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Michael Beckmann, Dieter Kuhn

The Authors:

Prof. Dr. Michael Beckmann

Department of Human Resources and Organization (WWZ)

University of Basel

Peter Merian-Weg 6

CH - 4002 Basel

phone: +41 (0) 61 267 32 24

michael.beckmann@unibas.ch

Dr. Dieter Kuhn, Assistant

Department of Human Resources and Organization (WWZ)

University of Basel

Peter Merian-Weg 6

CH - 4002 Basel

phone: +41 (0) 61 267 27 54

dieter.kuhn@unibas.ch

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Contact:
WWZ Forum | Peter Merian-Weg 6 | CH-4002 Basel | forum-wwz@unibas.ch | wwz.unibas.ch

Flexibility vs. screening: The performance effects of temporary agency work strategies

Michael Beckmann [a,*], Dieter Kuhn [b]

[a] University of Basel, Centre of Business and Economics, Department for Human Resources and Organization, Peter Merian-Weg 6, CH-4002 Basel, Switzerland

[*] Corresponding author. Phone: +41-(0)61-267 32 24, E-Mail: michael.beckmann@unibas.ch

[b] University of Basel, Centre of Business and Economics, Department for Human Resources and Organization, Peter Merian-Weg 6, CH-4002 Basel, Switzerland
E-Mail: dieter.kuhn@unibas.ch

Abstract

This paper empirically examines the impact of temporary agency work strategies on firm performance using panel data from German establishments. Thereby, special attention is devoted to the question, whether there are performance differences between establishments using temporary agency workers (TAWs) as a buffer stock (flexibility strategy) and establishments testing TAWs for permanent positions (screening strategy). Theoretically, there are good reasons for using one strategy as well as adopting the other. On the other hand, however, both strategies may also be associated with serious drawbacks to be borne by the establishments. Our empirical analysis suggests that establishments following the flexibility strategy perform significantly worse than establishments following the screening strategy. Hence, we conclude that employers act in their own interest, if they credibly consider temporary workers for permanent jobs instead of implementing a system of first- and second-class employees.

JEL Classification: C23; J24; J42; J82; M55
Keywords: Temporary agency work, firm performance, flexibility strategy, screening strategy

1. Introduction

In recent years, the growth in the temporary agency work industry has been tremendous – irrespective of the level of employment protection legislation (EPL). For example, both Germany (with a rather high level of EPL) and the USA (with a rather low level of EPL) have witnessed a huge growth in the number of temporary agency workers (TAWs) over the last two decades. Between 1994 and 2008 the number of TAWs employed in German firms increased from about 135,000 to 800,000 corresponding to 2.9 % of the total workforce. Just during the last year of this time period the TAW growth was at about 70,000 individuals. In the USA the number of TAWs increased from about one million in 1992 to 2.9 million in 2005 corresponding to 2.6 % of total employment (Antoni and Jahn, 2009; Jahn, 2010; Mitlacher, 2007). In trying to explain this development, literature points to changes in external forces boosting the demand for TAWs. These changes contain a growing competition and the need for flexibility and cutting costs, a distinct EPL, which can be avoided by employing TAWs, and deregulation tendencies in the temporary agency sector relaxing the requirements to employ TAWs (e.g., Kirk and Belovics, 2008; Chen and Funke, 2009; MacPhail and Bowles, 2008).

We refer to temporary work as the triangular relationship between a TAW, a temporary work agency and a client establishment, whose performance is being examined in this paper. The agency is the de jure employer of the worker. Therefore, the agency pays the wage and keeps disciplinary authority over the TAW (Mitlacher, 2005). The agency lends the TAW to a client firm, which in turn pays a fee to the agency. Therefore, the client firm has managerial authority over the TAW. Temporary work agencies help to reduce transaction costs (e.g., search costs and bargaining costs) between client firms and workers.[1] Additionally, temporary work agencies can specialize in human resources tasks such as improving hiring tests or attracting a larger pool of candidates.

[1] For example, client firms do not need to place an advertisement in a newspaper or on the internet. Furthermore, they do not necessarily need to interview and sometimes even select applicants. These (pre-)selection activities are typically delegated to the temporary work agencies.

