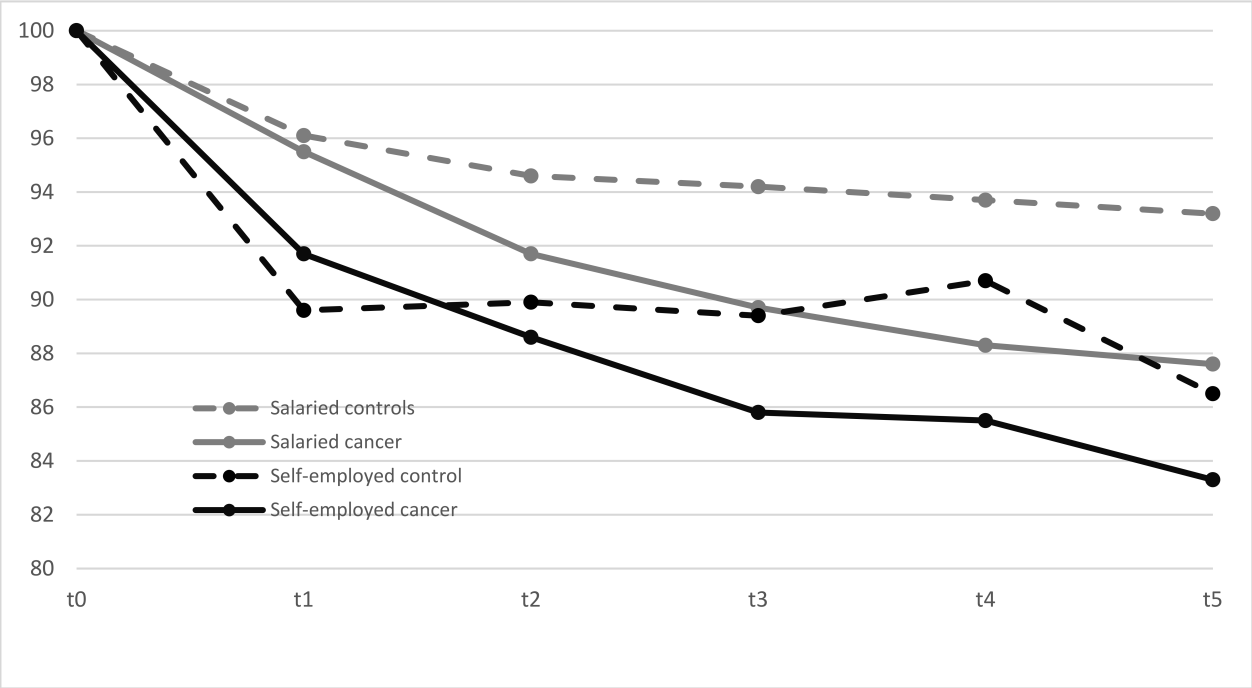

Figure 2. Percentage of *men* employed T0–T5 (one to five years after diagnosis/T0) in salaried and self-employed cancer survivors and their cancer-free controls.

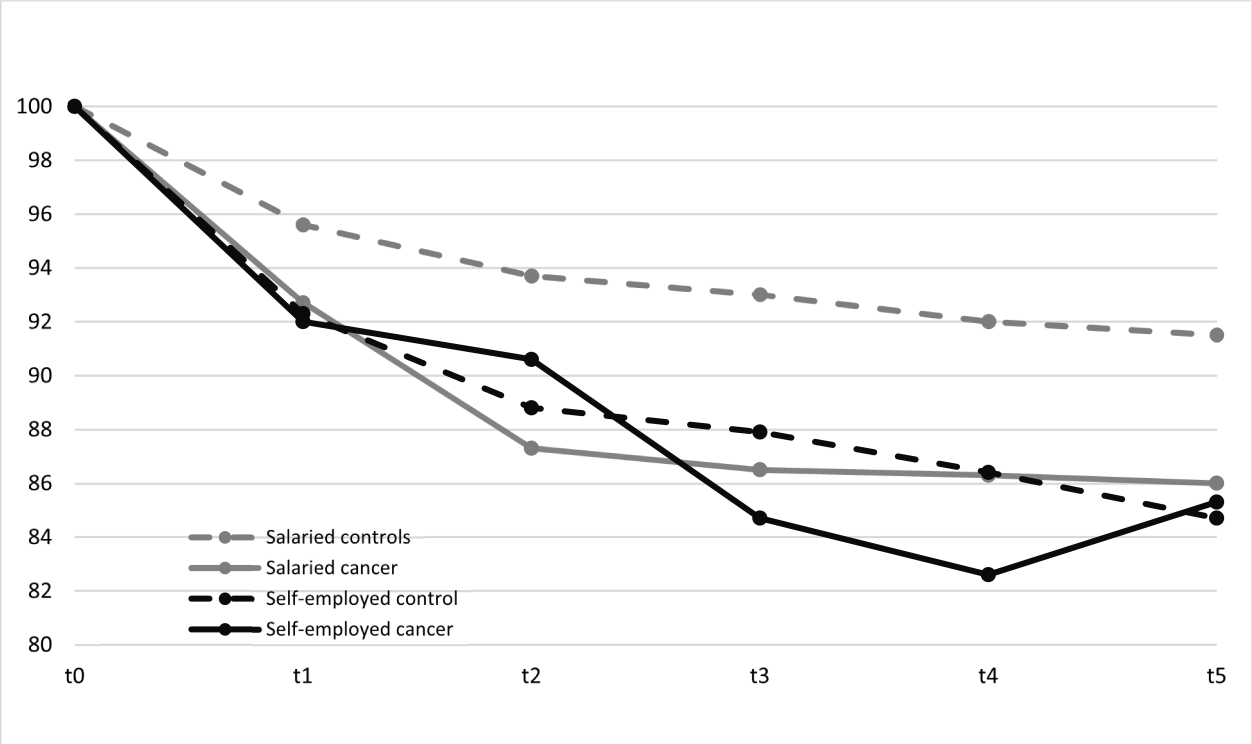

Figure 3. Percentage of *women* employed T0–T5 (one to five years after diagnosis/T0) in salaried and self-employed cancer survivors and their cancer-free controls.

Table 2 shows the odds ratios (ORs) for being employed five years post-diagnosis (T5) among the included groups. The table shows both unadjusted ORs and ORs adjusted for sociodemographic factors. The unadjusted results indicate that, overall and for both sexes, the likelihood of being employed at T5 was significantly lower for CSs than for the controls (ORs varying between 0.55 and 0.59). A similar pattern is seen when comparing salaried CSs and salaried controls (ORs varying between 0.52 and 0.57), whereas there were no significant differences in the odds of being employed at T5 for self-employed CSs compared to their controls. There was no significant difference in the odds of being employed between self-employed and salaried CSs, except for men, for whom the odds of being employed were slightly lower for the self-employed than for the salaried (OR = 0.70, 95% CI = 0.53–0.93). Compared to salaried controls, the odds of being employed were significantly lower for self-employed CSs (ORs varying between 0.36 and 0.54). There were also significantly lower odds of being employed for self-employed controls compared to salaried controls (ORs varying between 0.47 and 0.58), but not compared to salaried CSs. Adjusted predicted probabilities of employment at T5 were 92.1% (95% CI = 91.5–92.7) among salaried controls and 86.2% (95% CI = 85.3–87.0) among salaried CSs, corresponding to a difference of 6.0 percentage points. Among self-employed participants, the corresponding probabilities were 87.3% (95% CI = 84.7–89.5) for controls and 85.7% for CSs (95% CI = 82.9–88.0), a difference of 1.6 percentage points. Thus, the absolute difference associated with cancer was considerably larger among salaried than among self-employed participants.

Table 2. Odds of being employed five years post-diagnosis (T5) among male and female self-employed and salaried cancer survivors (CSs) and their cancer-free controls (N = 22,376).

	Unadjusted			Adjusted *
Groups Compared	**Men**	**Women**	**All**	**All**
	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)
CSs vs. controls	**0.55 (0.47–0.63)** [a]	**0.59 (0.53–0.66)** [e]	**0.57 (0.53–0.63)** [i]	**0.56 (0.51–0.61)** [i]
Salaried CSs vs. salaried controls	**0.52 (0.44–0.61)** [b]	**0.57 (0.51–0.63)** [f]	**0.55 (0.50–0.60)** [j]	**0.53 (0.49–0.58)** [j]
Self-employed CSs vs. self-employed controls	0.77 (0.52–1.14) [c]	1.05 (0.69–1.60) [g]	0.89 (0.67–1.19) [k]	0.86 (0.64–1.16) [k]
Self-employed CSs vs. salaried CSs	**0.70 (0.53–0.93)** [d]	0.94 (0.69–1.28) [h]	0.82 (0.67–1.01) [l]	0.97 (0.78–1.20) [l]
Self-employed CSs vs. salaried controls	**0.36 (0.27–0.49)** [d]	**0.54 (0.39–0.73)** [h]	**0.45 (0.37–0.56)** [l]	**0.51 (0.41–0.64)** [l]
Self-employed controls vs. salaried controls	**0.47 (0.34–0.65)** [d]	**0.51 (0.38–0.70)** [h]	**0.51 (0.41–0.64)** [l]	**0.58 (0.46–0.72)** [l]
Self-employed controls vs. salaried CSs	0.91 (0.67–1.24) [d]	0.90 (0.67–1.22) [h]	0.93 (0.75–1.15) [l]	1.10 (0.88–1.37) [l]

* Adjusted for the effects of sex, age, marital status, children, education, and income level measured at the time of diagnosis/T0. OR = Odds Ratio; CI = Confidence Interval; bold text indicates statistical significance < 0.05. Relevant ns: [a] n = 8448, [b] n = 7686, [c] n = 772, [d] n = 4229, [e] n = 13,918, [f] n = 13,240, [g] n = 678, [h] n = 7019 [I] n = 22,376, [j] n = 20,926, [k] n = 1450, [l] n = 11,188.

The adjusted analysis (Table 2) did not change the unadjusted ORs in any significant way. When comparing all CSs with controls, salaried CSs with controls, and self-employed CSs with controls, the ORs were 0.56 (95% CI = 0.51–0.61), 0.53 (95% CI = 0.49–0.58), and 0.86 (95% CI = 0.64–1.16), respectively. When conducting conditional regression analysis (as a sensitivity analysis), the corresponding results were essentially identical to those of the unconditional regression analysis, with the following ORs: 0.55 (95% CI = 0.51–0.60), 0.53 (95% CI = 0.48–0.58), and 0.86 (95% CI = 0.64–1.16).

In an additional logistic regression model including all participants, we added an interaction term between cancer status (no vs. yes) and employment category at T0 (salaried vs. self-employed). This model, adjusted for age, sex, marital status, children, education, and income, showed a statistically significant cancer × employment category interaction (OR = 0.61, 95% CI = 0.45–0.83, $p = 0.002$), indicating that the association between cancer and employment at T5 differed between self-employed and salaried people. In other words,

the adverse effect of cancer on the odds of being employed five years after diagnosis was weaker among self-employed workers than among salaried workers.

In summary, the likelihood of being employed five years post-diagnosis among self-employed CSs was about the same as for self-employed matched controls, whereas salaried CSs were less likely to be employed at T5 compared to salaried controls. The odds of falling out of work for self-employed people, with or without cancer, were about the same as for salaried CSs. The exception was for male self-employed CSs that had somewhat lower odds of being employed compared to salaried CSs.

3.3. Predictors of Employment

Table 3 shows the effects of sociodemographic factors (age, sex, marital status, children, education, and income level) on employment at T5 for the four included groups (self-employed and salaried CSs and their respective controls). In addition, it shows a model including all the participants with "group" as a variable.

Table 3. Multivariable logistic regressions of employment 5 years post-diagnosis (T5) on sociodemographic factors among salaried and self-employed cancer survivors (CSs) and cancer-free controls: adjusted odds ratios (ORs) and 95% confidence intervals (CIs).

	Salaried Controls (n = 10,463)	**Salaried Cancer Survivors (n = 10,463)**	**Self-Employed Controls (n = 725)**	**Self-Employed Cancer Survivors (n = 725)**	**All Participants (n = 22,376)**
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age_T0	0.99 (0.98–1.01)	**0.99 (0.98–1.00)**	0.98 (0.95–1.02)	0.96 (0.93–1.00)	**0.99 (0.98–1.00)**
Sex_T0					
Men	1.00	1.00	1.00	1.00	1.00
Women	1.05 (0.89–1.24)	1.09 (0.96–1.24)	0.93 (0.60–1.45)	1.36 (0.88–2.10)	1.08 (0.98–1.19)
Marital status_T0					
Single	1.00	1.00	1.00	1.00	1.00
Married/cohabiting	**1.41 (1.21–1.65)**	**1.29 (1.14–1.46)**	**1.63 (1.03–2.56)**	1.10 (0.69–1.77)	**1.34 (1.22–1.47)**
Children_T0					
No child	1.00	1.00	1.00	1.00	1.00
Child(ren)	1.10 (0.89–1.35)	1.03 (0.87–1.21)	**0.40 (0.17–0.94)**	0.57 (0.27–1.20)	1.00 (0.88–1.14)
Education_T0					
Basic/unknown	1.00	1.00	1.00	1.00	1.00
High school	**1.39 (1.16–1.65)**	**1.71 (1.49–1.96)**	1.35 (0.81–2.25)	**2.10 (1.30–3.41)**	**1.58 (1.43–1.76)**
University	**2.00 (1.61–2.48)**	**2.48 (2.10–2.93)**	1.33 (0.71–2.47)	1.80 (0.97–3.33)	**2.22 (1.96–2.51)**
Income_T0					
1st tertile	1.00	1.00	1.00	1.00	1.00
2nd tertile	**1.90 (1.60–2.26)**	**1.70 (1.48–1.95)**	1.68 (0.92–3.04)	1.68 (1.00–2.84)	**1.79 (1.61–1.98)**
3rd tertile	**2.95 (2.37–3.67)**	**2.31 (1.96–2.72)**	**2.40 (1.39–4.16)**	**6.91 (3.48–13.67)**	**2.61 (2.31–2.96)**
Group_T0					
Salaried controls					1.00
Salaried CSs					**0.53 (0.49–0.58)**
Self-employed controls					**0.59 (0.47–0.73)**
Self-employed CSs					**0.51 (0.41–0.63)**
Nagelkerke R^2	*0.06*	*0.06*	*0.06*	*0.15*	*0.08*

OR = Odds Ratio; CI = Confidence Interval; bold text indicates statistical significance < 0.05.

The analyses show that, in general, age had a weak negative effect on employment for all four groups, but was significant for the salaried CSs only. There were no significant sex differences in the likelihood of employment at T5. In all four groups, except for self-employed CSs, those who were married/cohabiting had higher odds of being employed compared to those who were not married/cohabiting (ORs ranging from 1.29 to 1.63). Among salaried controls and CSs, there were no significant differences in the likelihood of being employed among those with and without children. For self-employed controls

and CSs, however, having children reduced the odds of being employed at T5 [OR = 0.40 (95% CI = 0.17–0.94) and 0.57 (95% CI = 0.27–1.20), respectively] although the association was significant for the self-employed control group only.

Salaried CSs and controls with education at high school or university levels had higher odds of being employed at T5 compared to those with basic education (ORs ranging from 1.38 to 2.48). The odds of employment for self-employed CSs with a high school education were about two times that of their counterparts with a basic education [OR = 2.10 (95% CI = 1.30–3.41)]. The odds ratio for being employed for self-employed CSs with university education was about the same [OR = 1.80 (95% CI = 0.97–3.33)], but did not reach statistical significance. For self-employed controls with higher education, the likelihood of being employed was not much higher than for those with basic education.

Income level seemed to be of importance for all four groups, with ORs ranging from 1.68 to 6.91. Compared to self-employed controls and CSs in the first income tertile, the OR for self-employed controls and CSs in the second tertile was 1.68 ($p = 0.05$ for the CSs). Across all four groups, the ORs for people in the third income tertile were significantly higher than the ORs for those in the first tertile. Because employment rates were high in all income groups, odds ratios may give an exaggerated impression of the effect size. To complement the odds ratios, we calculated adjusted predicted probabilities and average marginal effects from the logistic regression model. Among self-employed CSs, the adjusted probability of being employed at T5 was 78.9% (95% CI = 71.7–84.6) in the lowest income tertile and 96.3% (95% CI = 92.7–98.1) in the highest tertile. This corresponds to an average marginal effect of 17.4 percentage points (95% CI = 11.2–23.6, $p < 0.001$) for being in the highest versus the lowest income tertile. Despite a wide confidence interval, a notable finding was the rather strong association between income and employment among self-employed CSs, with an OR of 6.91 (95% CI = 3.48–13.67) for those in the highest compared to the lowest tertile, consistent with the estimated average marginal effect in employment probability. The last column in Table 3 shows results for all four groups combined. Adjusting for sociodemographic factors (e.g., age, sex, marital status), findings for the Group_T0 variable shows that: compared to salaried controls (the reference group), the likelihood of being employed at T5 is lower for salaried CSs (OR = 0.53, 95% CI = 0.49–0.58), self-employed controls (OR = 0.59, 95% CI = 0.47–0.73), and self-employed CSs (OR = 0.51, 95% CI = 0.41–0.63). As already shown in Table 2 (All, Adjusted), there were no significant differences between the other groups.

3.4. Self-Employed CSs vs. Self-Employed Controls

To follow up on the result that there was no significant difference in employment at T5 between the self-employed CSs and self-employed controls (Table 2), we conducted a logistic regression analysis including only the self-employed (Table 4). In Model 1, we included the sociodemographic variables without the group variable (self-employed cancer-free controls vs. self-employed CSs), which was then added in Model 2. In Model 3, we added an interaction term between employment category/group (self-employed CSs vs. controls) and income (1st to 3rd tertiles). The main effects of these analyses (Table 4, Models 1–3) were rather similar to what was shown in Table 3 (column 5), with both salaried and self-employed people included. The exception was that self-employed CSs and controls who had children had a lower OR for employment [Model 2: OR = 0.48 (95% CI = 0.27–0.83)] compared to their counterparts without children.

The inclusion of the interaction term led to a significant improvement in model fit compared with Model 2 ($\Delta\chi^2 = 6.23$, $\Delta df = 2$, $p = 0.04$), indicating that the association between income and employment at T5 differed between self-employed CSs and controls. Specifically, the significant interaction term for 'self-employed CSs × 3rd tertile' indicates

that the positive association between being in the highest (vs. lowest) income tertile and employment at T5 was stronger among self-employed CSs than among self-employed controls [OR = 2.76, 95% CI = 1.19–6.39].

Table 4. Multivariable logistic regressions of employment 5 years post-diagnosis (T5) on sociodemographic factors among self-employed cancer survivors (n = 725) and self-employed cancer-free controls (n = 725).

	Model 1	**Model 2**	**Model 3**
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Main effects			
Age_T0	**0.97 (0.95–1.00)**	**0.97 (0.95–1.00)**	**0.97 (0.95–1.00)**
Sex_T0			
Men	1.00	1.00	1.00
Women	1.11 (0.82–1.52)	1.11 (0.82–1.52)	1.12 (0.82–1.53)
Marital status_T0			
Single	1.00	1.00	1.00
Married/cohabiting	1.37 (0.99–1.90)	1.38 (1.00–1.91)	1.35 (0.98–1.87)
Children_T0			
No child	1.00	1.00	1.00
Child(ren)	**0.48 (0.28–0.83)**	**0.48 (0.27–0.83)**	**0.48 (0.28–0.84)**
Education_T0			
Basic/unknown	1.00	1.00	1.00
High school	**1.66 (1.18–2.35)**	**1.66 (1.18–2.35)**	**1.68 (1.19–2.38)**
University	**1.55 (1.01–2.34)**	**1.55 (1.00–2.39)**	**1.55 (1.00–2.40)**
Income_T0			
1st tertile	1.00	1.00	1.00
2nd tertile	**1.67 (1.14–2.47)**	**1.68 (1.14–2.48)**	1.74 (0.96–3.14)
3rd tertile	**3.77 (2.48–5.75)**	**3.78 (2.48–5.77)**	**2.39 (1.40–4.09)**
Group T0			
Self-employed controls		1.00	1.00
Self-employed CSs		0.86 (0.64–1.16)	0.74 (0.51–1.07)
Interaction effects			
Group T0 × Income T0			
Self-employed CSs × 1st tertile			1.00
Self-employed CSs × 2nd tertile			0.96 (0.43–2.10)
Self-employed CSs × 3rd tertile			**2.76 (1.19–6.39)**
Nagelkerke R^2	*0.093*	*0.094*	*0.101*
Omnibus χ^2	*78.895*	*79.848*	*86.076*
$\Delta\,\chi^2$	-	*0.953*	***6.228***

OR = Odds Ratio; CI = Confidence Interval; bold text indicates statistical significance < 0.05.

Figure 4 illustrates the interaction effect shown in Table 4. The figure shows that the increase in employment across income tertiles was more pronounced among self-employed CSs than among self-employed controls. Overall, at all three income levels (1st, 2nd, and 3rd tertile), there were no statistically significant differences in employment at T5 between self-employed CSs and their respective controls. Nevertheless, the pattern of estimated group differences suggests that the percentage of employed CSs in the two lowest income tertiles was lower than that of cancer-free controls, whereas in the highest income tertile the estimated percentage was somewhat higher among CSs than among controls. Although the within-tertile differences were not statistically significant, the overall interaction effect indicates that the relationship between income and employment differed significantly between the two groups.

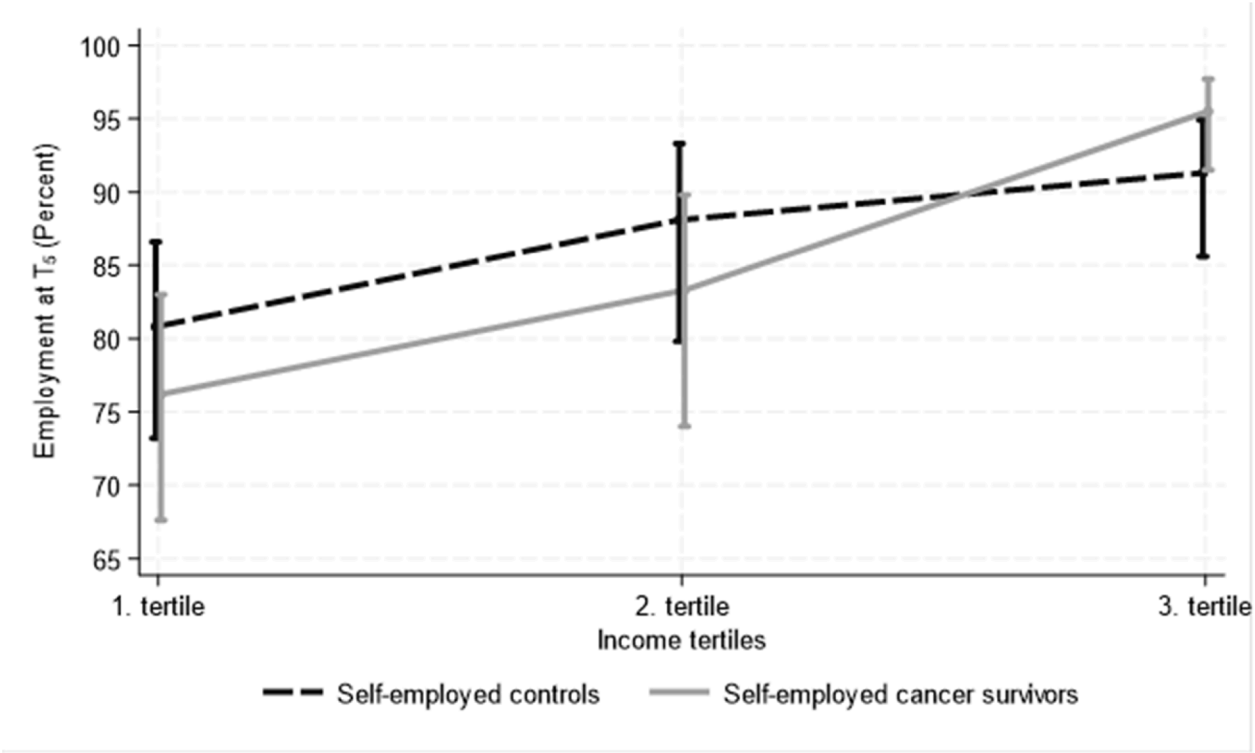

Figure 4. Interaction effects of group and income on average predicted probability of employment at T5 among self-employed cancer survivors and their self-employed cancer-free controls (cf. Model 3 in Table 4).

4. Discussion

Overall, this study shows that CSs who were employed at the time of diagnosis (T0) had a higher risk of not being employed five years after (T5) compared to cancer-free controls. This was particularly evident among salaried CSs. For self-employed CSs, 83 percent of men and 85 percent of women were employed at T5, and there was no significant difference in employment among self-employed CSs compared to self-employed cancer-free controls for either sex. Both self-employed CSs and their controls, and salaried CSs (male, female and "all"), were significantly less employed at T5 compared to the salaried control group.

The effects of sociodemographic factors on employment at T5 among self-employed CSs were similar to the effects among self-employed controls, and also among salaried CSs and controls. Age had a weak negative effect on employment in all groups, but was significant for the salaried CSs only. There were no significant effects of sex on employment in any of the groups. Being married/cohabiting generally had a positive effect on employment at T5. Among both self-employed CSs and controls, having children increased the risk of not being employed at T5.

Overall, there was a positive effect of education on employment at T5, but this effect was slightly more prominent among salaried people than among the self-employed. There was also a significant effect of high income on employment at T5 in all four groups. The effect of income was particularly evident in the self-employed CSs group, in which people in the highest income tertile had 6.91 times the odds of being employed at T5 compared to the odds in the lowest income tertile.

4.1. Employment Among the Groups

As has been documented in several reviews [3,15,16] and also in other research from Norway [40,41], this study shows that CSs in general were less often employed several

years after cancer diagnosis compared to cancer-free controls. Nevertheless, the percentage employed (83% for male self-employed CSs; 88% for male salaried CSs) was higher than what has been documented in most other studies [15,16]. As only individuals who were alive at T5 were included in the study, the cohort may be relatively healthy, which could help explain the relatively high employment rates. In addition, these high employment levels should be interpreted with caution, as they do not automatically imply good health, adequate work ability, or favorable working conditions. Rather, they may also indicate that CSs feel compelled to work under constrained circumstances.

In the available research on employment among CSs, results commonly indicate higher odds of being employed among self-employed CSs compared to salaried CSs [20,27,41–43]. Our study did not show any significant difference in employment at T5 between self-employed CSs and salaried CSs, except for lower odds of male self-employed CSs. As in the current study, a few other studies have shown no difference in employment when comparing self-employed and salaried CSs [26,44], but to our knowledge, no study has documented lower employment rates among self-employed CSs compared to salaried CSs as was the case for men. The comparisons between self-employed and salaried people should, however, be interpreted with caution, as these groups were not matched and the number of salaried was much higher than that of the self-employed.

Despite limited statistical power among self-employed participants and rather wide confidence intervals, what is most striking in this study is that there was no significant difference in the odds of 5-year employment status between self-employed CSs and the self-employed cancer-free controls. This indicates that self-employed controls and CSs (both self-employed and salaried) experienced similar patterns of falling out of work. Thus, one can conclude that being self-employed is demanding employment-wise, but being diagnosed with cancer, with all its known side and late effects [14], does not seem to influence self-employed CSs' employment status as much as it does for salaried CSs. To our knowledge, no other studies have shown similar results. We discuss this issue in Section 4.3.

4.2. Effects of Sociodemographic Factors

Corroborating earlier studies from Norway [41,45], this study did not show any significant sex effect on the employment of the self-employed and the salaried at T5. Some studies from other countries show a negative effect of female sex among CSs in general, but the lack of a sex effect is more common in the existing research [27]. Among the self-employed, Tison et al. [42] found no sex effect on employment two years after cancer diagnosis. Similarly, Torp et al. [26] showed no sex effect on self-reported work ability one to three years after a cancer diagnosis among the self-employed.

Age had a weak negative effect on employment in this study among the different groups, which is in line with other studies among CSs in general [16,27]. Among self-employed CSs in Norway, a previous study showed a negative effect of age on work ability [26].

The review study by Schellack [27] documents conflicting effects of both marital status and having children on CSs' employment post-diagnosis, with included studies showing positive, negative, and no effects. The current study documents a positive effect of being married/cohabiting in all the investigated groups except for the self-employed CSs group. Another study from Norway [45] documented higher employment five years post-diagnosis among male CSs living with a partner and who had children (compared with single male CSs without children), but not among female CSs.

For salaried CSs and controls, having children did not have any significant effect on employment five years later; whereas, for self-employed CSs and controls, having children versus not was associated with significantly lower odds of being employed at T5. It is well known that self-employed people work more hours and they report stress more often

compared to the salaried [2,3]. Additionally, it has been shown in some countries, including Norway, that the self-employed reduce their working hours more than the salaried after cancer [20]. A possible reason why having children was negatively associated with being in work for the self-employed is that self-employment combined with cancer-related side effects is too strenuous when further combined with childcare. Thus, if financially possible, the self-employed likely leave the labor market in favor of their children. In addition, if children get sick, it is more difficult for self-employed people to take time off (and thereby lose income) compared to salaried people who, in Norway, get full welfare financial support when at home caring for their sick children.

It is commonly reported that CSs with high socioeconomic status (high education and/or high income) are more often employed after treatment compared to those of lower socioeconomic status [16,27,40]. This study also found such an effect, although it was not as clear among the self-employed groups with regard to education. Despite a somewhat wide confidence interval, one of the most striking results of this study is the particularly strong association between income and long-term employment among self-employed CSs (OR = 6.91), with those in the highest income tertile having markedly higher odds of being employed at T5 than those in the lowest tertile. This suggests that self-employed CSs with high income at diagnosis are particularly likely to retain work in the long term.

4.3. Why Is There No Significant Difference in Employment Between Self-Employed CSs and Controls?

This study, together with review studies, shows that CSs in general, and salaried CSs, have a higher risk of falling out of work compared to cancer-free controls [15,27,46]. This is mostly explained by high job demands and low work ability because of negative treatment effects [3,47]. Even though one can expect the same negative treatment effects among self-employed CSs as among salaried CSs, and that self-employed CSs experience even higher job demands [2], the self-employed CSs in this study were not less likely to be employed five years post-diagnosis compared to their cancer-free controls. Thus, the consequences of cancer on employment seem different for self-employed people compared to the salaried (among whom CSs were less likely to be employed at T5 compared to controls). Although this somewhat puzzling finding should be interpreted with caution and the underlying mechanisms are likely to be complex, involving multiple factors, we consider it sufficiently interesting to outline some possible hypotheses that could be addressed in future research.

One hypothesis may be that, like in most other countries in Europe [2,48], the social security scheme for self-employed people in Norway is less generous than what is offered to salaried workers and is less adapted to the needs of self-employed people [20,28]. Thus, compared to salaried CSs, self-employed CSs may experience greater financial pressure to return to work.

Work and the private life of self-employed people are often more enmeshed than is the case for the salaried. The self-employed often report that their work is their whole life, or that "the work is them" [3,23]. If this is the case, it could be more difficult for the self-employed (compared to the salaried) to quit work due to health issues related to cancer, and their relatively high work-related autonomy [2] may enable them to make adaptations to continue working. Some qualitative studies among self-employed CSs support this [23,24], and it has also been shown that self-employed CSs feel ashamed when they are not able to work and financially support their families due to the cancer [23].

A last hypothesis may be that self-employed people exhibit personality traits that differ from those of the salaried. It has been shown that, compared to the salaried, self-employed people are more optimistic and extroverted, and have a higher internal locus of control [9]. Self-employed people may also be used to coping with challenges that may threaten their

income and living standard [49]. It could thus be hypothesized that self-employed people with such personality traits and experience approach the challenges of cancer in a different and more proactive way than CSs with other types of personalities.

A concept closely related to these personality characteristics is posttraumatic growth, defined as a positive psychological change experienced as a result of having struggled with highly challenging life circumstances [50]. It has been shown that posttraumatic growth is more common among people scoring high on optimism, extraversion, and self-confidence [51,52]. Research shows that CSs experience such growth after cancer [52], and that it is more common among CSs of high socioeconomic status [53]. Retaining work after cancer diagnosis and treatment may be a consequence of posttraumatic growth, and the current study found that the most financially well-off self-employed CSs were the most likely to be employed five years after diagnosis, even slightly surpassing the most well-off self-employed controls.

4.4. Implications

The present findings suggest that low-income self-employed CSs may be particularly vulnerable in terms of long-term employment. While self-employed CSs with high income appeared able to retain work and even slightly outperform self-employed controls, those in the lowest income tertile had substantially lower odds of being employed five years after diagnosis. This pattern indicates that existing social welfare provisions and occupational rehabilitation services may not adequately protect self-employed workers with limited financial resources when they are confronted with cancer and its long-term consequences.

From a policy perspective, these results point to a need for closer attention to how sickness benefits, rehabilitation schemes, and disability pensions are designed and implemented for self-employed workers. In particular, systems that tie benefits strongly to previous income may unintentionally exacerbate the vulnerability of low-income self-employed CSs. Strengthening income security for this group, for example through more generous minimum benefits or targeted support during and after treatment, could help reduce the risk of permanent labor market exit.

Occupational rehabilitation and social welfare services should also be better adapted to the specific situation of self-employed workers. Compared to salaried workers, self-employed CSs lack an employer who can facilitate work adjustments, and they often face more complex financial and organizational challenges. Services that explicitly address business-related needs—such as temporary wage subsidies, support to hire substitute workers, or assistance in restructuring work tasks—may be particularly relevant for the self-employed.

Finally, there is a clear need for further research on interventions and policy measures aimed at supporting self-employed CSs, especially those in vulnerable economic positions. Studies evaluating the effects of specific welfare reforms or rehabilitation programs on long-term employment outcomes in this group would be of great value for informing future policy development.

4.5. Methodological Strengths and Limitations

A strength of this study is that we have used registry data following CSs and matched controls for five years. Norwegian registries are regarded as reliable and accurate. The proportion of the self-employed compared to the salaried in this study (6.5%) seems representative of Norway's labor market at the time the data were collected [30]. We have included a selected age group (30–55 years) of workers in this study, which can be regarded as a strength because this group is most stable in the labor market. On the other hand, this

could be a weakness as it excludes from our study younger and older people who have shown a higher risk of falling out of work than our selected group [54].

There are several limitations of this study. One limitation is that the registry data do not include information on the working environment, occupation, or size of enterprise. Although information on sector is available, this variable was not meaningful to use because there were too few participants in the different sectors. Another is that we have investigated whether the participants were employed after cancer, but we have not included measures on working hours or full-/part-time work among those in employment. However, registry data on full-/part-time work for self-employed people will in general not be very reliable as their working hours are volatile and often exceed normal full-time work.

In this study, we did not include data on clinical factors that have previously been shown to be important for employment outcomes. This is a limitation and should be addressed in future research. Our decision not to include clinical data was based on the assumption that such factors are primarily relevant in short-term follow-up [41,55], and on the consideration that there is no obvious reason to expect systematic differences between self-employed and salaried workers in terms of cancer diagnoses or treatment. Furthermore, including detailed clinical information would have made the current article considerably more complex in terms of both analyses and presentation, and might have reduced the precision and statistical power of the estimates by increasing model complexity. Moreover, a recent French prospective study on return to work among self-employed and salaried women with breast cancer showed that adjusting for clinical and work-related factors did not change the associations between self-employment and return to work in any significant way [56]. Furthermore, we did not include work-related factors such as occupation, economic sector, and company size, which could also be expected to influence employment among both self-employed and salaried people [3].

The participants were grouped into salaried and self-employed people based on their status at T0. We have not recorded whether the participants changed their occupational status during the investigated five years, meaning that some of the workers who were registered as self-employed at T0 may be salaried in subsequent years, and vice versa for the salaried. Although such information could provide us with a more comprehensive understanding of the situation of self-employed CSs, our scope in the current study was to examine whether the self-employed at T0 were employed or not at T5, irrespective of the form of employment (salaried/self-employed). Future studies should investigate changes in employment category after cancer.

In this study, employment at T5 was operationalized as a binary outcome (not employed vs. employed). This entails several important limitations that must be considered when interpreting the findings. First, we were unable to distinguish between full-time and part-time work, or between stable and substantially reduced working hours. As a result, our analyses may overestimate favorable work outcomes if a proportion of those classified as "employed" are working very few hours or in marginal positions. Second, we did not capture changes in income or occupational status, including transitions between self-employment and salaried employment, or shifts from more secure to more precarious forms of work. Consequently, we cannot determine whether continued employment reflects a return to the pre-diagnosis work situation or adaptation through downgraded jobs, lower earnings, or altered employment form. The observed differences between CSs and controls may underestimate the true impact of cancer on work if survivors remain in employment under significantly worsened conditions that are not captured by our binary outcome. Future research should therefore employ more nuanced indicators of labor market participation—including work hours, income trajectories, job changes and employment

category transitions—to provide a more detailed understanding of post-cancer work life among both self-employed and salaried workers.

A further limitation is that, although annual employment information was available from T0 to T5, we did not apply time-to-event methods such as Cox regression. Employment status was recorded only at yearly intervals, without exact dates of exit from and re-entry into work, and many CSs may have moved in and out of employment during follow-up. Under these conditions, standard survival models based on time to first exit would not clearly distinguish between temporary and permanent exits and would not align with our primary aim, which was to compare long-term employment status at five years post-diagnosis. Instead, we chose to focus on employment at T5 using logistic regression, complemented by annual descriptive figures. We regard more detailed survival modelling as an avenue for future research when more granular employment data are available.

Our analyses are based on cancer diagnoses from 2004 to 2008, with follow-up to 2014. Parts of the discussion draw on more recent information to situate these historical findings within a contemporary perspective and to reflect ongoing developments in cancer treatment and social protection. While such changes may affect the absolute levels of employment and the specific design of benefits, we consider the core mechanisms identified in this study to be robust, including the differential vulnerability of self-employed versus salaried workers and the strong role of income in long-term employment. This study included only participants living in Norway. Compared to many other countries, the social welfare schemes in Norway are rather generous. Our results are therefore most relevant for countries with similar labor market and social welfare schemes as Norway's, such as the other Nordic countries.

5. Conclusions

The aim of this study was to investigate employment among self-employed CSs five years after diagnosis (T5), and to compare them with self-employed cancer-free controls and with salaried CSs and controls. Not surprisingly, salaried CSs were less likely to be employed at T5 compared to salaried controls. Such a difference in employment at T5 was, however, not found between self-employed CSs and self-employed controls for either sex. The self-employed CSs and controls had similar odds of employment to salaried CSs.

Self-employed people are a very heterogeneous group, spanning from high-status groups to low-status groups with precarious work situations. Self-employed people are a group who need special attention, considering that they often have poor social welfare schemes and volatile income [2,28,48]. This study shows that long-term employment differs between self-employed and salaried people, and that high-income self-employed CSs seem to fare rather well in the labor market, whereas low-income self-employed CSs do not. Therefore, it seems reasonable to conclude that future support measures and research studies should primarily focus on the latter group of self-employed people.

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