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Wage effects of labor market entry via temporary work agency employment - evidence for German apprenticeship graduates

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Wage effects of labor market entry via temporary work agency employment

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evidence for German apprenticeship graduates

Tanja Buch^(a), Annekatrien Niebuhr^{(a),(b)}

Abstract

In light of the remarkable number of young people who pass through a period of temp work at the beginning of their career the question arises whether labor market entry via temporary work agency (TWA) employment has any (persistent) effects on labor market outcomes. We investigate this issue using a unique dataset that contains information from the German apprenticeship system which is merged with the employment biographies of more than 8,000 apprenticeship graduates for the 1999-2007 period. We apply propensity score matching and the control function approach in order to analyze the wage gap and the medium-term wage effects of TWA employment. Our results point to a rather pronounced wage gap and persistent adverse wage effects. But we detect no significant wage disadvantage for graduates who switch to regular employment. An important percentage of graduates who enter the labor market via a temp spell does, however, not manage to permanently leave the TWA sector and thus has to bear persistent wage penalties.

Key Words: temporary work agency employment, labor market entry, apprenticeship graduates, wages, Germany

JEL: C21, J31, J42

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1. Introduction

The importance of temporary work agency (TWA) employment has – although starting from different levels and with different pace – increased considerably in most OECD-countries in recent years. In 2010, 10.4 million agency workers were employed by TWAs across the globe (CIETT 2012). The TWA sector employed about 1.6% of the EU working population in 2010. The penetration rate for agency work in the USA is even higher and amounts to 2.2% while the share in Japan is about 1.5% (Ibid.). A characteristic structural feature of temporary agency work is the low average age of employees. In most OECD-countries, the majority is aged below 30, implying that this age group is significantly over-represented in TWA industry compared to total work force (Arrowsmith 2006). Apparently, TWA employment often serves as a first professional experience for young workers (CIETT 2012).

In light of the remarkable number of young people who pass through a period of temp work at the beginning of their career the question arises whether labor market entry via temporary agency work has any (persistent) effects on labor market outcomes. To the best of our knowledge, no theoretical and empirical research has so far been devoted to this issue. However, there are two relevant strands of literature as regards the impact of TWA work at the beginning of working life. The first group of investigations deals with the effects on individual labor performance providing evidence on the wage outcome of TWA work (e.g. Jahn 2010; Segal and Sullivan 1998; Forde and Slater 2005; Autor and Houseman 2010; Lane, Mikelson, Sharkey, and Wissoker 2003) or on the question whether TWA employment serves as a “stepping stone” to regular employment for unemployed (e.g. Graaf-Zijl, van den Berg, and Heyma 2011; Amuedo-Dorantes, Malo, and Muñoz-Bullón 2008; Ichino, Mealli, and Nannicini 2008).

The second important strand of literature deals with labor market entry of young workers and stresses the transition from education to work as an important phase with far-reaching consequences for people’s employment biography (e.g. Mroz and Savage 2006; Skans 2011). In many OECD-countries young workers face severe problems in this phase such as unemployment, over-education or atypical forms of employment (Müller and Gangl 2003; Müller and Shavit 1998; Roberts, Clark, and Wallace 1994). The current economic crisis has even amplified these problems. Labor market entrants, mainly in Southern European countries, face youth unemployment rates of more than 50 % and suffer from such poor labor market prospects that they are called a new “lost generation”.

The rising importance of TWA work for young workers might likewise reflect difficulties of labor market entry for young workers coming along with significant effects on labor market outcomes. We merge the drafted two strands of literature and provide some evidence on the impact of TWA employment after vocational training on contemporaneous and on future individual wages compared to job starters in regular employment. In order to arrive at unbiased wage effects of labor market entry via TWA employment we apply propensity score matching and the control function approach to account for the fact that the selection of graduates into TWA employment and regular jobs is not random. Our study bases on a unique German micro data set that contains detailed individual information on socio-economic characteristics of graduates of a vocational training and on their early career. The remainder of this paper is organized as follows. In section 1 we discuss theoretical considerations regarding short- and medium-term wage effects of TWA work at the transition from education to work. In section 2 we review the existing empirical literature and in section 3 we introduce the data. Section 4 describes the empirical methods used to investigate the issue, whereas in section 5 we present and discuss the results of the empirical analysis. Section 6 summarizes the main findings and concludes.

2. Theoretical considerations

Pertaining to both effects of TWA work on contemporaneous and on future wages the theoretical expectations are not clear-cut. As regards contemporaneous wages, the theory of compensating differentials (Rosen 1986) suggests that we should observe relatively high earnings of TWA workers since temps face undesirable job characteristics like markedly short tenure (Antoni and Jahn 2009) and high unemployment risk (Segal and Sullivan 1998). Job instability implies less intra-firm career advancement opportunities and training (Kvasnicka and Werwatz 2002). Temporary workers should thus be compensated for the accumulation of these negative job attributes by a wage markup.

According to human capital theory (Becker 1964) employment spells in TWA can be regarded as an investment in human capital. By TWA work graduates gain work experience and may develop labor market contacts that might result in stable employment with higher remuneration (Houseman, Kalleberg, and Erickcek 2003). As the returns to these investments in terms of wage growth accrue largely to the worker, he or she also has to bear the costs by accepting lower wages (Jahn 2010; Kvasnicka and Werwatz 2002). Moreover

temps tend to be employed below their qualification level, which may result in a lower remuneration as well. The low bargaining power of TWA workers might also cause a wage penalty. Unionization in the TWA industry is very low (Segal and Sullivan 1998) and the short job tenures preclude the formation of groups of “insiders” with accordant bargaining power (Lindbeck and Snower 1989). Consequently, firms may pay wages below the productivity of temps (Blank 1998).

All these arguments for a lower remuneration of TWA workers do, however, raise the question why some graduates with similar productivity accept a TWA job instead of choosing regular employment.¹ According to job search theory workers have to cope with imperfect information on the labour market, i.e. regarding the characteristics of vacant jobs (Mortensen 1986). This might apply in particular to young workers before labour market entry. The relevant information must be acquired and evaluated in a costly search process before a worker will accept a job offer. As a consequence of search costs no graduate will wait infinitely for the best available employment opportunity. Young graduates whose information on the labor market is particularly limited might thus accept TWA work as the currently best possible option, especially if they face the risk of a significant unemployment spell at the beginning of their career. Whether a graduate starts with a regular or a TWA job may thus to some extent be governed by accident. In this setting we likely observe significant wages differences for identical workers.

Another argument for a wage discount of temp workers refers to their productivity (Jahn 2010). That might be lower as employers likely invest less in training and capital equipment to enhance temp`s productivity while temps may be less career-oriented or less motivated and therefore have fewer incentives to invest in job- or firm-specific human capital. However, if all TWA workers have a lower productivity than regular employed people neither contemporaneous nor future wage penalties can be explained by TWA work. The causal effect of TWA work on labor market outcomes refers to workers of the same level of productivity. Due to data restrictions it is hard to ensure that only wages of identical workers are compared in corresponding empirical research.

As regards the future wage effects of temp spells there are some reasons to expect that former TWA workers should receive at least the same remuneration as directly hired

¹ This issue has so far been largely neglected in the literature on wage effects of TWA employment.

workers. According to the literature on the stepping stone effect TWA jobs may lead to stable and well paid employment by providing both work experience and multiple contacts with potential employers through successive placements (Kvasnicka 2009). While workers can thus signal their ability to employers, clients can likewise screen TWA workers for direct-hire positions without the attendant risk of litigation in case of a bad job match (Autor 2009).² Since it is not possible to infer the productivity of labor market entrants from their past labor market trajectory, this argument should be of particular importance for graduates (Göbel and Verhofstadt 2008). If the client firm takes over a former temp worker, it is likely that he or she will get same wage as similar, directly hired workers (Houseman et al. 2003).

Moreover, if employment in the temporary help sector can be regarded as an investment in human capital, as argued e.g. by Houseman et al. (2003), this investment should pay off in future career. Given this assumption one may even imagine that young people intentionally choose a period of temporary work instead of a regular³ job because TWA employment offers the opportunity to accumulate human capital and this in turn gives rise to favorable income perspectives (Jahn 2010). Graduates may also be able to gather useful information about occupations they are well suited for (Segal and Sullivan 1998) that together with training may result in better job matches and wage growth (Jahn 2010).