There are two main reasons why client firms hire TAWs: flexibility and screening.[2] For example, firms can use TAWs to meet short-term fluctuations in demand flexibly and at low cost. In this case, TAWs serve as a buffer stock allowing short-term employment adjustments without affecting permanent employees. On the other hand, firms can also use TAWs to screen workers before hiring them on a permanent basis. Here, firms signal a long-term interest to TAWs, because temporary work may constitute a stepping stone into permanent employment. As a consequence, therefore, both the flexibility and the screening strategy appear to be quite beneficial human resources strategies that may have positive effects on firm performance.

However, one may also raise serious doubts regarding the beneficial performance effects of TAW use. For example, firms using TAWs as a buffer stock internally implement a segmented labour market consisting of permanent core workers and flexible temporary workers, whose employment opportunities are subject to demand fluctuations. This could impair the motivation of TAWs and thus firm performance. Analogously, the screening strategy may also involve adverse firm performance effects, when permanent employees feel threatened to be replaced by hard working TAWs. In this case, permanent workers are likely to reduce their willingness to cooperate with TAWs.

This a-priori open performance situation constitutes the objective of our paper. Focussing on establishments that apply temporary agency work, we are interested in examining the issue of whether there are performance differences between establishments using TAWs as a buffer stock and establishments that use them for screening purposes. To the best of our knowledge, this question has not been tackled by other studies before. Note that we do not aim at estimating the performance effects of temporary agency work in general. This has recently been done, for example, by Arvanitis (2005), Kleinknecht et al. (2006), Bryson (2007), and Hirsch and Mueller (2010) coming to mixed or insignificant results.[3]

[2] The discussion for TAWs is quite similar to the discussion regarding the employment of fixed-term workers. In the following, therefore, we additionally consider the literature on the motives and performance effects of fixed-term workers to be relevant for our analysis.

[3] For example, Hirsch and Mueller (2010) find a hump-shaped relationship between TAW use and establishment productivity. Furthermore, one main result of Bryson (2007) is that a modest TAW use (1-4 % of the workforce) has a positive impact on relative labour productivity.

In our study, we use data of the Institute for Employment Research (IAB) Establishment Panel (waves 2002-2007). Our empirical model is based on an augmented Cobb-Douglas production function. Furthermore, our estimation strategy accounts for unobserved establishment characteristics and other potential sources of endogeneity, so the parameter estimates can be viewed as causal effects. In the end, therefore, our estimation results allow the derivation of management implications for the effective use of TAWs.

The remainder of this paper is organized as follows. Section 2 provides the theoretical background of this study. In Section 3 we briefly discuss the related empirical literature. Section 4 contains our empirical investigation. The robustness of our results is checked in the sensitivity analysis of Section 5. Finally, Section 6 concludes.

2. Theoretical background

The employment of TAWs may be economically interesting for client firms for at least two reasons (Forde et al., 2008). First, the use of TAWs enables firms to meet their flexibility requirements more effectively than the alternative employment of permanent workers. Second, the use of TAWs provides firms with an additional screening device to reduce the typical pre-contractual principal agent information problem with respect to the abilities and motivation of the workers to be recruited. In this sense, the employment of TAWs serves as a prolonged probation period, in which the firm has the opportunity to obtain the necessary information. We refer to the first motive for employing TAWs as *flexibility strategy*, while we call the second motive just mentioned *screening strategy*.

The use of TAWs may increase the flexibility of client firms, because TAWs allow these firms to rapidly respond to demand fluctuations and staff shortages (Kirk and Belovics, 2008). For example, in times of labour shortage temporary work agencies are able to provide the firms concerned with TAWs in the short run. In this way, the flexible use of TAWs allows firms to maintain an uninterrupted production. This is important not only because production technology can be applied continuously and at

high capacity, but also because customers can be served in due time (Bryson, 2007). Additionally, in times of increasing demand firms may prefer to extend their workforce employing TAWs instead of permanent employees, because the separation from TAWs is usually much easier than the dismissal of permanent employees, when demand declines. Hence, employing TAWs offers firms an opportunity to flexibly adjust their workforce in response to demand requirements. The flexibility argument is even amplified in countries with a high level of EPL, since employing TAWs instead of permanent workers allows firms to save dismissal costs. Specifically, TAWs can easily be dismissed without dismissal costs returning the TAWs to the temporary work agency, while the dismissal of permanent employees typically requires the adherence of cancellation periods and substantial severance payments. Finally, firms employing TAWs are able to realize cost benefits relative to employing permanent workers. A direct cost advantage results from the fact that TAWs typically receive significantly lower wages than permanent workers (Jahn, 2010; Oberst et al., 2007), while an indirect beneficial cost effect can be achieved by putting pressure on the wages of all employees (Bryson, 2007). Summing up, these benefits of flexibility are likely to have a positive effect on firm performance.

