Premature Retirement due to back disorders. Using Propensity Score Matching to combine Cross-Sectional and Longitudinal Datasets - An Example with Data from the German Research Datacenter of the Federal Pension Insurance.

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Introduction

This work included two main parts. The first is the use of Propensity Score Matching (PMS) to analyze the career of early retired persons with a back disorder as the retiring reason. This Method allows to combine Datasets of different sources and to reduce selection bias. The PSM can be estimate with a logistic regression and can include a set of covariates.

The second part is the analysis of the career of premature retired (PMR). Here the career is selected in parts like unemployment, employment or disability. This allows showing the influence of a set dependent variables to the PMR.

Through this it should be able to show the effect of the career on PMR and also different influences between PMR, old-age retired (OAR) and still working people.

The career is an important risk factor for the PMR, this is a result of several international studies which had analyzed the influence of different factors for disability retirement. In this study a sample of the retired persons were used to show the influence of work on a general level

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Datasets

To analyze the effect of the career longitudinal data is necessary. For this the FDZ-RV holds a sample of insured people. This allows showing monthly changes in the career of the insured people. The data of the insured people include all insured from the age of fifteen till sixty-seven. The only limitation is, that in this longitudinal Data the diagnosis which leads to PMR are not included.

For this the FDZ-RV has a cross-sectional data with a sample of PMR with the ICD-10 diagnosis. In this there are PMRs for each year included.

This makes the use of statistical matching necessary. For different reasons it is not possible to get a longitudinal dataset which includes diagnosis for PMR.

Propensity-Score-Matching

To select treatment on the observables, matching estimators of treatment effects are used. Through this method, the control and treated population have comparable observed characteristics. The PSM is a non-parametric technique used for the estimating average treatment effects, but it can also be used to decompose effects due to observables and to unobservable and for DID treatment evaluation.

The Propensity Score is the probability of a unit being assigned to a particular condition in a study given a set of known covariates. With the PSM we can reduce the selection bias by equating groups based on these covariates. Let T any given binary Treatment, Y is the outcome and X the background variables. The propensity score is defined as the conditional probability of treatment given background variables:

$$p(x) = \Pr(D = 1 \mid X = x)$$

(Cameron/Trivedi 2005, p.865)

To build the propensity score we chose several items like gender, age, federal state, sum of earning points. This will allow to identify (the most) equal individuals. With the logistic Regression the propensity score can be calculated, as the predicted probability of the Treatment. A simple one-to-one matching would reduce the statistical power and could raise selection bias; the use of caliper and nearest-neighbor techniques can decrease these effects. With the caliper there is the closest neighborhood around the term p(x) chosen. The nearest-neighbor method selects for every individual *i* in the treatment group, the set

$$Ai(x) = \{j | min_j ||x_i - x_j||$$

In Terms of the propensity Score Nearest-Neighbor-Matching can be define as

$$A_i(p(x)) = \{p_j | min_j ||p_i - p_j||\}$$

The term || || stands for the Euclidean distance between vectors. (Cameron/Trivedi 2005, p.875)

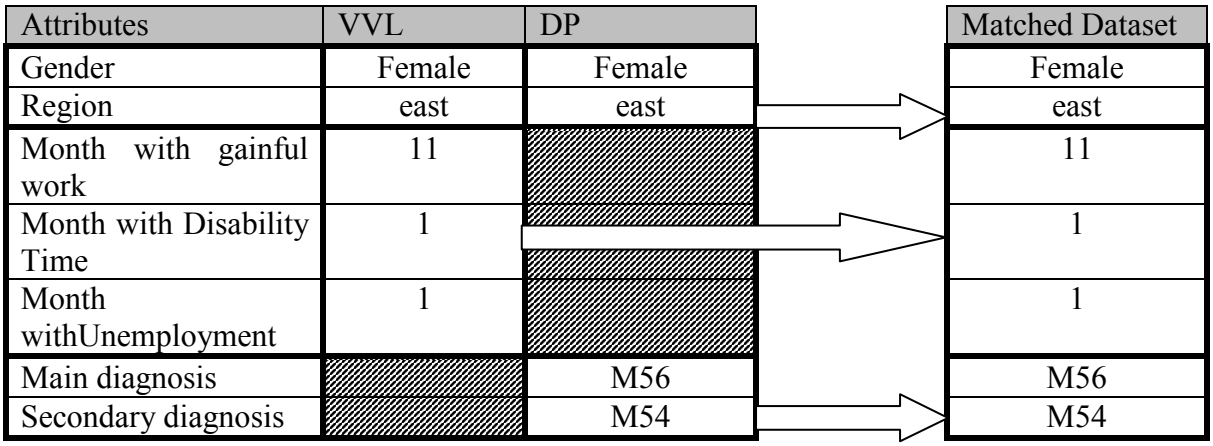
The PSM was origin modeled for matching control and treatment groups to estimate causal effects. In this work, it will be used to combine two datasets of different sources. That this leads to a valid result shows earlier work from Rasner et al. (2006).

To proof the validity of the created dataset there are four hierarchical levels of validity which can be verified (see Kiesl/Raessler 2006). These four phases are Preserving Marginal Distribution, Preserving Correlation Structures, Preserving Joint Distributions und Preserving Individual Values.

This test for validity is based on the existing datasets and the distribution of the used covariates which are used to merge the two sources.

Matching the Datasets

After the use of the Matching techniques described above, there should be a new dataset which includes the longitudinal information as well as the diagnosis for disability pensions. The following scheme shows how the matching process combines the sources.



Attributes	VVL	DP	Matched Dataset
Gender	Female	Female	Female
Region	east	east	east
Month with gainful work	11		11
Month with Disability Time	1		1
Month withUnemployment	1		1
Main diagnosis		M56	M56
Secondary diagnosis		M54	M54

[see Rässler 2002, p.3]

The recipient sample is in our case the VVL and there is enriched by information from the Data of the disability pensions.

Analysis

To test the goodness of the matching process the used items for matching will be analyzed by comparing the distribution of the matched dataset and the original sources. This will show if the matching will represent the distribution of the original datasets. This is an indicator for the validity of the matching process.

After the PSM it is possible to analyze several episodes of the career. The focus lies on the last gainful episode of occupation. This should have an effect of the PMR, but also the duration should differ between PMR and OAR. This effect and the influence of different Covariates will be analyzed with Cox-Regression Models.

Results

The episodes of the career differ between the retirement groups (PMR / OAR), especially the episodes of disability and unemployment are higher. Interesting is the result, that the age of retirement begin are much less in occupation with high risk for back disorders. This could be causation or a selection effect. Here is more research necessary to get a clearer result.

The hazard ratio shows no clear effect of the occupation as a risk factor. Neither the duration of the last work nor the occupational risk for low back pain had a clear influence of the PMR. A deeper analysis will show if this effect still occurs.

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