However, human capital theory also provides arguments for a lasting wage penalty of a temp spell. Due to the short duration of employment spells in the TWA industry neither the client firm nor the TWA might have strong incentives to invest into the human capital of temps. Thus their participation in training programs tends to be below average (Kvasnicka and Werwatz 2002). Besides, the short average duration of assignments in the client firms may also inhibit learning by doing / training on the job. Moreover, TWA workers are at risk of becoming stigmatized as potential employers under incomplete information may perceive a temp spell as an indicator of low productivity and motivation that triggers fewer job offers or offers with relatively low wages (Blanchard and Diamond 1994). TWA work at the beginning of the career might thus cause a “scarring effect” (OECD 1998) meaning that the scar of a

² According to Houseman (2001) 21% of employers in U.S. who use temporary agency work mention screening of prospective employees as an important reason.

³ We refer to social-security employment outside the temporary help industry as regular employment. Regular employment is in this context understood as a terminological convention as workers in the German temporary help industry do enjoy the same employment protection and worker rights as other workers under the provisions of general labor and social security law (Kvasnicka 2009).

non-smooth labor market entry via TWA employment is visible as unfavorable working conditions throughout the entire career. Temporary work has in this context to be discussed not only as a probable stepping stone but also as a potential “trap” that impedes access to regular and well paid employment.

In sum, theory offers no clear-cut implication with respect to the wage effects of temp spells. The various and opposed theoretical arguments leave the determination of the wage effect of labor market entrance via temporary work as a task for empirical research.

3. Previous Research

A high unemployment risk of young people mainly in the Southern European countries and in the USA as well as an increasing share of graduates who need to accept flexible employment forms at the beginning of their work life (Buchholz and Kurz 2008) reflect the difficulties young labor market entrants are currently confronted with. Non-smooth transitions from education to work tend to have lasting adverse effects on the employment biography. Evidence for scarring effects of an unemployment spell at the beginning of work life is e.g. documented by the OECD (1998) and Mroz/Savage (2006). As for the consequences of labor market entrance via atypical employment different studies also indicate scarring effects (see e.g. Esteban-Pretel, Nakajima, and Tanaka (2011) for the impact of contingent work on the chances to find a regular job; Gebel (2010) for the impact of fixed-term employment on wages and repeated fixed-term employment and Buchholz and Kurz (2008) for the impact of fixed term employment on unemployment risk). There is however some evidence that the disadvantages seem to disappear in the medium term (e.g. McGinnity, Mertens, and Gundert 2005; Esteban-Pretel et al.2011; Gebel 2010).

While several studies deal with the consequences of labor market entrance via atypical employment, none of them investigates the effects of TWA employment. A number of studies deals with the effects of TWA work on wages, none of them does however refer to the labor market entrance. As regards the contemporaneous wages of temporary workers most studies detect a wage gap of TWA workers compared to regular workers. Using US-data Segal and Sullivan (1997, 1998) estimate a wage penalty of between 5 to 10% after controlling for characteristics of workers and jobs and for non-temp opportunities respectively. Their findings are confirmed by several European studies. According to Forde and Slater (2005) the wage gap in the UK ranges between 6% (women) and 11% (men). Using

Portuguese data, Böheim and Cardoso (2009) identify a wage gap between one and nine percent comparing temps to observationally similar workers in non-temporary help jobs - young temps however actually realize a small wage mark-up.

The difference in contemporaneous wages seems to be even higher in Germany:⁴ Kvasnicka and Werwatz (2002) estimate a wage gap of 12% for men and 10% for women. A study by Jahn (2010) suggests that TWA workers earn about 15% less. She takes into account the distinct composition of temps and regular workers as well as the workers' employment biography. In a recent study, Jahn and Pozzoli (2011) estimate a wage gap of roughly 20% for men and 14% for women. Moreover, their findings indicate that the wage gap decreases with the number of weeks spent in TWA employment. Workers thus seem to be able to accumulate human capital in the TWA sector.

As for the effects of TWA work on future wages, studies arrive at very different conclusions.⁵ Some studies indicate that the wage penalty of former temps disappears some time after leaving the TWA sector. Jahn (2010) shows that TWA worker in Germany receive the same remuneration as comparable directly hired workers 2 years after leaving the sector. Kvasnicka and Wertwatz (2002) arrive at similar results investigating the effects of TWA work on wages five years after leaving the sector. According to Jahn and Pozzoli (2011) the wage penalty tends to disappear after four quarters.

There are, however, some studies that point to a lasting wage penalty. Böheim and Cardoso (2009) find some evidence that temps aged above 26, in particular males, have to fear a lower wage progression of about 1% to 4% compared to workers with no temp employment spell. Findings by Autor and Houseman (2010) suggest that moving low-skilled welfare participants into temporary help jobs fails to improve employment outcomes in the U.S.,

⁴ Although having the same employment protection and worker rights TWA worker in Germany hardly have same payment and working conditions as the permanent staff in the user firm. That goes back to the fact that TWA can deviate from the principle of equal pay and equal treatment in case of applying the conditions stipulated in a sectoral collective agreement – an opportunity nearly 97% of all TWA use (Antoni and Jahn 2009). Since union density is very low and earnings in the sector were as a consequence partly very poor a minimum wage has been determined in the beginning of 2012 and social partners have received the order to find an agreement about the arrangement of an equal pay acknowledgment.

⁵ Ambiguous empirical evidence also marks the role of TWA work as a stepping stone to regular employment. Whereas several studies conclude that temporary help jobs are an effective stepping stone toward regular employment (e.g. Lane et al. 2003 for the USA; Jahn and Rosholm 2010 for Denmark) other investigations offer no evidence in favor of the springboard function of TWA employment (Kvasnicka 2009 for Germany; Amuedo-Dorantes et al. 2008 for Spain; Graaf-Zijl et al. 2009 for the Netherlands). Findings in Ichino et al. (2008) suggest that the effect of TWA work on labor market outcomes in Italy depends on the region under consideration.

and, on net, may even moderately lower earnings over the follow-up seven quarter period. In contrast, placements in direct-hire jobs raise participants' earnings substantially. Results of Lane et al. (2003) and Addison, Cotti, and Surfield (2009) basically confirm the results of Autor and Houseman (2010).

Other studies suggest that the earnings prospects of temps crucially depend on whether they manage to leave the sector. Jahn and Rosholm (2010) find for workers in Denmark who had become temps after a period of unemployment that they achieve a higher likelihood to get a well-paid job than people who stayed unemployed – but only if they get a regular job while being employed in the TWA industry. Workers who do not find regular employment before they leave the sector and become unemployed again are more likely to end up with low-paid jobs than those who did not previously hold a temp job. Heinrich, Mueser, and Troske (2009) and Andersson, Holzer, and Lane (2009) provide corresponding evidence for the US.

We will close the research gap between the two discussed strands of literature by providing evidence on the effect of a labor market entrance via TWA work on contemporaneous and future wages of young graduates. Besides we compare the mid-term wage prospects of temps who manage to leave the TWA sector to those staying in it. This item has not been analyzed with German data so far.

4. Database

We use a unique dataset to identify the effects of TWA work after graduation on young workers' contemporaneous wages and future earnings. The *Vocational Training Panel Saarland* merges information from the Integrated Employment Biographies (IEB) of the Institute for Employment Research (IAB) with information from the German apprenticeship system. The IEB represent around 80% of the German workforce⁶ and consist of administrative event history data on employment and unemployment spells, on spells of job search and participation in active labor market programs (for a detailed description see Jacobebbinghaus and Seth 2007). Since the notification procedure for social security requires employers to record any change of employment relationships, the employment register contains detailed information on employment history for each worker's time in covered

⁶ No information is available on times of employment not liable to social security (e.g. civil servants or self-employed).

employment. The data contain a range of individual socio-economic characteristics (e.g. age, gender, qualification and nationality), on the employing firm (e.g. branch, size, location) and on the current employment (e.g. occupation, tenure, wage). Identification of temps is possible via the sector classification. Thus we cannot distinguish TWA workers from agencies' permanent administrative staff, which accounts for 5% to 7% of agency staff (Antoni and Jahn 2009). The wage information refers to gross daily wages at an annual reference day (June 30).⁷ Our analysis focuses on full-time employees.

We assemble a unique dataset by supplementing the IEB with data on individuals from the Chamber of Industry and Commerce and the Chamber of Crafts that is thought to be of particular importance for the labor market entry. Firstly, the data include detailed information on the school certificate. We distinguish between individuals with a lower, medium and upper secondary school certificate. Moreover, the population includes individuals with no school certificate (school dropouts) and graduates who attended other types of schools than the above mentioned. Secondly, the data provided by the chambers contain evidence on the quality of vocational skills: we have access to grades of the final theoretical and practical exams. In addition, we dispose over information on the individual apprenticeship occupation, on the date of graduation and on the size and industry of the apprenticeship firm. Trainees at members of professions (e.g. doctor's assistants) and trainees of school-based vocational education schemes (e.g. child care worker) are not included in the sample. However, about 80% of all graduates of the German apprenticeship system⁸ are covered by our dataset.

The sample is based on all workers who successfully finished an in-firm vocational training in the German state Saarland in the 1999-2002 period. Our information on the career history of the graduates covers the years until 2007. There are 216 workers in the dataset who passed an at least 3 months spell in TWA employment during the first two years after graduation, 94 of them with a temp spell in the first year after graduation.⁹

⁷ The IEB, being of administrative nature, are very useful for wage analyses as the contained wage information is used to calculate social security contributions and therefore very reliable. As contributions to the social security system have to be paid only up to a threshold, the wages are right-censored. However, for this analysis the censoring does not pose a problem because top coding is rarely observed for young medium-skilled workers.

⁸ For more detailed information on the apprenticeship system see Hoeckel and Schwartz (2010).

⁹ See for an overview of the sample characteristics table A1 in the appendix.

5. Methodological issues

We aim at investigating the wage difference of TWA work and whether temp spells at the beginning of the career have lasting wage effects. In other words, we are interested in how much a temp would earn as a worker employed in other industries and whether a temp spell has persistent causal impacts on the remuneration later in the labor market biography. We interpret labor market entry via TWA work as a treatment and apply methods which are frequently used to investigate corresponding effects, i.e. propensity score matching as proposed by Rosenbaum and Rubin (1983) and the control function approach which goes back to a seminal paper by Heckman (1978).

5.1 Matching

We distinguish two different types of treatment. Firstly, in order to estimate the wage gap of temp workers we define a treatment as having a TWA job at the reference date in the first year after graduation. Secondly, as regards the medium-term effects of TWA work the treatment refers to cumulative TWA employment of at least 3 month during the first 2 years after graduation.¹⁰ In the latter case, the binary variable that describes the treatment status of young workers is given by D , with $D = 1$ indicating that the graduate experienced TWA employment of at least 3 month. The variables Y_0 and Y_1 denote the potential or actual outcome according to treatment status, i.e. the wage without and with treatment of TWA employment spells. In order to determine the causal effect of TWA employment on wages we aim at the average treatment effect on the treated (ATT):

$$\tau_{ATT} = E[Y_1|D=1] - E[Y_0|D=1] \quad (1)$$

where $E[Y_0|D=1]$ is the counterfactual, i.e. the outcome without TWA spell for those individuals who received the treatment. The fundamental evaluation problem arises because we cannot observe the counterfactual outcome. Furthermore, comparing the sub-population averages of the treatment group and the non-participants likely results in a selection bias since both groups tend to have different wages even in absence of TWA work due to observable or unobservable characteristics such as age, (non-)cognitive skills and motivation. The graduates that enter the labor market via TWA work are not a random

¹⁰ Some collective agreements include a fixed-term employment in the training firm of up to two years after graduation. Thus, for some graduates TWA employment as a first job becomes an option not earlier than several months after graduation. Therefore we interpret the apprenticeship-to-work-transition rather as a phase than as certain point in time. Moreover, this definition of transition allows for a period of job search.

sample of the population, but are selected according to characteristics that also affect the wage level. This means that $E[Y_0|D=1] \neq E[Y_0|D=0]$, in other words we expect that the average wage of the group experiencing TWA work would significantly differ from the remuneration of the group not-experiencing TWA work even if both groups did not experience TWA work.¹¹

We can use the observed wages of a control group as an estimate of the counterfactual wage of the treated workers for the case of no treatment only if the conditional independence assumption (CIA) holds:

$$Y_1, Y_0 \perp D \mid X \quad \text{or} \quad Y_1, Y_0 \perp D \mid p(X) \quad (2)$$

where $p(X)$ is the propensity score and X observable characteristics of the young workers. The propensity score is the probability of experiencing TWA employment and used as balancing score in order to avoid “curse of dimensionality” that arises when the vector X comprises many influential factors. The conditional distribution of X given $p(X)$ is independent of the assignment to the treatment (see Heckman, Ichimura, and Todd 1998). For participants and non-participants with the same propensity score, the distributions of the covariates X are the same: they are balanced across the groups.

If the CIA holds, the wages of non-treated graduates have, conditional on $p(X)$, the same distribution that temps would have experienced if they had not undergone a TWA employment spell after graduation. Thus, we assume that the selection into TWA employment after apprenticeship training depends on observable factors, i.e. our dataset includes all variables that affect the treatment and the outcome simultaneously (see Caliendo and Kopeinig 2008). There are good reasons to believe that the CIA is plausible in this analysis, since our dataset is particularly rich in important aspects of the selection process and results. We have detailed information on the young workers, including socio-economic variables, the educational attainment and information on their apprenticeship training. Especially the final grades of the apprenticeship exams should allow to describe the selection process into TWA work more precisely than former studies that had to leave the impact of (non-)cognitive competences on the labor market outcomes an issue of unobservable heterogeneity. As we investigate a treatment that coincides with the

¹¹ See Caliendo and Hujer (2006) for a detailed discussion.

apprenticeship-to-work transition the labor market history of individuals cannot matter for the selection into treatment. Furthermore, we consider a relatively homogeneous group of workers as regards the skill-level, age and period of graduation. And finally, apprenticeship training takes place within same local labor market and we can restrict the analysis to those workers who stay in the region after graduation.¹²

Furthermore, the analysis should ensure that there is a suitable control unit for each treated graduate. In other words, we assume for all observable characteristics X there is a positive probability of not participating for the treated. This implies that there are no perfect predictors which determine TWA spells and refers to overlap or common-support condition:

$$0 < Pr(D=1 | X) < 1 \quad (3)$$

We only consider observations on support throughout the analysis. If the CIA holds and under common support we can identify the ATT as:¹³

$$E[Y_1 | D=1] - E[Y_0 | D=1] = E_{p(X)|D=1} [E(Y_1 | p(X), D=1) - E(Y_0 | p(X), D=0)] \quad (4)$$

This means that we construct the missing counterfactual wage from the wages of the control units where the selection of appropriate non-participants is governed by the propensity score. Given the large and informative set of pre-treatment variables it seems plausible to assume we can identify adequate control units.¹⁴

5.2 Control function approach

As the time elapsed since labor market entry becomes longer the importance of the labor market history of the young workers for the wage level should increase. This might pose a problem for the identification of the medium-term effects with the matching approach since we cannot take into account the employment biography when applying propensity score matching. The importance of the previous employment biography for labor market outcomes is stressed by several authors (e.g. Kvasnicka and Werwatz 2002). In order to

¹² The importance of information originating from the same local labor market is emphasized by Heckman, Ichimura, and Todd (1997) who note that the failure to locate treated and control units in the same region is a major source of bias.

¹³ See e.g. Caliendo, and Kopeinig (2008).

