The impact of firm characteristics on the success of employment subsidies: a decomposition analysis of treatment effects

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Arbeitspapier / working paper

Institut für Arbeitsmarkt- und Berufsforschung
Die Forschungseinrichtung der Bundesagentur für Arbeit

IAB-Discussion Paper 18/2008

Beiträge zum wissenschaftlichen Dialog aus dem Institut für Arbeitsmarkt- und Berufsforschung

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Mit der Reihe „IAB-Discussion Paper“ will das Forschungsinstitut der Bundesagentur für Arbeit den Dialog mit der externen Wissenschaft intensivieren. Durch die rasche Verbreitung von Forschungsergebnissen über das Internet soll noch vor Drucklegung Kritik angeregt und Qualität gesichert werden.

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Contents

Abstract

In this paper we show that firm characteristics have an influence on the success of employment subsidies e.g. wage subsidies and in-work benefits, as they can strengthen positive effects or mitigate negative effects. We consider firm characteristics as post treatment variables, which are realised after the (placement officer's or the unemployed job seeker's) decision regarding programme participation has taken place. Therefore in a first step we estimate pairwise treatment effects by propensity score matching, controlling for pre-treatment characteristics of the treated and control individuals only. In a second step as a methodological contribution we propose a decomposition of the pairwise treatment effects using an Oaxaca/Blinder style decomposition analysis on the matched samples. In this decomposition we include the post-treatment firm characteristics as explanatory variables. Because employment status is a binary outcome variable in our empirical application, we use a generalisation of the decomposition analysis to nonlinear regressions developed by Fairlie (2005). This procedure allows us to distinguish between the part of a treatment effect that is due to differences in firm characteristics between treated and controls (the "explained" part) and the part that is independent of those differences (the "unexplained" part).

JEL classification: J38, C25, C14

Keywords: treatment effects, decomposition analysis, employment subsidies

We thank Cerstin Erler for drawing the sample from the IEB/BewA and Karl Schmidt for his help in identifying participants in the "Mainz model" in the IEB. This paper has benefited from discussions with our IAB colleagues in the working group on employment subsidies ("Arbeitsgruppe Kombilohn"). We also thank Herbert Brücker, Hans Kiesl and Anton Nivorozhkin for helpful comments. Any remaining errors are our own.

1 Introduction

One major aim of programmes of active labour market policy (ALMP) is the labour market integration of unemployed people who are having difficulties finding a job on their own. For political decision makers it is of relevance whether a certain programme is successful in achieving this aim compared to either a different programme or implementing no programme at all. From a microeconomic perspective, an instrument of active labour market policy can be regarded as successful if the person receiving the subsidy succeeds better than he or she would have done without support or with a different kind of support. A measurement of success which is commonly used is the length of the (non-)subsidised employment relationship and the length of time that the person is not dependent on unemployment benefits.

The typical strategy for evaluating the success of ALMP is to compare two groups of individuals with similar characteristics on average, one group receiving the treatment (i.e. participating in a programme) and the control group receiving no treatment (see e.g. Heckman et al. 1999), receiving a different treatment (see e.g. Lechner 2001) or receiving a treatment at a later point in time (Sianesi 2004). Usually these characteristics are the individual's socio-demographic background (age, sex, nationality, health status), qualification level (formal qualifications, work experience), employment history (unemployment duration, past programme participation), the regional context as well as rules of eligibility (Caliendo et al. 2004, 2005; Fitzenberger et al. 2006; Lechner, Wunsch 2006; Lechner et al. 2005).

However, it is not only the individual's characteristics that can influence the success of ALMP in integrating unemployed people into employment. Employment stability in general is also dependent on the firm and its characteristics (for an overview see e.g. Abraham 2005). According to labour market segmentation theory (Doeringer, Piore 1971) for example, large firms provide working conditions that have a positive effect on employment stability, e.g. through job ladders, grievance procedures and what is known as an internal labour market. The effect of the establishment size on job tenure has been confirmed in empirical analysis (e.g. Rebitzer 1986). In addition, large firms can bear unused resources (organisational slack) to a higher degree (Cyert, March 1963), and therefore can afford to employ individuals who only reach the desired productivity after some time of settling-in.

If such firm characteristics are distributed randomly across participants in different programmes and non-participants, this poses no problem for ALMP evaluation. However, this seems not always to be the case. For example, Bellmann et al. (2006) show that whether establishments make use of certain kind of workfare jobs, so called "one-euro-jobs", varies by industry sectors and establishment size. Hartmann (2004) points out that usage of wage subsidies positively depends on firm characteristics like firm size and economic development.

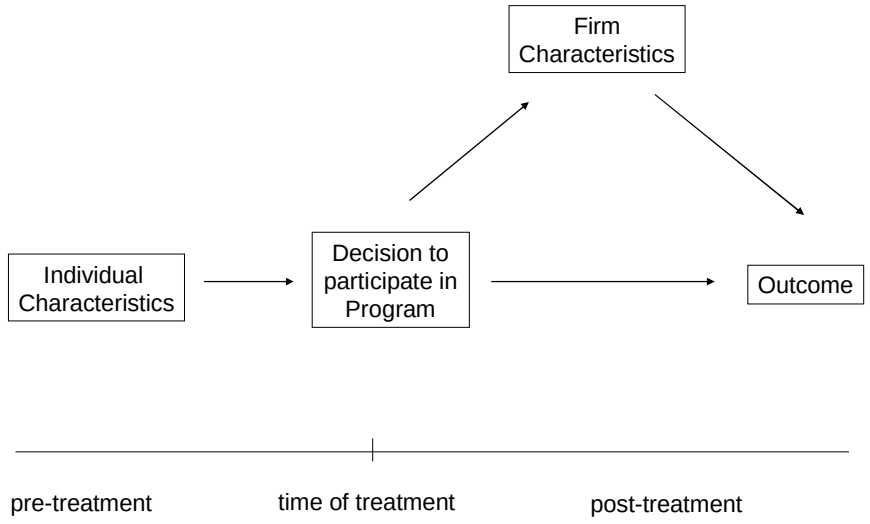
If random distribution is not the case, the question arises as to whether the relative success of a labour market programme is due to the programme itself or due to differences in the characteristics of employing firms. This question can be of practical relevance if a positive evaluation

led to the programmes being implemented more often than before, which could mean that the composition of the employing firms might change.

Of course, one could consider comparing not only treatment and control groups with similar individual characteristics but also with similar firm characteristics. The implicit assumption however would be that firm characteristics influence treatment participation. This means that the employing firm is predetermined before the individual's decision to accept a subsidy is taken, which is an indicator for a deadweight loss (Calmfors 1994). However, we think that at least for some programmes there is a strong argument to be made for assuming firm characteristics to be endogenous in the sense that they are post-treatment variables, i.e. already influenced by the treatment (see Figure 1).

The theoretical reasoning behind this assumption is that - if programmes work as intended - the caseworker's decision to offer and/or the unemployed job seeker's decision to accept participating in a programme influences what kind of job in what kind of firm will be available and acceptable for the unemployed person. Caseworkers would offer a certain kind of subsidy and ask the unemployed to consider this in their decision to apply for certain jobs. Accepting a subsidy therefore will lead to different job search behaviour and applications to different firms. In this case conditioning on firm characteristics would not identify the causal effect (Rosenbaum 1984).

Figure 1
Firm characteristics as post treatment variables



One group of programmes for which this is of particular importance is employment subsidies, because here programme participation coincides with taking up employment. One kind of employment subsidy is the wage subsidy (see e.g. Layard 1997). It is granted to the unemployed but paid to the employing firm and can therefore be termed an employer subsidy. The aim is to increase a firm's incentives to fill a vacancy even though the unemployed candidate's qualification level does not meet the requirements. Therefore the treatment is realised only when the individual job-seeker is offered a subsidy by the job placement officer and the firm accepts this

unemployed person even despite a lack of qualifications. Let us assume that wage subsidies tend to be granted to employees in small firms and evaluation results show that such subsidies are effective. As intended, placement officers will grant this subsidy more often based on these positive evaluations, and - since the number of small firms is limited - job seekers will now apply for jobs in larger firms more often. In this case the success of wage subsidies might decline simply because of the change in the composition of the employing firms.

In quite a similar way, in-work benefits (e.g. Blundell 2000) as employee subsidies are intended to motivate unemployed people to accept low-wage jobs which they would otherwise not have accepted. This is done by supplementing the low wage with a financial benefit that raises that wage above the reservation wage. Most of the low-wage jobs that are accepted because of a financial supplement are situated in different kinds of firms than other jobs which offer a wage that is above the individual's reservation wage even without the additional benefit. Here, too, the labour market programme is associated with a specific employment environment that can have an influence on the success or failure of the programme.

So on the one hand, employment stability is central for the success of certain labour market programmes and on the other hand, firms and their characteristics have been shown to influence employment stability. However, the role of the firm in helping or hindering the success of ALMP by providing a work environment that promotes employment stability is rather unclear.

The remainder of this paper is organised as follows. In section 2 we give a short overview of the target groups and prior evaluation results of German wage subsidies and in-work benefits. This is followed in section 3 by a description of our data and our proposal of a two step procedure of estimating and decomposing treatment effects using a generalisation of the Oaxaca/ Blinder decomposition introduced by Fairlie (2005) on the matched samples. In section 4 we apply this procedure to analyse the influence of firm characteristics on the success or failure of a German wage subsidy, the so-called settling-in allowance ("Eingliederungszuschuss bei Einarbeitung") and a German in-work benefit (the "Mainz model"). This allows us to distinguish between the part of the treatment effect that is due to differences in firm characteristics (the "explained" part) and the part that is independent of those differences (the "unexplained" part). To the best of our knowledge, the decomposition of a treatment effect using a Oaxaca/ Blinder or Fairlie decomposition is proposed for the first time[1].

2 German wage subsidies and in-work benefits - target groups and evaluation results

So far labour market programme evaluation indicates that (temporary) wage subsidies might be among the more successful active labour market programmes in Germany (ZEW et al. 2006; Bernhard et al. 2007; Eichhorst, Zimmermann 2007; Bernhard et al. 2008). In contrast, (temporary) in-work benefits suffer from low participation rates and are found to have at most

[1] Hohmeyer and Jozwiak (2008) use a Fairlie decomposition to analyse differences in treatment *participation* between East and West Germany. Biewen et al. (2007) use a regression on the matched sample to study treatment effect heterogeneity.

little effect on the labour market integration of the low skilled or long-term unemployed (BMWA 2005, Dann et al. 2002a,b, Kaltenborn, Wielage 2005, Krug 2007; Nivorozhkin et al. 2006).

Wage subsidies and in-work benefits are instruments of labour market policy with very similar goals[2]. They both constitute subsidies to employment that are intended to facilitate the labour market integration of unemployed people. But they approach different kinds of mismatch problems. When the problem is seen in high labour costs in relation to labour productivity, wage subsidies are a possible solution. They aim to compensate the low productivity of the unemployed applicants and to increase firms' incentives to hire them. When the problem is seen in the reservation wage exceeding market wages, in-work benefits can be proposed. They increase the work incentives of the unemployed by covering the gap between the reservation wage and the net wage by supplementing the market wage paid by the firm with a benefit.

Of course there are unemployed people with certain characteristics for whom one type of subsidy may be more appropriate than another. Obviously, wage subsidies are especially helpful for the low skilled. Furthermore low labour productivity may also be a problem for qualified people who are experiencing long-term unemployment and whose human capital is therefore deteriorating, for (qualified) people with serious health problems or people with poor language skills (migrants). Younger people might suffer from a lack of work experience despite a high qualification. Finally there might be characteristics signalling low productivity to the employer regardless of a person's true abilities. The applicant's age is one example of this kind of stigmatisation: older people are associated with less flexibility, less work capacity and lower stress resistance than younger workers (Bellmann et al. 2006).

In-work benefits can be successful if the net wage of given job opportunities does not match the reservation wage of the unemployed job candidate. The reservation wage depends positively on the last earned income and the "generosity" of transfer payments (Bender et al. 2007). In-work benefits are therefore more suited to older unemployed people with relatively high wages in their last jobs (due to seniority wages or long job tenure) and thus high transfer payments, to unemployed people with very specific skills, who were formerly employed in highly paid jobs or to unemployed people with large households and many children and high social security payments.

However, for certain unemployed people both programmes may be relevant. For example the older unemployed were mentioned as a target group for both instruments. After becoming unemployed the high reservation wage may be the major obstacle to labour market integration and thus in-work benefits might be successful. If the reservation wage exceeds the market wage for a longer period, human capital depreciation will become important, so wage subsidies might be more appropriate. Low-skilled unemployed people may have difficulty finding a

[2] At least this is the case for Germany. For the different use of in-work benefits in Anglo-Saxon and other western countries see Eichhorst 2006.

job because of a combination of rather low productivity and a relatively high reservation wage (Bender et al. 2007). In more concrete terms, if an individual's reservation wage is € 1000, this can be achieved by taking up a low-wage job supplemented by a benefit (low wage € 900 plus benefit € 100 = € 1000) or by taking up a high-wage job (€ 1000) for which the employing firm receives a subsidy. In both cases the (subsidised) wage does not equal the productivity of the previously unemployed worker (€ 900)[3].

Some programmes combine both kinds of subsidy, for example the "Hamburg model". This regional programme showed positive results in a microeconometric evaluation (Pfeifer 2007), but there was no answer to the question of whether the payments to the firm or to the employer are crucial for the successful labour market integration.

3 Data and method

In this section we describe the data and the method used to estimate the treatment effects of different employment subsidies as well as their decomposition into the parts which are explained and not explained by firm characteristics. We combine the usual potential outcome approach with a parametric decomposition of a logistic regression on the sample constructed by means of propensity score matching.

3.1 Data

In our analysis we consider two kinds of German labour market measures, a wage subsidy and an in-work benefit as well as a control group of people who start employment at a similar time and in a similar region but do not receive any kind of subsidy or measure at all.

The wage subsidy under consideration is the German settling-in allowance, "Eingliederungszuschuss bei Einarbeitung" (EGZ). This is granted to employees who are seen to require some training before they can achieve the productivity demanded for a certain job. As a general rule the EGZ refunds a maximum of 30 per cent of the wage to the firm for up to 6 months. This is then followed by a period of equal duration in which continued employment is mandatory. If a subsidised worker is dismissed within this follow-up period for reasons attributable to the employer, part of the subsidy has to be refunded. There are also other kinds of EGZ for special groups of unemployed people (ZEW et al. 2006; Bernhard et al. 2007).

We focus on this type of wage subsidy, as the structure of the target group seems most similar to the participants in the "Mainz model" (MZM), an in-work benefit which was started as a pilot project in certain areas of Rhineland-Palatinate and Brandenburg in 2000 and was extended to the whole of Germany in May 2002. In the Mainz model the benefit was imple-

[3] We consider temporary subsidies, which aim to increase the productivity of the subsidized workers on the job so they will be able to earn their wages when the subsidy period ends. Another effect which leads to a successful integration could be a decreasing reservation wage resulting in a downward pressure on gross wages. At least one of these changes must take place in order to transform a subsidized job into a non-subsidized employment relationship.

mented as a subsidy to social security contributions and was granted for up to 36 months[4]. Eligibility was means tested and mainly based on the applicant starting a new job with wages above € 325, whereby the overall household income (including income from this job) had to be below certain thresholds (€ 810 for single people). For single people without children the benefit decreased as gross wages increased, and amounted to a maximum of € 67. The subsidies and the income threshold were double for households with children and were supplemented by additional child benefit (BMWA 2005). In April 2003 the MZM was discontinued and replaced by so-called "Mini and Midi Jobs" (Rudolph, 2003). Benefits already granted were paid until 2006. A possible indication of the similarity of the target groups is the fact that from May 2002 onwards MZM recipients were eligible to receive this kind of wage subsidy in addition, although in practice this double subsidy was seldom used. In our analysis we exclude these cases of double subsidies[5].

Data on the recipients of wage subsidies in the EGZ, in-work benefits in the MZM and on the control persons is drawn from register data which is collected by the Federal Employment Services (Bundesagentur für Arbeit) and made available for scientific analysis by the Institute for Employment Research (IAB) in the Integrated Employment Biographies (IEB) of which there is also a scientific use file (Zimmermann et al. 2007), supplemented with data on job search originating from the applicants pool database (BewA). It contains information on socio-demographic characteristics, receipt of benefits, participation in active labour market programmes, job search as well as information about previous and current employment, including gross wages. The latter are given as the average gross wage per day in a given employment spell. For reasons concerning the validity of our conditional independence assumption (see section 4.1) all single-person households[6] subsidised by MZM or EGZ who entered employment between May 2002, when the parallel subsidisation of MZM recipients with EGZ was first allowed, and April 2003, when the MZM was discontinued. The two groups of programme participants are supplemented with a random sample of non participants. This gives us approximately 19,500 wage subsidy recipients, 1,600 in-work benefit recipients and 14,500 non-subsidised employees.

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[4] Of the entrants to the Mainz model between March 2002 and April 2003 more than 50% were granted the benefit for longer than 18 months. 26% of the in-work benefit recipients were granted a benefit for up to 6 months and 19% for a duration of between 7 and 12 months (Gewiese et al. 2004: 23).

[5] This brief information concerning the design of MZM and EGZ makes it clear that these instruments differ in many ways, including in such important features as the amount of money granted and the subsidy period. All of these differences are potentially important for the comparison of their relative success, but we are mainly interested in the firm characteristics. Differences other than the firm characteristics will be captured in the unexplained part of the treatment effect.

[6] To qualify for a single person household, individuals had to be listed as single and without children in the IEB as well as the BewA.