On the other hand, firms following the flexibility motive internally implement a segmented labour market consisting of privileged permanent employees in a secure position and precarious TAWs sitting in a trap. Moreover, TAWs usually experience lower wages, poorer working conditions and less training than permanent employees (Nienhueser and Matiaske, 2006). When TAWs recognize that permanent workers executing similar tasks are privileged with respect to important job characteristics, this perception of relative job discrimination could reduce TAWs' effort, motivation and productivity and may even deteriorate the cooperation with permanent employees. Following this line of reasoning, the flexibility strategy is likely to have a negative effect on firm performance.

Alternatively, by following a screening strategy a firm may increase the motivation, effort level and productivity of TAWs (Engellandt and Riphahn, 2005). The reason for this is that – contrary to the flexibility strategy – the screening strategy includes the opportunity of a long-term perspective for the TAWs. While in firms following

the flexibility motive temporary work can be thought of as being a 'dead end' for the TAWs concerned, it may serve as a 'stepping stone' for TAWs working in firms following the screening motive (Jahn and Rosholm, 2010; Barbieri and Sestito, 2008; Booth et al., 2002).[4] In these firms, namely, TAWs are initially employed under the usual conditions of temporary agency work, but they are offered a permanent job after having proven high abilities. This option may enhance the TAWs' motivation and effort level.

The rationale for applying the screening strategy can be explained using standard results of information economics and tournament theory (e.g., Lazear and Gibbs, 2009; Garibaldi, 2006). For example, it is well-known that employers usually face a pre-contractual information problem with respect to unobserved individual worker characteristics, such as ability and motivation. The employment of TAWs may represent a possible solution to this information problem. Initially employing workers on a temporary basis enables the firm to gain the required information, and thus, contributes to reduce the cost of wrong employment decisions. If a TAW is positively evaluated after the screening period, he will be promoted to a permanent position, while he has to leave the firm in the converse case of a negative evaluation. As a result, the average quality of the workforce will rise, which should in turn have a positive effect on firm performance. In addition, it is also well-known that promotion tournaments are intended to encourage workers to spend high effort, when the winner prize is high relative to the loser prize. In the present case, there is a winner-takes-all situation, because the positively evaluated TAWs are offered a permanent job, while the negatively evaluated TAWs have to leave the firm. Hence, the wage differential between positively and negatively evaluated TAWs is likely to be sufficiently large to generate high effort levels among the competing TAWs. As a consequence, the screening strategy is supposed to have a positive effect on firm performance.

On the other hand, applying the screening strategy may also be associated with substantial drawbacks calling the reasoning just mentioned into question. For example, permanent workers may perceive the job tournament among the TAWs as a threat for their own jobs, which virtually should be quite secure by definition (Bryson,

[4] The terms 'dead end' and 'stepping stone' can be ascribed to Booth et al. (2002).

2007).[5] More precisely, permanent workers may worry about their own jobs, because they cannot definitely rule out the possibility to be replaced by successful TAWs, even if this is not the primary intention of the up or out-tournament. In this case, peer relations are likely to suffer because permanent workers might refuse to cooperate with TAWs (Chattopadhyay and George, 2001). Hence, work organization could substantially be affected. Furthermore, worker-manager relations and the loyalty between those two parties could also worsen, encouraging permanent employees to quit, and thus, increasing the turnover rate of the firm (Davis-Blake et al., 2003). As a consequence, these negative spill-over effects on permanent employees may involve a negative effect on firm performance.[6]

All in all, the theoretical discussion with respect to the effect of TAWs on firm performance is heterogeneous. Both the flexibility strategy and the screening strategy may be associated with positive or negative performance effects, while the relative effect of the two strategies remains an open question. Our empirical analysis, therefore, aims at shedding light on this issue. More precisely, we estimate whether there are performance differences between establishments following the flexibility strategy and those following the screening strategy. Before turning to the empirical analysis, however, we provide a brief review of the related empirical literature.

3. Related literature

As mentioned in the introduction, several authors empirically investigate the productivity effects of temporary agency work at the establishment or firm level. