**Supplementary material**

Supplementary material S1 – Predicting group membership

In table S1, results of the LPM analysis on what individual characteristics predicts type of group membership is presented. The dependent variable is group membership, defined as (0) entering disability benefits system directly or (1) entering disability benefits system from sick leave benefits. The sample consists of observations on individuals and their first entry into the disability benefits system from 2003-2016. 4720 observations from 2017 were excluded, as the registers lack sick leave information for 2017 (i.e., 2017 predicts group membership = 0 perfectly). The group sizes consist of n=6690 who entered directly to disability benefits and n=34896 who entered disability benefits from sick leave benefits, resulting in an analysis sample of N=41586. LPM predicted estimates were examined, and 8.55 per cent of the estimates fall outside the range of 0-1, on the positive side.

From the results in table S1, being female positively predicts sick leave membership. With each increase in years of age, probability of sick leave membership increases. Having high education (longer or shorter university degree) negatively predicts sick leave membership, compared to those with no higher education. Having college or university (longer) educated parents negatively predicts sick leave group membership, compared to those with unspecified socio-demographic background. For immigrant status, being born in Norway with immigrant parents and being born abroad with Norwegian parents negatively predicts sick leave membership, compared to Norwegian born individuals with Norwegian parents. For marital status, being married positively predicts sick leave membership compared to unmarried individuals. Every quartile for wage positively predicts sick leave membership, compared to the lowest quartile. Having tenure of 1.5 to 4 years and over 4 years with same employer prior to entry to disability benefits positively predicts sick leave membership, compared to the lowest tenure category. Every increase in months on disability benefits negatively predicts sick leave membership. For year, 2008-2016 negatively predicts sick leave membership compared to 2003, except for 2004, which positively predicts sick leave membership. Years 2005-2007 have no effect on group membership.

Table S1. Predicting group membership

|  |  |  |
| --- | --- | --- |
|  | b | se |
| Sex, ref = male |  |  |
| Female | .016\*\*\* | .004 |
| Age | .001\* | .000 |
| Education, ref = no high education |  |  |
| High education | -.037\*\*\* | .004 |
| Socio-demographic background, ref = unspecified |  |  |
| Primary school | -.013 | .030 |
| High school | -.020 | .030 |
| College or university, shorter | -.048 | .030 |
| College or university, longer | -.069\* | .031 |
| Immigration status, ref = born in Norway with Norwegian parents |  |  |
| Immigrants | .023 | .015 |
| Born in Norway with immigrant parents | -0.061\* | .025 |
| Born abroad with one Norwegian parent | .000 | .021 |
| Born in Norway with one immigrant parent | -.005 | .009 |
| Born abroad with Norwegian parents | -.040\* | .018 |
| Marital status, ref = unmarried |  |  |
| Married | .012\*\*\* | .003 |
| Wage (quartiles), ref = lowest |  |  |
| Second | .155\*\*\* | .006 |
| Third | .229\*\*\* | .005 |
| Highest | .266\*\*\* | .006 |
| Tenure prior to disability benefits, up to 1.5 years |  |  |
| Between 1.5-4 years | .123\*\*\* | .005 |
| Over 4 years | .111\*\*\* | .005 |
| Time on disability benefits | -.001\*\*\* | .000 |
| Year, ref = 2003 |  |  |
| 2004 | .067\*\*\* | .009 |
| 2005 | .011 | .010 |
| 2006 | -.003 | .010 |
| 2007 | .002 | .010 |
| 2008 | -.032\*\* | .010 |
| 2009 | -.047\*\*\* | .010 |
| 2010 | -.130\*\*\* | .010 |
| 2011 | -.142\*\*\* | .010 |
| 2012 | -.037\*\*\* | .010 |
| 2013 | -.046\*\*\* | .011 |
| 2014 | -.044\*\*\* | .010 |
| 2015 | -.077\*\*\* | .009 |
| 2016 | -.071\*\*\* | .009 |
| Constant | .667\*\*\* | .032 |
| r2 | .133 | |
| N | 41 586 | |

\*p=.05, \*\*p=.01 \*\*\*p=.001

Supplementary material S2 – Selection of parametric distribution

Table S2 presents the results of the goodness of fit statistics for selection of parametric distribution. According to the AIC and BIC statistics, the Lognormal distribution has the lowest scores, followed closely by the Gompertz distribution. Figure S2 presents parametric distribution performance based on Csnell pseduresiduals. The Gompertz distribution performs best. If the AIC and BIC scores are taken together with the Csnell pseudoresiduals, the Gompertz distribution performs best, is retained for analysis.