3.2 The matching estimator and its decomposition

To analyse the effect of firm characteristics on the success of labour market programmes we propose the following procedure. In a first step the average treatment effect on the treated is estimated by propensity score matching on the individual (pre-treatment) characteristics like human capital, socio-demographics, regional background, etc. In the second step we use only the sample of matched observations (matched sample) and perform a Oaxaca/Blinder style decomposition of the difference in means between treated and controls with regard to the post-treatment firm characteristics. Oaxaca (1973) and Blinder (1973) developed their method for decomposing linear regressions, but our analysis focuses on a binary outcome of the treatment. Therefore we use a variant suitable for nonlinear regressions proposed by Fairlie (2005). By performing this decomposition analysis on the matched sample and by using the (post-treatment) firm characteristics this amounts to a decomposition of the treatment effect with regard to these characteristics. As a result we can decompose the treatment effect in two parts, a part explained by differences in firm characteristics between treated and controls and a part unexplained, i.e. either due to the treatment alone or due to further, unobserved post-treatment characteristics.

3.2.1 Step one: Estimating the treatment effect

We follow the potential outcome framework (Rubin 1974, 2005), extended to the multiple treatment case (e.g. Lechner 2001). The potential outcomes are $Y^k, k = 0,..,2$ with Y^0 for the case of no subsidy. For each individual only one of the K alternative outcomes can be observed.

The outcome variable of interest here is employment status after 18 months[7] (Y) with $Y = 1$ if the individual is still employed in the original firm 18 months after he or she began the (subsidised) employment and $Y = 0$ otherwise (i.e. if the employment has been terminated). Note that we focus on the original employment, so $Y = 0$ even if the individual is in employment again but in a different job[8].

The effect to be estimated is the average treatment effect on the treated (ATT). This tells us whether individuals who received treatment k would have fared better or equally well in terms of employment stability (after 18 months) with treatment l $(l \neq k)$:

$$ATT\ (k,l) = E_X\left(E(Y^k \mid K = k, X) - E(Y^l \mid K = l, X)\right) \quad (1)$$

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[7] Our observation period is limited to 24 months. Even though we could estimate monthly treatment effects we focus on the effect 18 months after treatment start. This is done mostly for pragmatic reasons of avoiding unmanageable many estimates (four treatment effects and eight decomposition results for each month). We choose 18 months because it exceeds the combined subsidy and follow up period of wage subsidies. Estimates for the monthly treatment effects are available upon request. Usually they are rising at the beginning of the employment, start to decline after about the ninth month, and sometimes become rather small after 24 months.

[8] This is necessary for the decomposition with regard to the firm characteristics of the subsidized employment to make sense. In a companion paper we will try to identify from the process data, whether persons who quit a (subsidized) job simply moved directly into a different job or into unemployment.

Since the outcome variable is binary, the treatment effect is the difference in the probability of still being employed in the (originally) subsidised job one and a half years after it started. The conditioning on characteristics X identifies the effect of the treatment if the conditional independence assumption holds:

$$E(Y^l \mid K = k, X) = E(Y^l \mid K = l, X) = E(Y^l \mid X). \tag{2}$$

X denotes the individual's pre-treatment characteristics. According to Rosenbaum and Rubin (1983, 1985) it is sufficient to condition on the propensity score $P(X)$ as the probability of receiving a treatment. Conditioning is done by matching each treatment recipient *i* to a control person *j* with a similar propensity score. In our application, similarity will be based on the nearest neighbour method and a calliper of 0.001 is set for the maximum allowed distance $|P(X_i) - P(X_j)|$. The single nearest neighbour (without replacement) matching estimator is given by the differences between the means of treatment and control recipients (Smith, Todd 2005; Heckman et al. 1998):

$$\hat{ATT}(k,l) = \frac{1}{N_k} \sum_{i \in Dk \cap CS} Y_i^k - \frac{1}{N_k} \sum_{i \in Dk \cap CS} \sum_{j \in Dl \cap CS} w(i,j) Y_j^l \tag{3}$$

with Dk and Dl denoting the set of treatment and control recipients respectively and CS the region of common support. N_k is the number of individuals in the set $Dk \cap CS$ and $w(i,j)$ is the weight given to observation j when matched with observation i. Here $w(i,j) = 1$ if *j* is the nearest neighbor, and $w(i,j) = 0$ otherwise.

3.2.2 Step two: Decomposing the treatment effect

According to our hypothesis, when entering (subsidised) employment the observed individuals also enter different kinds of firms with characteristics Z. These characteristics are not part of the vector X because they are not characteristics of the individual and are realised only after treatment status has been determined. To analyse the extent to which the estimated effect of a subsidy can be attributed to such firm characteristics, we construct a decomposition of the treatment effect. For this we perform a decomposition analysis on the matched sample with Z as the independent and Y as the dependent variable.

Let us first consider the case of a continuous outcome variable. Then we could use the Oaxaca/Blinder decomposition (Oaxaca 1973; Blinder 1973), where, depending on what subgroup is chosen as the reference group:

$$\hat{ATT}(k,l) = \hat{\bar{Y}}_i^k - \hat{\bar{Y}}_j^l = \left[(\bar{Z}_i - \bar{Z}_j)\hat{\beta}^k\right] + \left[\bar{Z}_j(\hat{\beta}^k - \hat{\beta}^l)\right] \tag{4.1}$$

or

$$\hat{ATT}(k,l) = \hat{\bar{Y}}_i^k - \hat{\bar{Y}}_j^l = \left[(\bar{Z}_i - \bar{Z}_j)\hat{\beta}^l\right] + \left[\bar{Z}_j(\hat{\beta}^k - \hat{\beta}^l)\right]. \tag{4.2}$$

$$\overbrace{\text{explained}} \quad \overbrace{\text{unexplained}}$$

Z denotes the vector of firm characteristics, $\hat{\beta}^k$ is the vector of coefficient estimates from a linear regression of Y on Z in the sample of matched treatment recipients and $\hat{\beta}^l$ is the vector of coefficient estimates in the sample of matched controls. Because it is performed on the matched sample, the decomposition of the difference between the means of the two subgroups amounts to a decomposition of the $A\hat{T}T(k,l)$, where (in equation 4.1) $(\overline{Z}_i - \overline{Z}_j)\hat{\beta}^k$ gives the part explained by firm characteristics and $\overline{Z}_j(\hat{\beta}^k - \hat{\beta}^l)$ the unexplained part. It is easy to see, that individual characteristics X should not contribute to the explained part treatment effect, because the matching balances their distributions and therefore also their means over the two subpopulations and therefore $[(\overline{X}_i - \overline{X}_j)\hat{\gamma}^k] = 0$. If included, however, the decomposition could - under the usual parametric assumptions - indicate different effects of the individual characteristics under treatment or control status (i.e. effect heterogeneity), given that $\hat{\gamma}^k \neq \hat{\gamma}^l$:

$$A\hat{T}T(k,l) = \hat{\overline{Y}}_i^k - \hat{\overline{Y}}_j^l = [(\overline{Z}_i - \overline{Z}_j)\hat{\beta}^k] + [(\overline{X}_i - \overline{X}_j)\hat{\gamma}^k] + [\overline{Z}_j(\hat{\beta}^k - \hat{\beta}^l)] + [\overline{X}_j(\hat{\gamma}^k - \hat{\gamma}^l)] \quad (5)$$

Since the outcome of interest in our analysis is binary, i.e. employment status after 18 month, we can not use the linear decomposition but have to resort to a generalisation for the nonlinear case proposed by Fairlie (2005). Here, too, each of the two subgroups can be used as the reference group leading to either decomposition equation (eq1) or (eq2). So the decomposition can be conducted in one of the following ways:

$$A\hat{T}T(k,l) = \hat{\overline{Y}}_i^k - \hat{\overline{Y}}_j^l = \left[\sum_{i=1}^{N_k}\frac{F(Z_i\hat{\beta}^k)}{N_k} - \sum_{j=1}^{N_l}\frac{F(Z_j\hat{\beta}^k)}{N_l}\right] + \left[\sum_{j=1}^{N_l}\frac{F(Z_j\hat{\beta}^k)}{N_k} - \sum_{j=1}^{N_l}\frac{F(Z_j\hat{\beta}^l)}{N_l}\right] \quad \text{(eq1)}$$

$$A\hat{T}T(k,l) = \hat{\overline{Y}}_i^k - \hat{\overline{Y}}_j^l = \left[\sum_{i=1}^{N_k}\frac{F(Z_i\hat{\beta}^l)}{N_k} - \sum_{j=1}^{N_l}\frac{F(Z_j\hat{\beta}^l)}{N_l}\right] + \left[\sum_{i=1}^{N_k}\frac{F(Z_i\hat{\beta}^k)}{N_l} - \sum_{i=1}^{N_k}\frac{F(Z_i\hat{\beta}^l)}{N_k}\right] \quad \text{(eq2)}$$

$$\underbrace{\qquad\qquad}_{\text{explained}} \qquad \underbrace{\qquad\qquad}_{\text{unexplained}}$$

$F(.)$ stands for a nonlinear function, e.g. the cumulative standard normal or logistic distribution functions. Again, N_k is the number of treatment recipients in the set $Dk \cap CS$ and N_l is the number of matched individuals from the control population. Z is the vector of firm characteristics. $\hat{\beta}^k$ is the vector of coefficient estimates from a logistic regression of Y on Z in the sample of matched treatment recipients and $\hat{\beta}^l$ is the vector of coefficient estimates in the sample of matched controls.