¹⁴ We do not discuss the stable-unit-treatment-value-assumption (SUTVA) in detail and assume that labor market entry via TWA employment of graduates does not have any impact on the wages of other young workers. Violation of the assumption is unlikely because in the period under consideration the average share of workers with a TWA spell after graduation was 2.7%.

check the robustness of our results we therefore investigate the wage effects of temp spells with the control function approach. The wage equation of the approach is given by:

$$Y_{it} = \beta' Z_{it} + \gamma D_i + \varepsilon_{it} \quad (5)$$

where Y_{it} is the log of the daily wage for worker i in year t , Z_i is a vector of observed worker and job characteristics. The error term is ε_{it} . As socio-demographic controls we include a gender dummy, the age of the young worker, the squared age, citizenship dummies¹⁵, the school certificate (5 categories), the theory and practice grade of the apprenticeship exam, 15 apprenticeship occupations, 6 industries of apprenticeship firms, month and year of the graduation and a dummy indicating whether the apprenticeship firm is member of the Chamber of Industry and Commerce or of the Chamber of Crafts. We also consider if an apprenticeship occupation is female-dominated by including the average percentage of female graduates in the occupation. With respect to the current job we take into account the firm size, 6 occupation groups and 6 industries and whether current employment is in the apprenticeship firm. The employment biography is controlled for by the cumulative duration of unemployment and tenure (also squared and cubic). The binary variable D_i indicates whether graduate i belongs to the treatment group ($D_i = 1$) or enters the labor market via a regular job. The model also includes year, state and region type dummies.

If selection into TWA employment is non-random, OLS estimation of γ will suffer from a selection bias due to the correlation between D_i and ε_i (see Heckman, Hotz, and Dabos 1987). The endogenous treatment variable D_i is defined according to the following binary response model:

$$D_i^* = X_i \delta + u_i \quad (6)$$

where the vector X_i includes the covariates used in the estimation of the propensity score, i.e. both a set of graduate characteristics as well as information on the apprenticeship training and the apprenticeship firm. Following Heckman et al. (1987) we interpret D_i^* as an unobserved index of the net benefit of a TWA job. The selection into treatment is governed by this decision rule:

$$D_i = \begin{cases} 1, & \text{if } D_i^* > 0 \\ 0, & \text{otherwise} \end{cases} \quad (7)$$

¹⁵ We differentiate between Germans, Italians, Turks and other foreign nationalities.

We apply the two-stage and maximum likelihood (ML) procedures developed by Heckman (1978, 1979) to estimate the wage effect of the treatment and to account for selection on observables and unobservables. In principle the vector X_i may include all covariates in Z_i . But in the present analysis we allow the vector to differ since the wage some years after labor market entry will be influenced by the employment biography that simply cannot impact on the earlier selection into treatment. Identification requires, however, at least one variable in the selection equation (6) which is not included in the wage equation (5). We need a reliable exclusion restriction, which explains the selection into TWA work but does not influence the wage level of the young workers. We use the size of the apprenticeship firm and the length of the apprenticeship training as exclusion restrictions since they impact on the likelihood of a temp spell after graduation but do not significantly influence the wage level of young workers.

6. Estimation Results

6.1 Quality of the matching procedure

We first apply propensity score matching in order to determine the wage difference between young temps and regular workers as well as the medium-term wage effects of TWA employment after graduation. A probit model is applied to estimate the propensity scores for TWA spells. Variables that simultaneously influence the selection into TWA work and the individual wage level are considered in the matching procedure. The results of different probit-estimations are summarized in Table A.2 in the appendix. The selection into treatment is influenced by different groups of variables, first of all by the educational attainment of the workers and the quality of the apprenticeship training. The likelihood of a temp spells significantly increases for workers with no or lower secondary school leaving certificate. Moreover, the grade of the apprenticeship exam is an important predictor and should reflect the relevance of productivity and motivation in this context. We also consider a number of specific apprenticeship occupations such as electronics technician or clerk that are characterized by an above average probability of TWA employment. An occupation marked by a high share of male workers significantly increases the likelihood of a temp spell in the early career. Characteristics of the apprenticeship firm and whether the first work contract is with the apprenticeship firm also matter. Figure A.1 in the appendix displays the distribution of propensity scores for the treatment and the non-treatment group for the

wage effects after 3 years. It is obvious that for the majority of young workers the likelihood of working in a TWA is fairly low. Furthermore, all graduates with a TWA spell are on support, i.e. there are always non-participants with a comparable propensity score that might be used to build a control group.

{{Place Table 1 about here}}

Table 1 and A.3 (in the appendix) summarize some measures that provide information on the quality of the matching procedure. In Table A.3 we display the results of t-tests that are used to compare the distribution of observable characteristics between the treatment group and the graduates with no temp spell before and after matching. The results refer to the medium-run wage effects 3 years after graduation.¹⁶ Before matching 22 variables show significant mean differences between treated and non-treated whereas after matching there are no significant differences at all. This applies also to the analyses for the contemporaneous wage difference and the wage penalty 4 and 5 years after graduation as summarized in Table 1. The table provides additional information on the considerable bias reduction that is achieved by the matching approach. However, with respect to the medium-run wage effects the bias reduction remains slightly above the values discussed in the literature.¹⁷ And finally, as proposed by Sianesi (2004), we estimate the propensity score on the matched sample. The sharp decline of the pseudo R^2 and corresponding differences in the likelihood-ratio tests of the joint significance of all regressors confirm that there are no systematic differences in the distribution of the covariates between both groups after matching. So to sum up, the matching procedures have thus been rather successful.

6.2 Wage gap

The results of our analyses suggest that wages of graduates in TWA employment are significantly lower than wages of young workers employed outside this industry. The raw wage gap amounts to 20.4 euros in the first year after graduation. This is almost 33% of the average wage of young full time workers. The estimated wage gaps in the matched samples applying different matching algorithms are depicted in Table 2. The wage gap ranges between 19.3 euros and 19.8 euros. This corresponds with a relative gap of almost 31% up

¹⁶ The evidence on balancing for the wage gap and the wage effects 4 and 5 years after labor market entry are very similar and available from the authors upon request.

¹⁷ Caliendo and Kopeinig (2008) note that in the empirical literature a bias reduction to a maximum of 5% is seen as sufficient.

to 32%. Thus, considering systematic differences in characteristics of the employees only slightly decreases the wage gap.¹⁸ This indicates that the selection bias is rather small in this case. This is in contrast to findings provided by Jahn (2010) and Jahn and Pozzoli (2011). The latter report a raw wage difference of almost 40 euros (41%) for German workers. Moreover, the earnings gap decreases significantly to 14% up to 20% if the selection is taken into account.¹⁹

{{Place Table 2 about here}}

The significant differences between our estimates and the evidence provided by Jahn (2010) and Jahn and Pozzoli (2011) could be due to the rather homogenous group of workers we consider here. Firstly, other studies tend to investigate the wage effects for all skill levels. If the skill level is not controlled for rather pronounced raw wage gaps will show up, i.e. larger differences than just for one skill group as in our case. Secondly, huge wage differences in the population of other studies may be explained by seniority-based pay. Experts in regular employment may receive higher payment due to tenure and working experience while employers have lower incentives for seniority-pay to comparable temps who are besides less likely to show long job tenures. For the population of our study seniority-based payment is irrelevant due to the age structure and the short duration of the career. Therefore the raw wage differences as well as its reduction achieved by taking into account the selection are smaller. Although the results with respect to the distribution of covariates before and after matching indicate that young temps and regular workers are characterized by systematic differences, the importance of these differences for the wage gap seems to be smaller than for older workers of different qualification levels.

The results of the matching procedure are confirmed by the regression results in the lower part of Table 2. The size of the wage gap estimated by OLS does not differ by much from the disparity identified by propensity score matching. Applying an OLS regression we estimate an unadjusted wage gap of 31%. When we take into account the selection into TWA employment by means of the control function approach the wage disadvantage even increases up to 45% depending on the estimator and whether the employment biography is

¹⁸ The significant wage gap that we estimate for German graduates is in contrast to evidence on wage differences for young workers in Portugal provided by Böheim and Cardoso (2009). Their findings indeed suggest that young temps realize a wage mark-up.

¹⁹ Jahn (2010) detects a wage gap of 15%.

controlled for. The increase of the wage gap is surprising but in line with evidence on the wage effect of fixed-term contracts in Hagen (2002).

In order to investigate the robustness of our wage gap estimates with respect to potential unobserved heterogeneity we also apply a simulation approach proposed by Ichino et al. (2008). The method allows investigating the sensitivity of the estimates with respect to a possible violation of the CIA. The basic idea is to simulate the impact of a binary confounding variable that is not considered in the matching procedure. The distributions of different observed variables are used to simulate unobserved confounders and their influence on the ATT estimate. The results are summarized in Table 3. The variable that is used to simulate the unobserved factor is given in the first column. The second and the third column show the impact of a corresponding confounder on the untreated outcome and the selection into TWA employment. The effects are computed as odds ratios. To allow for presentation as odds ratios we follow the approach proposed by Nannicini (2007) and transform our continuous outcome variable to a binary variable using $I(Y > y^*)$, where y^* is the average wage. For values larger than one a value smaller than one points to a negative effect and vice versa. The last column shows the ATT (with standard errors in parentheses) if we take into account an additional confounder with a similar distribution as the variable specified in column one.

{{Place Table 3 about here}}

The result in the first row replicates the estimate of the wage gap in case of no unobserved heterogeneity applying nearest neighbor matching. According to the result the wage gap is highly significant and amounts to 19.6 euros (see also Table 2). In the absence of unobserved heterogeneity there is of course no effect on the outcome and the selection into treatment. In the second row we simulate the impact of an unobserved confounder that has the same distribution as the gender dummy. The identified wage gap even slightly increases when considering the existence of a corresponding variable. The impact on the wage level and on the selection into TWA employment is negative. This means that a corresponding unobserved term tends to decrease both the daily wage of graduates and the probability of labor market entry via a temp spell. A threat to our baseline results should come from an unobserved confounder which would impact negatively (positively) on the wage simultaneously increasing (decreasing) the likelihood of a temp spell. In particular the

qualification variables (school certificate, grades of apprenticeship exam) and specific apprenticeship occupations tend to produce such differentiated effects on outcome and selection. The corresponding ATTs indicate that our estimates are rather robust. If the distribution of an unobserved confounder resembles the distribution of different important binary variables that we consider in the estimation of the propensity score the detected wage gap does not change significantly. Altogether we might therefore conclude that our estimates are robust against violation of the CIA due to neglected unobserved determinants of wages and selection into TWA work.²⁰

6.3 Medium-term wage effects

For the sake of lucidity we only present matching estimates of medium-term wage effects that base on the Kernel matching algorithm. Other algorithms produce similar ATT results.²¹ Table 4 shows the wage differences between the treatment and the control group 3 up to 5 years after graduation. The difference in remuneration between the two groups is much smaller than the wage gap immediately after labor market entry. The wage effect varies between 6.8 euros and 8.7 euros in the baseline approach where we consider all available observations. This corresponds with a relative gap of 9.7% up to 12.5%.²² After graduation some young workers might leave the local labor market and wage differences between migrants and immobile graduates might thus be influenced by the characteristics of local labor markets. We investigate whether corresponding effects influence our results by restricting the dataset to the immobile young workers. As they are all employed in the region we need not control for disparities in labor market conditions. The corresponding estimates in the second row of Table 4 indicate that restricting the analysis to the same local labor market slightly increases the detected wage impact of the TWA spell after graduation.

²⁰ We display between-imputation standard errors that are lower than the default ones. However, we refrain from a detailed discussion of the significance. Nannicini (2007) argues that interpretation of the simulation results should focus on the differences between the point estimates rather than on the significance level of the simulated treatment effects.

²¹ Corresponding results are available from the authors upon request. Important differences only show up for nearest neighbour matching. The wage effect tends to be smaller and does not significantly differ from zero in certain cases.

²² This is in line with corresponding OLS estimates that point to a wage difference of 9% up to 11.5%. Results of the simulation analysis proposed by Ichino et al. (2008) indicate that the findings on the long-term wage effects are robust with respect to a possible violation of the CIA. All results are available from the authors upon request.

Moreover, confining the control group to workers with the same apprenticeship grade as the treated graduates (third and fourth row) does not give rise to major changes either.²³

{{Place Table 4 about here}}

The persistent impact of labor market entry via TWA employment might, however, be due to those graduates who do not succeed in leaving the sector. The share of such stayers in the treatment group ranges between 27% and 33% three up to five years after graduation.²⁴ Thus the question arises whether we detect any persistent effects of labor market entry via TWA work. Do the graduates have to accept a wage reduction even if they manage to leave the TWA sector? If the graduates in TWA employment are able to accumulate human capital to the same extent as outside the sector and do not suffer from a significant depreciation of human capital, we might expect that they receive the same wages after they leave the sector as comparable graduates with a career in regular employment. The main counterargument here is that TWA employment might stigmatize workers. In this case one would expect agency workers to receive lower wages when they move to a regular job. To examine this issue we estimate the wage effect after excluding those workers that are still employed in a TWA. The corresponding results in the last row of Table 4 indicate that the persistent wage disadvantage is indeed brought forth by this group. When the stayers are removed from the dataset the wage differences between the treated graduates and the non-treated decrease dramatically. The remuneration does not differ significantly between treated and controls for all time spans after graduation that we investigate.

However, as outlined in Section 5 the results from the matching approach suffer from one important drawback: we cannot control for the employment biography of the graduates that will increasingly influence labor market outcomes as the time span since graduation becomes larger. Moreover, the impact of the employment biography might point to some indirect effects of TWA work that we cannot detect with the matching estimator. As a reference we first display in Table 5 the OLS estimates with socio-demographic controls and job characteristics as explanatory variables including the stayers. According to these estimates the wage gap amounts to 9.2% and 11.5% up to five years after graduation. When we also consider the selection effect by applying the control function approach the wage

²³ We only consider the grades “satisfactory” and “pass” here because the number treated individuals with better grades is fairly small.

²⁴ We only consider the treated with an employment spell to calculate the percentages of stayers.

difference increases notably up to 43% for the two-step procedure and almost 24% in case of the ML estimates. By contrast, taking into account the employment biography considerably reduces the estimated wage differences. But still some significant gaps emerge. Finally, the bottom rows of Table 5 show the wage difference if we exclude the stayers in TWA from the dataset. The results of the matching procedure pointing to no important stigma effects are confirmed by the regression results as we detect no significant wage differences between treated and control group.

{{Place Table 5 about here}}

7. Conclusion

The empirical literature on apprenticeship-to-work transition has so far neglected labor market entry via TWA employment and its impact on the early career of graduates. Neither have by now the numerous studies that investigate the consequences of TWA spells on individual labor market performance considered the specific situation of young workers after graduation. The rapidly increasing percentage of TWA work and the above average share of young workers among the temps call for corresponding evidence. Applying propensity score matching and the control function approach to a unique dataset that offers very interesting information on young individuals, such as final grades for the completed apprenticeship degree, we investigate the wage gap of young temps in Germany and the medium-term wage effects of labor market entry via TWA employment.

Young temps are not compensated for accepting unfavorable working conditions as assumed by the theory of compensating differentials. In fact, we detect a considerable wage discount of between 30 and 45% (depending and the used method) that according to our data otherwise comparable graduates in the TWA industry have to accept. This is much higher than the average gap determined in some recent studies that cover all age and skill groups in Germany pointing to differences of at most 20%. Moreover, the selection bias is of minor importance for our rather homogenous sample of apprenticeship graduates. Whereas the raw wage gap roughly halves in most studies if the non-random selection into TWA work is taken into account, our estimates rather indicate a positive selection of the graduates. This raises the question whether the function of TWA employment differs significantly across age groups. More precisely, firms may use TWA work primarily as recruitment device if

graduates are considered, whereas other tasks dominate for older workers. Therefore young workers might accept a relatively high wage penalty as a compensation for the placement service and the possibility to achieve work experience and labor market contacts.

The recruitment argument is also in line with the lasting wage effects. Apprenticeship-to-work transitions via temp jobs also do not seem to stigmatize young workers. We detect no persistent wage effects for those graduates that are able to leave the TWA sector. This confirms the findings of previous studies. Furthermore, the disappearance of the wage gap that we observe for those who quit the sector is inconsistent with a significant depreciation of their human capital while TWA employment. The catching-up process might also indicate some kind of investment in human capital– at least for the workers who manage to permanently leave the TWA sector.

However, when discussing the lasting effects of labor market entry via TWA work we have to consider that a significant share of the graduates does not succeed in getting a stable regular employment. So far, we focused on rather direct stigma effects on the wage level. As regards those graduates who seem to be trapped in TWA work, stigma might as well refer to the possibility of getting a job outside the TWA sector. In this sense there are likely important lasting effects for a sizable share of young workers. We are not able to disentangle all the direct and indirect effects on individual labor market outcomes that are linked to a TWA spell after graduation. The evidence on a direct scar effect with respect to the wage level is rather weak. But there might be indirect wage effects of TWA work caused by the impact of TWA work on the employment biography, i.e. on tenure and unemployment experience which in turn influence the remuneration.²⁵ In this context it is also important to remember that the graduates who are somehow trapped in TWA work are by no means low-skilled workers. All of them managed to successfully complete their apprenticeship training.

²⁵ A simple regression analysis with tenure and cumulative unemployment experience as dependent variables points to a strong relationship. Corresponding results are available upon request.

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Tables and Figures

Table 1: Matching quality

Before matching				After matching		
Different indicators						
	Pseudo R ²	LR-Test	Mean standardized Bias	Pseudo R ²	LR-Test	Mean standardized Bias
Wage gap (T=1)	0.181	164.3***	19.3	0.021	5.1	4.5
T=3	0.165	207.2***	17.8	0.035	13.6	6.4
T=4	0.193	224.9***	20.9	0.039	13.7	7.3
T=5	0.183	216.4***	20.4	0.035	12.3	6.2
t-test of equal means ^{a)}						
Significance level	1%	5%	10%	1%	5%	10%
Wage gap (T=1)	12	3	5	0	0	0
T=3	12	3	3	0	0	0
T=4	14	1	7	0	0	0
T=5	12	4	6	0	0	0

Source: Vocational Training Panel Saarland, Institute for Employment Research, own calculations.

Notes: a) Results referring to the t-test of equal means give the number of covariates which differ significantly between treated and controls. The number of observable variables varies between 40 and 43, including interaction terms in order to achieve balancing as proposed by Caliendo and Kopeinig (2008).

Table 2: Causal effects of TWA employment on wage gap in first years after graduation

Results of matching approach	wage gap	Effect in %	t-statistic
<i>Matching algorithm</i>			
Nearest Neighbour			
One nearest	-19.6	-31.3	-8.03
10 nearest	-19.3	-30.8	-11.82
Caliper with replacement			
Caliper 0.001	-19.8	-31.6	-8.05
Caliper 0.01	-19.6	-31.3	-6.64
Kernel (Gaussian)	-19.6	-31.3	-12.6
Stratification	-19.5	-31.1	-14.7
Regression results	coefficient	Effect in %	t-statistic
OLS ^{a)} - raw	-0.37	-31.1	-18.48
OLS ^{a)} - no employment biography	-0.35	-29.7	-16.63
OLS ^{a)} - with employment biography	-0.39	-32.0	-17.95
<i>Control function approach</i>			
Two-step ^{b)} - no employment biography	-0.44	-35.7	-4.61
Two-step ^{b)} - with employment biography	-0.61	-45.5	-7.48
ML ^{c)} - no employment biography	-0.44	-35.5	-4.09
ML ^{c)} - with employment biography	-0.56	-43.1	-8.88

Source: Vocational Training Panel Saarland, Institute for Employment Research, own calculations.

Notes: a) t-statistics of OLS results base on robust standard errors. Results with clustered standard error and random effects estimates do not significantly differ from the OLS estimates displayed in the table.

b) t-statistics of two-step estimates base on bootstrapped standard errors.

c) t-statistics of ML estimates base on robust standard errors.

Table 3: Sensitivity of wage gap to unobserved heterogeneity – simulation approach

Confounder	Influence of unobserved confounder on		ATT (S.E.)
	Outcome	Selection	
No unobserved heterogeneity	0	0	-19.638 (1.563)
Confounder with an influence like...			
Female	0.176	0.574	-19.975 (0.220)
School dropouts	0.910	3.623	-19.586 (0.192)
Lower secondary school	0.688	1.674	-19.585 (0.128)
Medium secondary school	1.652	0.638	-19.553 (0.137)
Upper secondary school	0.966	0.173	-19.646 (0.134)
Grade theory “Good”	1.301	0.219	-19.481 (0.155)
Grade theory “Satisfactory”	1.141	1.129	-19.650 (0.097)
Grade theory “Pass”	0.738	2.140	-19.530 (0.220)
Turkish	1.372	4.093	-19.620 (0.158)
Occupation with share of males > 70%	5.800	2.161	-20.077 (0.247)
Component adjuster	3.443	24.967	-19.707 (0.502)
Clerk office communication	0.683	1.770	-19.624 (0.111)
Graduation year 1999	0.538	0.660	-19.708 (0.105)

Source: Vocational Training Panel Saarland, Institute for Employment Research, own calculations.

Note: Reported results are achieved by using sensatt.ado (see Nannicini, 2007) using a Kernel matching algorithm and refer to outcome variable daily wage measured in euros.

Table 4: Medium-term wage effects of labor market entry via TWA employment – result of propensity score matching

<i>Matching algorithm:</i>	t=3			t=4			t=5		
	Effect	Effect in %	S.E.	Effect	Effect in %	S.E.	Effect	Effect in %	S.E.
Kernel (Gaussian)									
Baseline estimates	-7.42***	10.6	1.60	-6.81***	9.3	1.77	-8.74***	11.4	1.86
Same regional labor market	-8.70***	12.4	1.97	-7.28***	9.9	1.85	-9.16***	12.0	2.17
Grade “Satisfactory”	-11.08***	15.8	3.72	-11.43***	15.6	3.13	-7.59	9.9	3.97
Grade “Pass”	-5.93***	8.5	2.21	-3.62	4,9	2.64	-8.08***	10.6	2.72
No persistent temporary agency work	-0.59	0.84	2.29	-2.35	3.2	2.26	-3.80	5.0	1.97

Source: Vocational Training Panel Saarland, Institute for Employment Research, own calculations.

Note: *** significant at 1 % level.

Table 5: Medium-term wage effects of labor market entry via TWA employment – results of control function approach

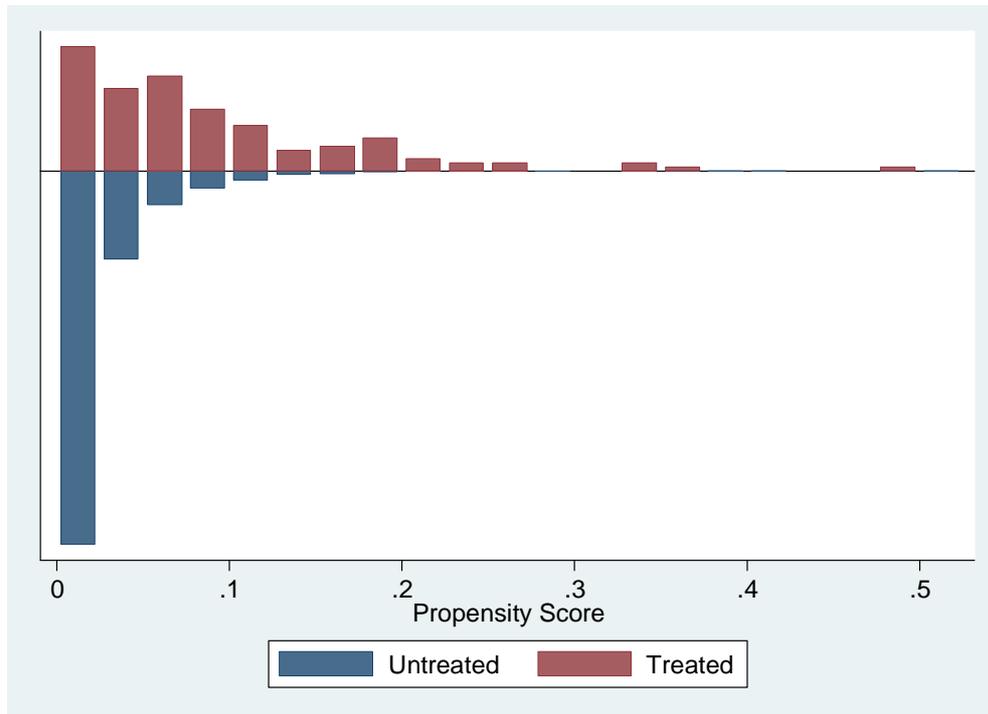
Regression results	coefficient	Effect in %	t-statistic
OLS ^{a)} – no employment biography			
T = 3	-0.12	-11.5	-4.04
T = 4	-0.10	-9.2	-3.09
T = 5	-0.12	-11.0	-3.81
OLS ^{a)} – with employment biography			
T = 3	-0.04	-3.9	-1.72
T = 4	-0.02	-2.0	-0.93
T = 5	-0.02	-1.5	-0.66
<i>Control function approach</i>			
Two-step ^{b)} – no employment biography			
T = 3	-0.48	-38.3	-5.29
T = 4	-0.50	-39.4	-5.6
T = 5	-0.57	-43.0	-6.14
Two-step ^{b)} – with employment biography			
T = 3	-0.19	-17.5	-2.37
T = 4	-0.12	-11.3	-1.48
T = 5	-0.17	-15.8	-2.09
ML ^{c)} – no employment biography			
T = 3	-0.20	-17.7	-3.77
T = 4	-0.20	-18.1	-3.19
T = 5	-0.27	-23.9	-3.70
ML ^{c)} – with employment biography			
T = 3	-0.09	-8.8	-1.75
T = 4	-0.09	-8.5	-1.10
T = 5	-0.11	-10.3	-1.41
No persistent temporary agency work			
Two-step ^{b)} - with employment biography			
T = 3	-0.17	-15.3	-1.50
T = 4	-0.01	-0.5	-0.04
T = 5	-0.11	-10.5	-0.98
ML ^{c)} - with employment biography			
T = 3	-0.07	-6.9	-0.80
T = 4	-0.01	-0.5	-0.04
T = 5	-0.10	-9.9	-0.72

Source: Vocational Training Panel Saarland, Institute for Employment Research, own calculations.

Notes: a) t-statistics of OLS results base on robust standard errors. Results with clustered standard error and random effects estimates do not significantly differ from the OLS estimates displayed in the table.
b) t-statistics of two-step estimates base on bootstrapped standard errors.
c) t-statistics of ML estimates base on robust standard errors.

Appendix

Figure A.1: Propensity score distribution for medium-term wage effects in T=3



Source: Vocational Training Panel Saarland, Institute for Employment Research, own calculations.

Note: The displayed distribution of the propensity score bases on the probit regression summarized in column 2 of Table A.2. We refrain from a presentation of the corresponding figures for the wage gap and the wage effects in T=4 and T=5 because they are similar. The results are available upon request.

Table A1 – Sample Characteristics

	Mean	Sd	Minimum	Maximum
Wage (€/day)	68.81	21.36	25.02	177.69
TWA work after graduation	0.026	0.161	0.000	1.000
TWA work	0.027	0.161	0.000	1.000
Schooling				
School dropouts	0.020	0.141	0.000	1.000
Lower secondary school	0.390	0.488	0.000	1.000
Medium secondary school	0.377	0.485	0.000	1.000
Upper secondary school	0.160	0.366	0.000	1.000
Other schools	0.033	0.178	0.000	1.000
Final grade of vocational training				
Theoretical exam	3.1	0.8	1.0	4.4
Practical exam	2.7	0.9	1.0	4.4
Female	0.276	0.447	0.000	1.000
Nationality				
German	0.958	0.200	0.000	1.000
Italian	0.019	0.136	0.000	1.000
Turkish	0.012	0.108	0.000	1.000
Other foreign	0.011	0.104	0.000	1.000
Age	23.2	2.725	16.0	38.0
Age at graduation	20.5	2.214	16.000	33.0
Apprenticed profession				
Component adjuster	0.004	0.064	0.000	1.000
Construction mechanic	0.017	0.130	0.000	1.000
Joiner	0.030	0.171	0.000	1.000
Metalworker	0.024	0.153	0.000	1.000
Electronics technician for energy and building systems	0.040	0.196	0.000	1.000
Electrical fitter	0.047	0.212	0.000	1.000
Clerk	0.076	0.265	0.000	1.000
Motor mechanic	0.072	0.258	0.000	1.000
Sales assistant	0.007	0.080	0.000	1.000
Architectural draughtsperson	0.009	0.095	0.000	1.000
Painter / Varnisher	0.026	0.161	0.000	1.000
Plant machanic for sanitary, heating and air conditioning systems	0.020	0.141	0.000	1.000
Clerk office communication	0.070	0.255	0.000	1.000
Plumber	0.013	0.113	0.000	1.000
Baker	0.019	0.137	0.000	1.000
Apprenticeship occupations with male share > 70%	0.677	0.468	0.000	1.000
Branch of training company				
Agriculture and forestry; fishery; mining; energy and water; effluent and waste; pollution	0.043	0.203	0.000	1.000
Manufacturing	0.315	0.464	0.000	1.000
Building and construction	0.144	0.351	0.000	1.000
Trade and repair	0.157	0.364	0.000	1.000
Communications and information transmission	0.037	0.189	0.000	1.000
Other services	0.187	0.390	0.000	1.000
Size apprenticeship firm	648	1552.654	1	7.149
Chamber of training company: Industry and Commerce	0.516	0.500	0.000	1.000

	Mean	Sd	Minimum	Maximum
First contract in training company	0.64	0.480	0.000	1.000
Year of graduation				
1999	0.194	0.395	0.000	1.000
2000	0.284	0.451	0.000	1.000
2001	0.279	0.449	0.000	1.000
2002	0.243	0.429	0.000	1.000
Occupational Segment of Apprenticeship				
Agricultural	0.007	0.084	0.000	1.000
Mining&chemistry	0.013	0.114	0.000	1.000
Glass&ceramics&paper	0.014	0.117	0.000	1.000
Textiel&leather	0.004	0.064	0.000	1.000
Metalworker	0.359	0.480	0.000	1.000
Electrical apprenticeship	0.159	0.366	0.000	1.000
Woodworking	0.033	0.179	0.000	1.000
Construction	0.107	0.310	0.000	1.000
Gastronomy	0.069	0.254	0.000	1.000
Transport&storage	0.017	0.128	0.000	1.000
Sales&finance	0.064	0.245	0.000	1.000
Clerical&administrative	0.146	0.353	0.000	1.000
Technics&safety	0.002	0.044	0.000	1.000
Artists&athletes	0.005	0.072	0.000	1.000
Length of apprenticeship training (days)	1.086	217	123	1.834
Unemployment experience (days)	110	165	0.000	1.746
Tenure	498	507	0.000	2.163
Female share in apprenticed occupation	0.272	0.356	0.000	1.000
Employment in apprenticeship firm	0.439	0.496	0.000	1.000
Firm size of employment	845	1.790	1	42.632
Branch of employment				
Agriculture and forestry; fishery; mining; energy and water; effluent and waste; pollution	0.020	0.140	0.000	1.000
Manufacturing	0.397	0.489	0.000	1.000
Building and construction	0.127	0.333	0.000	1.000
Trade and repair	0.167	0.373	0.000	1.000
Communications and information transmission	0.040	0.196	0.000	1.000
Other services	0.222	0.416	0.000	1.000

Source: Vocational Training Panel Saarland, Institute for Employment Research, own calculations.

Table A.2: Propensity score estimation - results of probit regressions

	t = 1	t = 3	t = 4	t = 5
Schooling (reference: Lower secondary school)				
School dropouts	0.052 (0.207)	0.092 (0.149)	0.096 (0.150)	0.098 (0.150)
Medium secondary school	-0.191 (0.112)	-0.266** (0.088)	-0.258** (0.087)	-0.248** (0.087)
Upper secondary school	-0.828** (0.302)	-0.739*** (0.172)	-0.708*** (0.169)	-0.714*** (0.168)
Other schools	0.186 (0.136)	0.184 (0.107)	0.208 (0.107)	0.205 (0.107)
Final grade vocational training				
Theoretical exam	0.075 (0.062)	0.177*** (0.054)	0.178*** (0.053)	0.178*** (0.053)
Practical exam	0.136* (0.055)	0.079 (0.046)	0.108* (0.046)	0.087 (0.046)
Female	0.095 (0.100)	0.093 (0.118)	0.074 (0.119)	0.074 (0.117)
Nationality (reference: German)				
Italian	0.282 (0.260)	-2.171 -1.606	0.225 (0.204)	0.225 (0.204)
Turkish	-0.129 (0.935)	0.630*** (0.178)	0.612*** (0.177)	0.620*** (0.178)
Other foreign	0.229 (0.279)	0.386* (0.197)	0.407* (0.201)	0.403* (0.200)
Age at graduation	0.070 (0.223)	0.358* (0.164)	0.385* (0.166)	0.366* (0.164)
Age at graduation squared	-0.001 (0.005)	-0.008* (0.004)	-0.008* (0.004)	-0.008* (0.004)
Apprenticed profession (reference: other occupations)				
Component adjuster	0.655* (0.295)	0.958*** (0.237)	0.936*** (0.237)	0.929*** (0.237)
Construction mechanic	0.374 (0.227)	0.929 (0.875)	0.090 (0.212)	0.093 (0.211)
Joiner	0.350 (0.200)	0.421** (0.146)	0.432** (0.148)	0.438** (0.146)
Metalworker	0.294 (0.245)	0.172 (0.193)	0.187 (0.195)	0.192 (0.193)
Electronics technician for energy and building systems	0.408* (0.197)	0.398* (0.156)	1.781** (0.681)	0.402** (0.155)
Electrical fitter	0.104 (0.246)	0.252 (0.199)	0.249 (0.197)	0.231 (0.196)
Clerk	0.667* (0.273)	0.486** (0.182)	0.430* (0.176)	0.390* (0.169)
Motor mechanic	0.080 (0.207)	0.015 (0.149)	0.036 (0.152)	0.029 (0.150)
Sales assistant	0.678 (0.401)	0.237 (0.305)	0.204 (0.304)	
Architectural draughtsperson		0.559 (0.291)		
Painter / Varnisher	0.074 (0.234)	0.443** (0.156)	0.457** (0.157)	0.454** (0.154)

	t = 1	t = 3	t = 4	t = 5
Plant mechanic for sanitary, heating and air conditioning systems	-0.290 (0.377)	-0.156 (0.258)	-0.168 (0.259)	-0.157 (0.257)
Clerk office communication	1.012*** (0.247)	0.936*** (0.167)	0.874*** (0.161)	0.833*** (0.153)
Plumber	-0.172 (0.399)	0.076 (0.278)	0.072 (0.280)	
Baker	0.134 (0.297)	0.189 (0.217)	0.208 (0.218)	0.212 (0.216)
Apprenticeship occupations with male share > 70%	0.670*** (0.201)	0.470** (0.157)	0.397** (0.154)	0.377* (0.147)
Branch of training company (reference: manufacturing)				
Agriculture and fishery; mining; energy and water; effluent and waste; pollution	-0.071 (0.213)	0.002 (0.171)	0.006 (0.170)	0.004 (0.169)
Building and construction	0.106 (0.147)	-0.120 (0.120)	-0.100 (0.123)	-0.092 (0.121)
Trade and repair	-0.068 (0.164)	0.001 (0.115)	0.002 (0.115)	0.021 (0.113)
Communications and information transmission		-0.525 (0.302)	-0.512 (0.301)	-0.521 (0.300)
Other services	0.008 (0.126)	-0.076 (0.107)	-0.044 (0.104)	-0.048 (0.103)
Size apprenticeship firm	-0.000 (0.000)	-0.000 (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
Chamber of training company: Industry and Commerce	0.292* (0.134)	0.209 (0.112)	0.222* (0.113)	0.226* (0.108)
First contract in training company	-0.411*** (0.094)	-0.433*** (0.068)	-0.431*** (0.068)	-0.436*** (0.069)
Year of graduation (reference 2002)				
1999	-0.350* (0.143)	-0.391*** (0.103)	-0.383*** (0.103)	-0.375*** (0.102)
2000	-0.099 (0.109)	-0.273** (0.086)	-0.262** (0.086)	-0.261** (0.086)
2001	-0.279* (0.115)	-0.331*** (0.089)	-0.324*** (0.089)	-0.328*** (0.088)
Constant	-4.403 -2.449	-6.932*** -1.813	-7.251*** -1.828	-6.958*** -1.810
Number of observations	8.130.000	8.130.000	8.130.000	8.130.000
Pseudo-R ²	0.141	0.163	0.162	0.159
Chi ²	176.230	272.059	267.532	261.340
Log-likelihood	-440.156	-834.326	-835.675	-838.031

Source: Vocational Training Panel Saarland, Institute for Employment Research, own calculations.

Note: *** significant at 1 %, ** significant at 5 %, * significant at 10 %.

The results of several Interaction terms are not reported in the table

Table A.3: Balancing – results of t-tests for T=3

	before matching			after matching		
	TAW	No TAW	t-test (p-value)	TAW	No TAW	t-test (p-value)
Schooling						
School dropouts	0.044	0.021	0.074	0.044	0.075	0.264
intermediate school	0.217	0.380	0.000	0.217	0.242	0.628
grammar school	0.044	0.158	0.000	0.044	0.035	0.711
other	0.167	0.054	0.000	0.167	0.117	0.243
Final grade vocational training						
theoretical exam	3.567	3.113	0.000	3.567	3.522	0.574
practical exam	3.089	2.741	0.000	3.089	3.097	0.936
Female	0.225	0.271	0.230	0.225	0.219	0.908
Nationality						
Italian	0.435	0.019	0.037	0.045	0.023	0.350
Turkish	0.030	0.012	0.067	0.030	0.032	0.916
other foreign	0.022	0.012	0.228	0.022	0.033	0.558
Age at graduation squared	20.457	20.510	0.781	20.457	20.509	0.824
Age at graduation⁴	421.93	425.67	0.659	421.93	424.93	0.772
Apprenticed profession						
Component adjuster	0.036	0.004	0.000	0.036	0.049	0.613
Construction mechanic	0.015	0.015	0.988	0.015	0.017	0.848
Joiner	0.065	0.033	0.040	0.065	0.093	0.387
Metalworker	0.043	0.023	0.116	0.043	0.035	0.711
Electronics technician for energy and building systems	0.087	0.039	0.005	0.087	0.078	0.777
Electrical fitter	0.030	0.046	0.353	0.030	0.032	0.889
Clerk	0.058	0.078	0.379	0.058	0.047	0.687
Motor mechanic	0.101	0.074	0.244	0.101	0.072	0.395
Sales Assistant	0.007	0.006	0.898	0.007	0.007	1.000
Architectural draughtsperson	0.007	0.008	0.875	0.007	0.010	0.796
Painter / varnisher	0.079	0.028	0.000	0.079	0.090	0.763
Plant mechanic for sanitary, heating and air conditioning systems	0.015	0.019	0.673	0.015	0.009	0.700
Clerk office communication	0.130	0.069	0.006	0.130	0.110	0.606
Plumber	0.007	0.012	0.605	0.007	0.012	0.670
Baker	0.036	0.018	0.132	0.036	0.023	0.525
Apprenticeship occupations with male share > 70%	0.731	0.681	0.202	0.731	0.765	0.516
Branch of training company						
Agriculture and fishery; mining; energy and water; effluent and waste; pollution	0.435	0.401	0.873	0.043	0.068	0.362
Building and construction	0.210	0.144	0.031	0.210	0.184	0.588
Trade and repair	0.167	0.159	0.818	0.167	0.146	0.644
Communications and information transmission	0.007	0.038	0.062	0.007	0.011	0.710
Other services	0.217	0.172	0.166	0.217	0.188	0.541
Size of apprenticeship firm	141.83	669.69	0.00	141.83	143.67	0.963
Chamber of training company: Industry and Commerce	0.370	0.510	0.001	0.370	0.424	0.358
First contract in training comp.	0.355	0.637	0.000	0.355	0.334	0.715

	before matching			after matching		
	TAW	No TAW	t-test (p-value)	TAW	No TAW	t-test (p-value)
Year of graduation						
1999	0.174	0.228	0.132	0.174	0.209	0.464
2000	0.217	0.274	0.132	0.217	0.263	0.377
2001	0.225	0.273	0.209	0.225	0.214	0.828
2002	0.384	0.224	0.000	0.384	0.314	0.227

Source: Vocational Training Panel Saarland, Institute for Employment Research, own calculations.