Table S2. AIC and BIC statistics for parametric distribution selection

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Weibull | Loglogistic | Lognormal | Gompertz |
| *N* | 46306 | 46306 | 46306 | 46306 |
| aic | 124829.5 | 122094.1 | 121523.8 | 121705.2 |
| bic | 125231.6 | 122496.2 | 121926.0 | 122107.3 |

Figure S2. Distribution performance based on Csnell pseudoresiduals

Graphical user interface, chart, line chart

Description automatically generated

Supplementary Material S3 – Employee characteristics and year effects

Table S3 – Estimation results for employee and year characteristics

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | M1a |  | M1b |  | M2a |  | M2b |  |
|  | Hr | se | Hr | se | Hr | se | Hr | se |
| Sex, ref = male |  |  |  |  |  |  |  |  |
| Female | .913\*\*\* | .016 | .924\*\*\* | .015 | .918\*\*\* | .016 | .930\*\*\* | .015 |
| Age | .980\*\*\* | .001 | .983\*\*\* | .001 | .981\*\*\* | .001 | .983\*\*\* | .001 |
| Marital status, ref = unmarried |  |  |  |  |  |  |  |  |
| Married | .961\*\* | .014 | .958\*\* | .013 | .963\*\* | .013 | .963\*\* | .013 |
| Income category, ref = lowest |  |  |  |  |  |  |  |  |
| Second | .613\*\*\* | .011 | .674\*\*\* | .011 | .620\*\*\* | .011 | .674\*\*\* | .011 |
| Third | .502\*\*\* | .010 | .570\*\*\* | .010 | .510\*\*\* | .010 | .570\*\*\* | .010 |
| Highest | .398\*\*\* | .010 | .467\*\*\* | .011 | .407\*\*\* | .010 | .466\*\*\* | .011 |
| Education, ref = low education |  |  |  |  |  |  |  |  |
| High education | 1.04\* | .020 | 1.04\* | .018 | 1.04\*\* | .019 | 1.04\*\* | .019 |
| Time on disability benefits | .998\*\*\* | .000 | .998\*\*\* | .000 | .998\*\*\* | .000 | .999\*\*\* | .000 |
| Year, ref = 2003 |  |  |  |  |  |  |  |  |
| 2004 | 1.17\*\*\* | .032 | 1.11\*\*\* | .028 | 1.14\*\*\* | .030 | 1.09\*\*\* | .027 |
| 2005 | 1.18\*\*\* | .036 | 1.08\*\* | .031 | 1.10\*\* | .034 | 1.07\* | .031 |
| 2006 | 1.25\*\*\* | .042 | 1.16\*\*\* | .035 | 1.21\*\*\* | .039 | 1.14\*\*\* | .034 |
| 2007 | 1.20\*\*\* | .043 | 1.13\*\*\* | .036 | 1.17\*\*\* | .040 | 1.11\*\*\* | .035 |
| 2008 | 1.17\*\*\* | .043 | 1.09\*\* | .036 | 1.13\*\*\* | .040 | 1.07\* | .035 |
| 2009 | 1.25\*\*\* | .046 | 1.14\*\*\* | .037 | 1.19\*\*\* | .042 | 1.11\*\*\* | .036 |
| 2010 | 1.18\*\*\* | .041 | 1.11\*\*\* | .034 | 1.14\*\*\* | .038 | 1.07\* | .033 |
| 2011 | .972 | .037 | .916\*\* | .031 | .954 | .035 | .918\* | .031 |
| 2012 | 1.20\*\*\* | .051 | 1.16\*\* | .041 | 1.14\*\*\* | .046 | 1.06 | .040 |
| 2013 | .964 | .043 | .894\*\* | .035 | .913\* | .039 | .866\*\*\* | .034 |
| 2014 | .340\*\*\* | .018 | .354\*\*\* | .017 | .349\*\*\* | .018 | .371\*\*\* | .018 |
| 2015 | .042\*\*\* | .003 | .049\*\*\* | .003 | .044\*\*\* | .003 | .049\*\*\* | .004 |
| 2016 | .022\*\*\* | .003 | .024\*\*\* | .003 | .022\*\*\* | .002 | .023\*\*\* | .003 |
| 2017 | .052\*\*\* | .006 | .045\*\*\* | .005 | .046\*\*\* | .005 | .038\*\*\* | .004 |
| Constant | .311\*\*\* | .024 | - | - | .315\*\*\* | .022 | - | - |
| Employer shared frailty | .150\*\*\* | .010 |  |  | .070\*\*\* | .008 |  |  |
| N | 46306 | | 46306 | | 46306 | | 46306 | |

Exponentiated coefficients. Hr = hazard rates. \*p = .05, \*\*p = .01, \*\*\*p = .001.

Model 1a & 2a = parametric gompertz models with employer shared frailty

Model 1b & 2b = Proportional cox models

Supplementary material S4 – Robustness analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Model a | | Model b | |
|  | Hr | se | Hr | se |
| Employer size, ref = Small |  |  |  |  |
| Medium | 1.08\*\* | .030 | 1.08\*\* | .028 |
| Large | 1.24\*\*\* | .047 | 1.22\*\*\* | .042 |
| Policy proxy, ref = lowest |  |  |  |  |
| Second | 0.90\*\* | .029 | 0.90\*\*\* | .028 |
| Third | 0.83\*\*\* | .035 | 0.82\*\*\* | .033 |
| Highest | 0.72\*\*\* | .025 | 0.67\*\*\* | .020 |
| Sector, ref = public |  |  |  |  |
| Private | 0.81\*\*\* | .019 | 0.86\*\*\* | .016 |
| Industry, ref = Agriculture, fishing, forestry |  |  |  |  |
| Manufacturing, electricity, mining, water | 1.02 | .059 | 1.01 | .047 |
| Construction | 1.09 | .072 | 1.09 | .057 |
| Wholesale, retail, financial, real estate | 1.16\* | .068 | 1.18\*\*\* | .053 |
| Hospitality, logistics, communication | 0.99 | .064 | 1.01 | .053 |
| Public administration, education, health care | 1.09 | .066 | 1.09\* | .051 |
| Household activities & other services | 1.09 | .068 | 1.14\*\* | .055 |
| Gender composition, ref = Lowest |  |  |  |  |
| Second | 0.94\* | .025 | 0.95\* | .020 |
| Third | 0.96 | .031 | 1.00 | .027 |
| Highest | 0.98 | .035 | 1.01 | .031 |
| Age composition, ref = lowest |  |  |  |  |
| Second | 0.94\*\* | .020 | 0.95\* | .019 |
| Third | 0.94\* | .026 | 0.94\* | .024 |
| Highest | 0.89\*\* | .030 | 0.91\*\* | .027 |
| Mean wage composition, ref = lowest |  |  |  |  |
| Second | 0.99 | .021 | 1.00 | .019 |
| Third | 1.04 | .029 | 1.05\* | .026 |
| Highest | 1.07 | .039 | 1.08\*\* | .035 |
| Education composition, ref = lowest |  |  |  |  |
| Second | 0.95\* | .020 | 0.95\* | .017 |
| Third | 0.91\*\*\* | .024 | 0.90\*\*\* | .020 |
| Highest | 0.78\*\*\* | .027 | 0.81\*\*\* | .024 |
| Medium employer # policy proxy, ref = lowest |  |  |  |  |
| Medium # Second | 1.03 | .043 | 1.02 | .041 |
| Medium # Third | 1.04 | .056 | 1.02 | .052 |
| Medium # Highest | 1.12\*\* | .047 | 1.08\* | .043 |
| Large employer # policy proxy, ref = lowest |  |  |  |  |
| Large # Second | 1.00 | .050 | 1.01 | .048 |
| Large # Third | 0.96 | .054 | 0.96 | .051 |
| Large # Highest | 1.02 | .050 | 0.97 | .044 |
| Constant | 0.32\*\*\* | .023 |  |  |
| Employer shared frailty | .070\*\*\* | .008 | - | - |
| N | 46 306 | | 46 306 | |

Table S4. Robustness analysis with interaction between employer size and policy proxy

Exponentiated coefficients. Hr = hazard rates. \*p = .05, \*\*p = .01, \*\*\*p = .001.

Model a = parametric gompertz model with employer shared frailty

Model b = proportional cox model