In both equations the expression in the first bracket of the right-hand side gives the part of the treatment effect explained by the different composition of the two groups with regard to variables Z, the second gives the part that remains unexplained. Since results can differ, it is prudent to report the results from both variants. Due to the nonlinearity, the order in which

the Z variables enter the calculation of the decomposition can influence the results. The nonlinearity of the regressions that are used for the decomposition also implies that the contribution of the individual characteristics X need not balance each other out, so it might be that $F(Z_i \hat{\beta}^k, X_i \hat{\gamma}^k) - F(Z_j \hat{\beta}^k, X_j \hat{\gamma}^k) \neq F(Z_i \hat{\beta}^k) - F(Z_j \hat{\beta}^k)$. Therefore in the empirical analysis (section 4) we also perform a sensitivity check of our results to see if they differ when we include the individual characteristics.

We propose this kind of decomposition analysis as a simple alternative to principal stratification as put forward by Frangakis and Rubin (2002). Compared to the method of principal stratification, the use of a decomposition analysis on the matched sample has both advantages and disadvantages. One advantage is that principal strata of a post treatment variable must not be affected by treatment assignment, an exclusion restriction that sometimes is not fulfilled (as is the case here). Second, principal stratification becomes highly complex when more than one post-treatment variable is considered, whereas the decomposition can easily be extended to more than one variable, as is done in this paper. One disadvantage of the decomposition analysis is however, that the conditional independence assumption has to be extended towards the post-treatment (firm) characteristics (see Rosenbaum 1984). Another is that the decomposition analysis reintroduces parametric assumptions, whereas principal stratification remains nonparametric.

4 Empirical Analysis

4.1 Estimating the treatment effects

To achieve conditional independence, it is necessary to cover all of the variables that simultaneously determine selection into one of the programmes and employment stability. This leads us to focus on single-person households in order to avoid any influence of the household context (partner's employment status, children to support), which is necessary because benefit eligibility in the MZM was based on household income (that is including the partner's income as well as income from other sources) but from the data we only observe individual income from employment. Of course this raises the question as to whether the estimated treatment effect can be generalised to cover programme participants with other household contexts. However, the aim of this paper is not to evaluate in-work benefits and/or wage subsidies per se but rather to illuminate the role of firm characteristics in the success or failure of active labour market programmes, particularly those which subsidise employment.

In accordance with the current literature on labour market programme evaluation (Caliendo, Hujer et al. 2004; Fitzenberger et al. 2006; Lechner, Wunsch 2006) we cover a wide range of covariates. First of all we use age, sex and German citizenship to account for the socio-demographic background in the logistic regression to compute the propensity scores. Since the individual employment history is considered to have a major influence on programme participation, we include several dummies that indicate whether the individual participated in short-term training, EGZ, job creation measures (so-called ABM or SAM) or further training at least once in the last seven years as well as the number of days in labour market programmes dur-

ing the same period. In addition we calculated the number of days in employment within the last seven years and the duration of the last unemployment spell (with zero indicating no unemployment immediately prior to the subsidised employment) as well as what kind of social security benefit was received immediately prior to programme participation. To take into account differences in individuals' propensities to quit a job we included information about who terminated the last employment relationship, the employer or the employee him/herself, whether it ended under a cancellation agreement or because the job was fixed-term. An important aspect of our analysis is the influence of firm characteristics on the treatment effect. For this reason we included information about the characteristics of the firm in which the individual was previously employed, such as the average wage in the firm, the firm size and the share of unskilled workers in the firm as well as the wage from the last employment relationship (see also Fitzenberger et al. 2006). For some of the covariates squares were included to enhance the balancing property of the matching procedure.

In order to take the influence of regional characteristics into account we let two different regional classifications enter the logistic regression. Region classification I is according to Görmar, Irmen (1991) and is mainly based on population density, classification II is according to Blien et al. (2007) and covers the regional labour market context (unemployment rate, vacancy rate, etc) of the employment office that granted the subsidy. Since caseworkers often have ample scope to offer either of the programmes (or non at all) to a job-seeker, we included the caseworker's assessment of whether the potential participant suffers from health problems relevant to job placement, whether he or she has work experience and assessment of the job-seeker's qualification level. The MZM was specifically designed to promote part-time jobs, so we also used the desired working time (full-time, part-time or no preference) in the logistic regression (For the logistic regressions of treatment and control status see Table 4 in the appendix).

Table 1 gives the respective treatment effects[9]. The use of *single* nearest neighbour matching *without* replacement to construct the respective control groups is motivated by the fact that the standard errors in the Fairlie decomposition would need adjustment if some observations are to be used repeatedly.

Compared to unsubsidised employees, the wage subsidy has a positive average treatment effect of 13 percentage points on the probability of employment 18 months after starting the job, which is highly significant. Compared to in-work benefits as a different subsidy, the effect of wage subsidies is slightly smaller, at 9 percentage points, but still highly significant. In-work benefits on the other hand seem not to have any effect on employment stability at all. As need not necessarily be the case, a comparison of in-work benefit to wage subsidy recipients yields

[9] We used the stata supplement *psmatch2* (Leuven, Sianesi 2003) for computing the treatment effects, *mhbounds* (Becker, Caliendo 2006) for the Rosenbaum bounds analysis and *fairlie* (Jann 2007) for the decomposition analysis.

a negative effect, complementary to the reverse comparison of wage subsidy with in-work benefits.

Table 1
Pairwise treatment effects

Comparison	Treatment effect	$OR_{p>0.05}$ or $OR_{p<0.05}$	Balance after matching			Matched pairs
			F-test	pseudo R^2	mean s.bias	
wage subsidy vs. no treatment	0.13 ***	1.68	0.76	0.00	0.87	6257
wage subsidy vs. in-work benefit	0.094 ***	1.24	0.88	0.02	3.77	576
in-work benefit vs. no treatment	0.024	1.11	1.00	0.01	2.68	610
in-work benefit vs. wage subsidy	-0.115 ***	1.35	0.90	0.02	3.15	547

Single nearest neighbour matching without replacement and calliper of 0.001; linear propensity score; single person households only

* p<0.1 ** p<0.05 *** p<0.01

Next to the treatment effect we report the odds ratio on treatment participation necessary for an unobserved covariate to account for a significant treatment effect or to account for the result that no significant effect was determined (Rosenbaum 2002; Becker, Caliendo 2007). We only report the odds ratio necessary for the p-value to exceed the 0.05 level in the case of significant treatment effects and the odds ratio necessary to lead to a p-value of under 0.05 for insignificant treatment effects. Also we give an overview of the balancing property of the matching procedure by presenting an F-test of joint insignificance of the covariates in a logistic regression on the matched sample as well as the pseudo R^2 and the mean standardised bias (Rosenbaum, Rubin 1983).

As we can see from the Rosenbaum bounds, all of the significant treatment effects are reasonably robust with regard to unobserved heterogeneity. For example in the case of the wage subsidy versus no subsidy, an unobserved binary influence would have to raise the odds for receiving a wage subsidy by at least 1.68 and simultaneously influence employment stability to account for the observed treatment effect. The positive but insignificant effect of the in-work benefit compared to no subsidy, in contrast, would already be statistically significant if there were an unobserved covariate with an odds ratio of 1.11 or higher. For all of the comparisons, the matching led to a good balance, as can be seen from the F-test, the pseudo R^2 and the mean standardised bias[10].

All in all we can conclude that firstly, at least for the subgroup of single-person households and the two specific programmes that we are analysing, wage-subsidised jobs are more stable than non-subsidised jobs or jobs subsidised with an in-work benefit. In-work benefits in contrast have no effect on employment stability. The effectiveness of wage subsidise is all the more remarkable because we analyse employment status after 18 months, but the maximum duration of the wage subsidy including the follow-up period is 12 months whereas the maxi-

[10] Results from bivariate t-tests are shown in the appendix (Table 5). Further balancing tests were conducted and results are available from the authors on request.

mum duration of the in-work benefit is 36 months. So after 12 months formerly wage-subsidised jobs will have passed the market test and are transformed into regular employment relations while most jobs in the MZM (in-work benefits) will still be subsidised and it is not clear, whether they will continue when the subsidy expires.

In a next step we will analyse whether differences in firm characteristics can help to explain the observed effects of the wage subsidy and the missing effect of the in-work benefit.

4.2 Decomposing the treatment effects

Before we proceed to the decomposition of the pair-wise treatment effects we take a look at whether there is a remaining difference between the firm characteristics for subsidised and non-subsidised employees and for the two subsidies respectively if individual characteristics have been accounted for through propensity score matching. Since we rely on register data, we have only limited information available on the employing firms. For the decomposition analysis we can use information on the industry to which the firm belongs, the average wage paid by the firm, the share of low-skilled employment, and firm size.

Table 2 contrasts the averages of the firm characteristics in the treatment and control groups with the estimated treatment effects. It shows that there are significant differences between the different kinds of subsidies and the unsubsidised employees respectively. The positive average treatment effect of the wage subsidy is accompanied by employment in firms with lower average wages, a smaller share of low-skilled employees and smaller firm size[11] of the wage subsidy recipients. The effect of wage subsidies compared to in-work benefits on average goes along with wage subsidy recipients working in firms with higher average wages than the recipients of in-work benefits, but lower share of skilled labour and smaller firm size.

Table 2
Pairwise treatment effects and difference in firm characteristics after matching individual characteristics

Comparison	Treatment effect (t-value)	Average firm wage		Share of low skilled		Firm size	
		Treatment	Control	Treatment	Control	Treatment	Control
ws vs. not	0.13***	52,76	56.59	0.12	0.16	69.3	212.8
ws vs. iwb	0.094***	47,36	40,43	0.12	0.19	76,3	151.8
iwb vs. not	0.024	40.97	50.26	*0.19*	*0.19*	*173.6*	*233.3*
iwb vs. ws	-0.115***	40.31	47.95	0.19	0.12	149.6	80.5

ws: wage subsidy; iwb: in-work benefit; not: no treatment
Single nearest neighbour matching without replacement and calliper of 0.001; linear propensity score; single person households only
Numbers in italics indicate, that the difference between treatment and control group is statistically not significant at the 10% level
* p<0.1 ** p<0.05 *** p<0.01

[11] We do not present the differences in industry sectors (10 dummy variables) here to prevent our tables from becoming too crowded. The full table is available from the authors on request.

Despite the fact that there is no treatment effect of in-work benefits, its recipients tend to work in firms with average firm wages that are lower than those for non-subsidised employees. However, there is no significant difference in the share of low skilled or in firm size. The differences in firm characteristics revealed by a comparison of in-work benefit to wage subsidy recipients mirror those of the reverse comparison.

Having shown that there are significant differences in firm characteristics even after the matching, this does not necessarily mean that they are responsible for the observed treatment effects (or any missing effect). Therefore the decomposition analysis is performed next. The logistic regressions for computing the vectors $\hat{\beta}^k$ and $\hat{\beta}^l$ respectively are shown in the appendix (Table 6).

Table 3 again reports the pair-wise average treatment effects of receiving a wage subsidy, an in-work benefit or no subsidy at all. For each treatment effect we report the results of a decomposition using equations (eq1) and (eq2). They give the absolute amount of the treatment effect that is explained by the respective firm characteristics. Sensitivity checks indicate that the order in which the variables enter the decomposition has no influence the results.

Table 3
Decomposition of the pairwise treatment effects

Comparison	Treatment effect	Industry sectors	Average wage	Share of low skilled	Firm size	
ws vs. not	0.13***	0.009***	-0.006***	0.004***	-0.007***	eq1
		0.016***	-0.013***	0.001	-0.001	eq2
ws vs. iwb	0.094***	-0.002	0.024***	0.007	-0.018**	eq1
		0.007	0.021**	0.006	0.001	eq2
iwb vs. not	0.024	-0.013	-0.015	0.002	0.001	eq1
		0.000	-0.020**	0.000	-0.001***	eq2
iwb vs. ws	-0.115***	-0.023	-0.031***	-0.005	-0.001	eq1
		0.014	-0.017**	-0.007	0.002	eq2

Ws: wage subsidy; iwb: in-work benefit; not: no treatment
* p<0.1 ** p<0.05 *** p<0.01

When comparing wage subsidised with non subsidised employment, differences in the industry sectors of employment contribute significantly to the positive treatment effect of wage subsidies. Depending on which variant is used for the decomposition, between 1 and 1.6 percentage points of the effect can be attributed to the sorting into different industry sectors. The opposite is the case for differences in the average firm wage. If not for such differences, the treatment effect of wage subsidies would be between 0.6 and 1.3 percentage points higher. As for the share of low skilled and the firm size, results differ between (eq1) and (eq2), so we cannot be sure if there really is an influence of these firm characteristics.

When compared to in-work benefits, the effect of wage subsidies is to a large and significant part due to differences in the average wage in firms, where the two kinds of subsidised individuals work. More than 2 percentage points of the treatment effect of 9.4 percentage points,

this amounts to more than 20 percent, can be explained by such differences. Among the other firm characteristics only the firm size has a significant effect, but this holds only for decomposition equation (eq1).

For in-work benefits there is no significant effect on employment stability compared to non subsidised employment. However, at least according to results based on (eq2), without the sorting into firms of smaller firm size and lower average wage matters could be worse. Regardless of the decomposition variant, compared to wage subsidies, lower average firm wages explain a significant part of the negative treatment effect of in-work benefits.

So, to sum up, even though some results vary between the two variants of the decomposition, a clear pattern emerges for some of the variables. Above all, differences in the average firm wage are important for explaining part of the success or failure of the active labour market programmes wage subsidy and in-work benefit, since across all but one of the comparisons and for the two different decomposition variants, the explained part is always significantly different from zero. As for the other variables, their effect depends on which reference group is used for the decomposition. A notable exception is the industry sector variable in the decomposition of the wage subsidy versus no treatment comparison.

In section 3.2.2 we pointed out, that because of the nonlinearity of the regressions that are used here to compute the decomposition one might consider the logistic regression misspecified, if the x-variables are left out. Including them, however, does not change our results substantially. In all but one case individual characteristics do not contribute significantly to the treatment effect. In the case of "ws vs. iwb" there is a significant contribution, but it remains rather small (-0.5 of 9.4 percentage points). Including the x-variables mostly does not change the effect of the firm characteristics substantially. An exception is (eq2) of the comparison "iwb vs. not", where the significance of the effects disappear, thereby leading to similar results consistent with (eq1) of the same comparison.

5 Conclusions

For some instruments of ALMP programme participation always has to coincide with finding employment, so it always takes place in a certain firm-specific context. Since the receipt of a subsidy has an influence on which specific firms are regarded as possible employers, it is not quite clear, to what extent positive or negative programme effects on labour market integration depend on the specific characteristics of the firms that employ subsidised individuals. To shed light on this question we conducted a two step analysis, firstly computing the average treatment effect on the treated and secondly decomposing this effect with regard to the characteristics of the firms in which the subsidised and unsubsidised persons are employed.

The results from our analysis lead to the conclusion that firm characteristics do have an influence on the success of employment subsidies. They can strengthen positive effects or mitigate negative effects. However, the part of the treatment effects that is explained by firm characteristics ranges from very small to a considerable 52 percent. Of the firm characteristics under consideration here, average firm wages have the strongest impact on programme success.

Lower average firm wages tend to lead to lower job stability, as we can see from Table 6 in the appendix. Therefore, if a programme is accompanied by a sorting into firms which offer lower wages on average than other firms, this will reduce the effectiveness of this programme. For example, although wage subsidies lead to a treatment effect of about 13 percentage points compared to unsubsidised employment, this effect would be slightly larger (0.6 or 1.3 percentage points, depending on the specific decomposition) if it were not for the lower average wage in firms that employ workers on wage subsidies. On the other hand, the effect would be smaller if workers on wage subsidies were not sorted into sectors with relatively high employment stability. In-work benefits, in contrast, would be slightly less ineffective, if there were no sorting into firms with low average wages.

Concerning the design and the implementation of labour market programmes, these results highlight the fact that the success of active labour market instruments is also influenced by the companies on the demand side of the labour market. So the quality of the pool of firms willing to employ subsidised workers is also crucial to the success of ALMP and justifies intensive efforts of caseworkers to gain attractive employers.

Finally there are two points worth mentioning. Firstly we were only able to use the firm characteristics that were included in the register data. These were limited to industry sector, average firm wage, share of low-skilled workers and firm size. So we cannot rule out there being other aspects of the job which are important for employment stability but which could not be controlled here, for example workplace characteristics (e.g. Brown, McIntosh 2003). Therefore not all of the unexplained part of the treatment effects is necessarily to be attributed to the treatment(s) alone.

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Appendix

Table 4
Logistic regressions for estimating the propensity scores

	Odds Ratio (exp β)			
	ws vs. not	ws vs. iwb	iwb vs. not	iwb vs. ws
Sex	1.093**	0.311***	3.573***	3.218***
Age	1.429***	1.351***	1.176***	0.740***
Age^2	0.995***	0.996***	0.998***	1.005***
Desired working time (full time)				
No preference	1.031	0.689*	1.491*	1.451*
Part time	0.907	0.280***	2.753***	3.574***
participation in short term training in last 7 years: yes	1.775***	1.122**	1.306***	0.891**
work experience (caseworker's assessment): yes	0.984	0.834*	1.237**	1.199*
participation in EGZ in last 7 years	1.257***	1.750**	0.585**	0.571**
participation in a job creation measure in last 7 years	0.762	0.717***	1.018	1.395***
participation in a further training measure in last 7 years	1.156***	0.919	1.115	1.088
duration of past unemployment spell	1.002***	0.998***	1.001**	1.002***
duration of past unemployment spell^2	1.000***	1.000	1.000	1.000
Not German citizen	0.919	0.781	1.282	1.280
Qualification level (caseworker's assessment): top executive;				
workers with university degrees;	0.828	1.943	0.649	0.515
workers with other higher education qualifications;	1.140	10.509**	0.136*	0.095**
skilled workers with technical college qualifications;	1.166	3.776	0.486	0.265
workers with specialised knowledge	1.061	1.266	1.335	0.790
workers without specialised knowledge	0.768	0.711	1.583	1.407
days in employment in last 7 years (cumulated)	1.000	1.000	1.000	1.000
days in employment in last 7 years (cumulated)^2	1.000	1.000	1.000	1.000
days in measurement in last 7 years (cumulated)	1.001***	1.000	1.001**	1.000
days in measurement in last 7 years (cumulated)^2	1.000***	1.000	1.000	1.000
reason for cancelation of last employment (employer)				
employee	1.085	0.802	1.055	1.246
cancelation agreement	1.106	0.479***	1.709**	2.089***
limitation	0.839***	0.918	0.750**	1.089
Not canceled	1.128	0.691	1.617	1.447
other	1.000	1.600	0.714	0.625
not known	1.025	0.853	1.055	1.172
Wage (last job)	0.996***	1.017***	0.983***	0.983***
Wage (last job)^2	1.000	1.000***	1.000	1.000***
Average wage in firm (last job)	1.001	1.009***	0.993***	0.991***
Average wage in firm (last job) ^{2}	1.000	1.000**	1.000*	1.000**
Firm size (last job)	1.000	1.000	1.000	1.000
Share of unskilled in firm (last job)	0.964	0.822	1.066	1.217
Health problems (caseworker's assessment)	0.904	0.562***	1.422**	1.778***
Social security benefit (unemployment benefit)				

	Odds Ratio (exp β)			
	ws vs. not	ws vs. iwb	iwb vs. not	iwb vs. ws
Unemployment assistance	0.623***	0.380***	1.882***	2.634***
Maintenance allowance	1.098	1.607	0.913	0.622
Region classification I (Population Density): Core cities in regions with major agglomerations				
Very densely populated districts in regions with major agglomerations	1.364***	1.433*	0.795	0.698**
Densely populated districts in regions with major agglomerations	1.408***	1.589**	0.857	0.629**
Rurally structured districts in regions with major agglomerations	1.378***	0.984	1.336	1.016
Core cities in regions with conurbational features	1.101	0.674***	1.430**	1.483***
Densely populated districts in regions with conurbational features	1.594***	1.546***	0.967	0.647***
Rurally structured districts in regions with conurbational features	1.510***	1.725***	0.910	0.580***
Densely populated districts in rurally structured regions	1.293***	1.371*	0.956	0.729*
Rurally structured districts in rurally structured regions	1.268***	2.033***	0.523***	0.492***
unknown	1.042	1.008	0.895	0.992
Region classification II (Labour Market): Areas mainly in eastern Germany with a dominant job deficit				
Areas characterised by big cities, mainly in western Germany, with high unemployment	1.473***	1.677***	0.954	0.596***
Areas in western Germany with average unemployment	0.672***	0.958	0.798**	1.044
Centres in western Germany with a good labour market situation and strong dynamics	1.267**	1.367	1.497	0.732
Areas in western Germany with a good labour market situation and strong dynamics	0.528***	0.764**	0.843	1.308**
Region classification I according to Görmar, Irmen (1991), classification II according to Blien et al. 2007				
* p<0.1 ** p<0.05 *** p<0.01				
cases	19973	12355	9315	12355
Pseudo R^2	0.0913	0.2461	0.1966	0.2461
Prob > Chi^2	0.0000	0.0000	0.0000	0.0000

Figure 2
Common support wage subsidy vs. no treatment

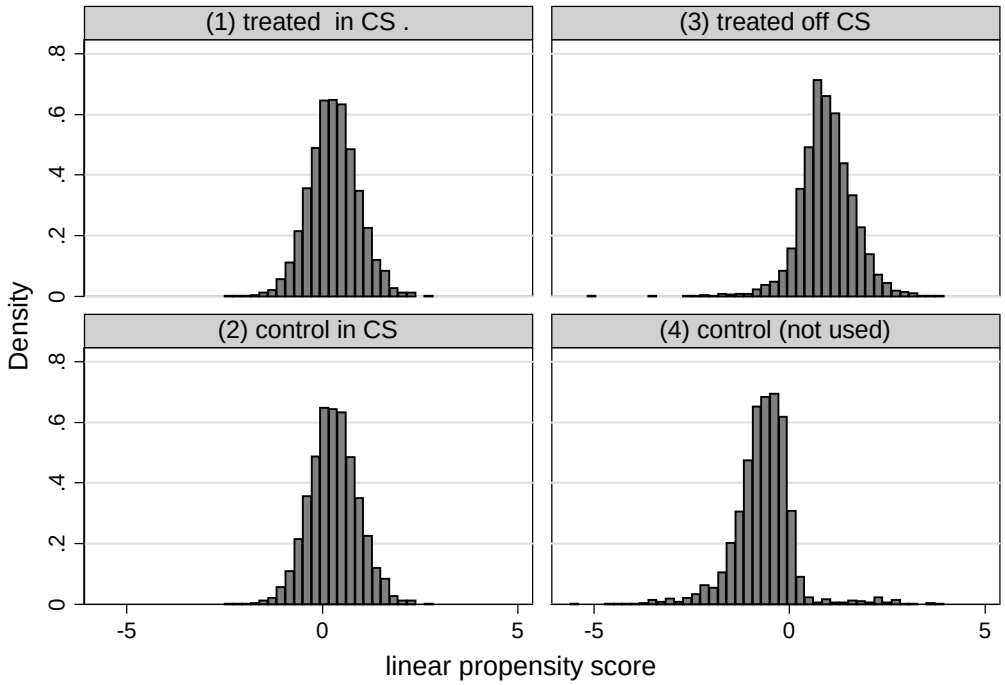

Figure 3
Common support wage subsidy vs. in-work benefit

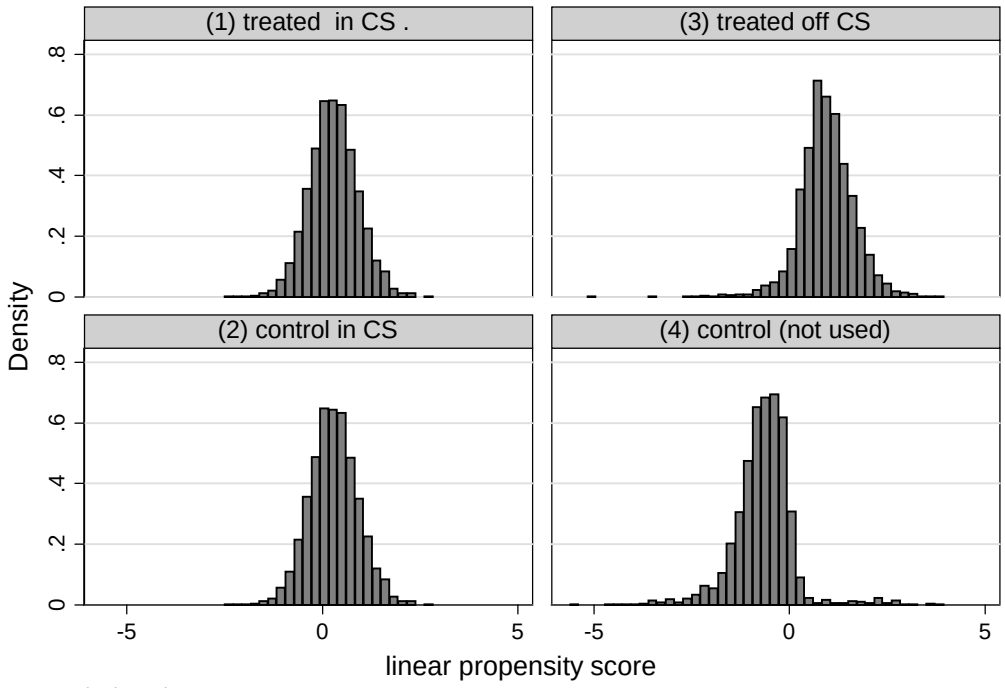

Figure 4
Common support in-work benefit vs. no treatment

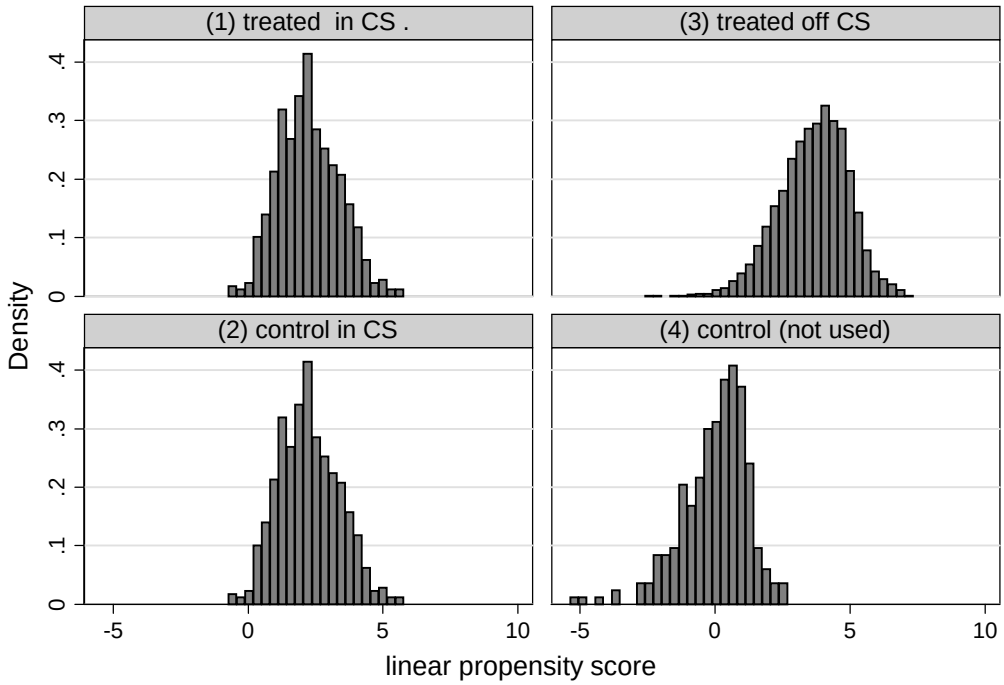

Figure 5
Common support in-work benefit vs. wage subsidy

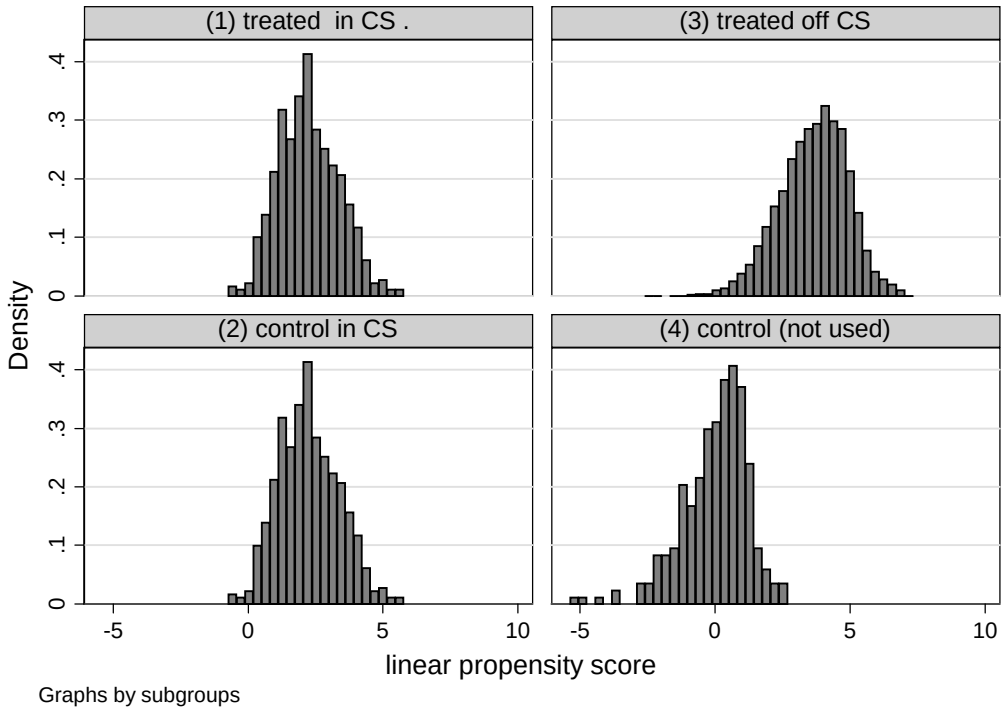

Table 5
T-test for equality of means in the unmatched and matched sample

		ws vs not		ws vs iwb		iwb vs not		iwb vs ws	
		t	p	t	p	t	p	t	p
Sex	unmatched	-2.26	0.024	-20.23	0.000	19.07	0.000	20.23	0.000
	matched	0.08	0.936	-1.18	0.239	-0.29	0.775	1.06	0.288
Age	unmatched	4.83	0.000	-6.94	0.000	7.68	0.000	6.94	0.000
	matched	-0.23	0.815	1.74	0.082	-0.48	0.630	-0.74	0.461
Age^2	unmatched	0.79	0.429	-9.02	0.000	7.70	0.000	9.02	0.000
	matched	-0.00	0.996	1.73	0.083	-0.37	0.710	-0.79	0.432
Desired working time: full time	unmatched	1.16	0.244	11.99	0.000	-10.86	0.000	-11.99	0.000
	matched	0.19	0.846	-0.45	0.655	-0.97	0.334	0.45	0.655
No preference	unmatched	-0.47	0.637	-6.56	0.000	6.62	0.000	6.56	0.000
	matched	-0.24	0.814	0.18	0.856	0.55	0.586	-0.00	1.000
Part time	unmatched	-1.38	0.168	-11.37	0.000	9.04	0.000	11.37	0.000
	matched	0.00	1.000	0.50	0.615	0.82	0.410	-0.73	0.464
participation in short term training in last 7 years: yes	unmatched	25.80	0.000	-0.06	0.955	11.95	0.000	0.06	0.955
	matched	1.53	0.126	0.16	0.874	1.10	0.272	0.20	0.841
work experience (caseworker's assessment): yes	unmatched	-4.74	0.000	-3.98	0.000	1.85	0.065	3.98	0.000
	matched	0.41	0.681	-0.41	0.680	0.46	0.644	1.76	0.079
participation in EGZ in last 7 years	unmatched	8.05	0.000	3.25	0.001	-0.54	0.587	-3.25	0.001
	matched	-0.19	0.848	0.44	0.663	0.99	0.324	-0.58	0.565
participation in a job creation measure in last 7 years	unmatched	0.30	0.767	-6.32	0.000	6.52	0.000	6.32	0.000
	matched	1.06	0.291	0.83	0.408	-1.39	0.164	-1.45	0.148
participation in a further training measure in last 7 years	unmatched	13.33	0.000	-3.14	0.002	9.53	0.000	3.14	0.002
	matched	0.14	0.886	0.54	0.589	0.11	0.914	-0.45	0.651
duration of past unemployment spell	unmatched	2.85	0.004	-20.80	0.000	17.72	0.000	20.80	0.000
	matched	-1.26	0.209	0.46	0.643	-0.06	0.954	-0.87	0.383
duration of past unemployment spell^2	unmatched	-4.01	0.000	-16.86	0.000	12.58	0.000	16.86	0.000
	matched	-3.47	0.001	-0.40	0.688	0.25	0.803	0.16	0.876
Not German citizen	unmatched	-4.81	0.000	-3.36	0.001	1.30	0.195	3.36	0.001
	matched	0.44	0.658	0.58	0.563	-0.41	0.684	-0.15	0.882
workers with university degrees;	unmatched	-0.26	0.792	2.61	0.009	-2.76	0.006	-2.61	0.009
	matched	0.27	0.787	0.63	0.528	-0.90	0.368	-0.22	0.826
workers with other higher education qualifications;	unmatched	2.55	0.011	4.15	0.000	-3.57	0.000	-4.15	0.000
	matched	0.47	0.636	0.45	0.654	.	.	0.58	0.564
skilled workers with technical college qualifications;	unmatched	2.12	0.034	4.60	0.000	-4.11	0.000	-4.60	0.000
	matched	-0.34	0.734	0.28	0.781	0.28	0.781	-0.28	0.781
workers with specialised knowledge	unmatched	8.82	0.000	8.44	0.000	-4.80	0.000	-8.44	0.000
	matched	-1.05	0.296	-0.55	0.579	-0.95	0.345	0.56	0.578
workers without specialised knowledge	unmatched	-11.38	0.000	-14.40	0.000	8.98	0.000	14.40	0.000
	matched	0.97	0.330	0.32	0.752	1.20	0.229	-0.51	0.612

		ws vs not		ws vs iwb		iwb vs not		iwb vs ws	
		t	p	t	p	t	p	t	p
days in employment in last 7 years (cumulated)	unmatched	8.88	0.000	17.81	0.000	-13.78	0.000	-17.81	0.000
	matched	-1.55	0.120	-1.13	0.258	-0.19	0.852	0.44	0.660
days in employment in last 7 years (cumulated)^2	unmatched	8.12	0.000	15.85	0.000	-12.63	0.000	-15.85	0.000
	matched	-1.39	0.166	-1.03	0.304	0.25	0.800	0.36	0.722
days in measurement in last 7 years (cumulated)	unmatched	13.78	0.000	-5.20	0.000	11.64	0.000	5.20	0.000
	matched	0.57	0.569	0.40	0.690	-0.03	0.975	-0.55	0.585
days in measurement in last 7 years (cumulated)^2	unmatched	7.33	0.000	-4.63	0.000	7.06	0.000	4.63	0.000
	matched	0.56	0.575	-0.04	0.972	-0.29	0.773	-0.26	0.796
reason for cancelation of last employment: employer	unmatched	2.83	0.005	7.99	0.000	-6.66	0.000	-7.99	0.000
	matched	-0.95	0.343	0.24	0.811	0.41	0.680	0.91	0.365
employee	unmatched	1.30	0.194	-0.47	0.635	0.83	0.407	0.47	0.635
	matched	0.48	0.628	0.27	0.788	0.97	0.334	-0.52	0.602
cancelation agreement	unmatched	0.03	0.978	-1.61	0.107	1.76	0.079	1.61	0.107
	matched	0.54	0.590	0.86	0.391	0.41	0.680	-1.20	0.230
limitation	unmatched	-8.47	0.000	-1.65	0.098	-1.61	0.108	1.65	0.098
	matched	0.70	0.483	0.16	0.875	-1.30	0.194	-1.07	0.286
Not canceled	unmatched	0.83	0.407	0.27	0.791	-0.01	0.996	-0.27	0.791
	matched	-0.54	0.588	-1.52	0.130	0.00	1.000	0.84	0.403
other	unmatched	0.16	0.871	1.59	0.111	-1.28	0.201	-1.59	0.111
	matched	-0.00	1.000	-0.45	0.654	0.38	0.705	-0.38	0.705
not known	unmatched	3.00	0.003	-7.43	0.000	8.46	0.000	7.43	0.000
	matched	0.23	0.821	-0.44	0.661	0.06	0.952	0.50	0.614
Wage (last job)	unmatched	-0.19	0.853	12.38	0.000	-16.05	0.000	-12.38	0.000
	matched	-0.36	0.720	0.62	0.535	0.58	0.561	-1.09	0.275
Wage (last job)^2	unmatched	0.67	0.500	0.94	0.346	-10.70	0.000	-0.94	0.346
	matched	0.07	0.944	-0.38	0.704	0.59	0.554	0.41	0.682
Average wage in firm (last job)	unmatched	-3.10	0.002	7.19	0.000	-8.30	0.000	-7.19	0.000
	matched	0.19	0.847	0.35	0.728	-0.23	0.818	-0.01	0.991
Average wage in firm (last job)^2	unmatched	-2.53	0.011	3.99	0.000	-4.37	0.000	-3.99	0.000
	matched	0.41	0.685	-0.11	0.911	-0.13	0.897	0.44	0.664
Firm size (last job)	unmatched	-2.18	0.029	0.89	0.371	-1.64	0.101	-0.89	0.371
	matched	0.30	0.760	1.11	0.267	-0.16	0.871	1.29	0.196
Share of unskilled in firm (last job)	unmatched	-7.54	0.000	-5.45	0.000	2.19	0.028	5.45	0.000
	matched	-0.20	0.840	-0.40	0.689	0.69	0.491	0.66	0.512
Health problems (caseworker's assessment)	unmatched	-2.64	0.008	-10.40	0.000	8.46	0.000	10.40	0.000
	matched	-0.29	0.772	-0.64	0.524	0.11	0.915	0.37	0.710
Social security benefit: unemployment benefit	unmatched	1.23	0.218	21.10	0.000	-20.38	0.000	-21.10	0.000
	matched	0.00	1.000	-1.43	0.153	0.58	0.563	0.60	0.549
Unemployment assistance	unmatched	-3.02	0.003	-22.64	0.000	20.79	0.000	22.64	0.000
	matched	-0.09	0.928	1.56	0.120	-0.47	0.642	-0.48	0.629
Maintenance allowance	unmatched	4.89	0.000	1.64	0.102	0.15	0.878	-1.64	0.102
	matched	0.27	0.787	-0.45	0.652	-0.50	0.615	-0.41	0.680
Region classification I (Population Density): Core cities in regions with major agglomerations	unmatched	-2.65	0.008	-2.68	0.007	1.77	0.076	2.68	0.007
	matched	1.28	0.202	-2.40	0.017	-0.78	0.434	0.23	0.820

		ws vs not		ws vs iwb		iwb vs not		iwb vs ws	
		t	p	t	p	t	p	t	p
Very densely populated districts in regions with major agglomerations	unmatched	-2.59	0.010	1.17	0.242	-2.30	0.022	-1.17	0.242
	matched	0.16	0.871	0.00	1.000	0.66	0.511	0.12	0.903
Densely populated districts in regions with major agglomerations	unmatched	0.85	0.396	1.08	0.280	-1.03	0.305	-1.08	0.280
	matched	0.94	0.346	0.23	0.817	0.64	0.524	-0.56	0.578
Rurally structured districts in regions with major agglomerations	unmatched	1.61	0.108	-1.69	0.090	2.30	0.022	1.69	0.090
	matched	-0.42	0.671	0.45	0.654	0.13	0.900	-0.34	0.733
Core cities in regions with conurbational features	unmatched	-3.59	0.000	-8.37	0.000	6.53	0.000	8.37	0.000
	matched	-0.28	0.780	-0.42	0.674	0.48	0.632	0.25	0.800
Densely populated districts in regions with conurbational features	unmatched	2.30	0.021	2.74	0.006	-1.65	0.099	-2.74	0.006
	matched	-0.62	0.538	0.39	0.697	0.38	0.703	0.31	0.754
Rurally structured districts in regions with conurbational features	unmatched	3.20	0.001	2.47	0.014	-1.40	0.160	-2.47	0.014
	matched	-0.83	0.408	1.03	0.304	-0.39	0.697	0.29	0.768
Densely populated districts in rurally structured regions	unmatched	-1.31	0.189	0.48	0.629	-0.99	0.325	-0.48	0.629
	matched	-0.24	0.812	1.12	0.261	0.09	0.926	-0.86	0.391
Rurally structured districts in rurally structured regions	unmatched	0.18	0.855	3.89	0.000	-3.84	0.000	-3.89	0.000
	matched	-0.07	0.947	-0.66	0.511	-0.97	0.331	0.00	1.000
unknown	unmatched	2.88	0.004	0.27	0.784	0.79	0.427	-0.27	0.784
	matched	0.00	1.000	0.92	0.357	-0.16	0.874	0.51	0.607
Region classification II (Labour Market): Areas mainly in eastern Germany with a dominant job deficit	unmatched	15.19	0.000	2.53	0.011	3.72	0.000	-2.53	0.011
	matched	-0.61	0.539	0.29	0.768	-0.46	0.646	-0.12	0.906
Areas characterised by big cities, mainly in western Germany, with high unemployment	unmatched	8.19	0.000	1.68	0.093	1.67	0.095	-1.68	0.093
	matched	0.75	0.455	1.12	0.265	-0.20	0.840	-0.21	0.833
Areas in western Germany with average unemployment	unmatched	-8.81	0.000	-1.28	0.200	-2.28	0.022	1.28	0.200
	matched	0.10	0.921	-1.17	0.242	-0.06	0.949	0.68	0.498
Centres in western Germany with a good labour market situation and strong dynamics	unmatched	2.17	0.030	-0.04	0.964	1.04	0.297	0.04	0.964
	matched	0.47	0.636	-0.94	0.347	0.35	0.728	-0.81	0.416
Areas in western Germany with a good labour market situation and strong dynamics	unmatched	-16.78	0.000	-3.54	0.000	-3.29	0.001	3.54	0.000
	matched	-0.07	0.944	0.48	0.633	0.70	0.486	-0.08	0.936
Mean standardised bias	unmatched	6.65		19.63		20.06		19.63	
	matched	0.88		3.77		2.68		3.15	
Pseudo R^2	unmatched	0.090		0.246		0.199		0.246	
	matched	0.002		0.024		0.012		0.024	

Table 6
Logistic regressions for estimating the coefficients β^k and β^l for the decomposition analysis in the matched samples

	ws vs. not		ws vs. iwb		iwb vs. not		iwb vs. ws	
	ws	not	ws	iwb	iwb	not	iwb	ws
Industry Sectors (Nace)								
0	0.466**	1.043***	-0.507	-1.214	-0.874	0.511	-1.046	0.402
1	-0.231	0.490**	-0.329	1.158	0.729	-0.281	1.332	-0.203
2	0.071	0.049	-0.157	0.317	-0.042	-0.188	0.549	0.360
R: 3								
4	0.894***	0.865	0.644	1.506	1.171	1.161	+++	1.173*
5	0.229*	0.109***	-0.232	0.382	0.096	0.077	0.533	0.163
6	0.406***	0.169	0.348	-0.061	-0.081	0.802	0.103	-0.068
7	0.471***	0.592***	0.191	0.712	0.590	0.113	0.849	0.395
8	0.036	-0.032	-0.410	0.268	-0.056	-0.501	0.612	0.098
9	0.320*	0.218	-0.598	-0.036	-0.053	-0.116	0.095	-0.448
Average wage in firm	-0.008***	-0.012***	-0.014***	-0.016***	-0.008	-0.010**	-0.019***	-0.009**
Share of low skilled	0.486***	0.147	0.536	0.688	0.548	0.056	0.434	0.446
Firm size	0.000***	0.000	-0.002**	0.000	0.000	0.000	0.000	0.000
Constant	0.268*	1.097***	1.256**	1.031	0.800	1.436**	0.982	0.528

Ws: wage subsidy; iwb: in-work benefit; not: no treatment

* p<0.1 ** p<0.05 *** p<0.01

+++ Industry sector 4 predicted "failure" in this estimation perfectly, the respective observations were discarded

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Imprint

IAB-Discussion Paper 18/2008

Editorial address
Institute for Employment Research
of the Federal Employment Agency
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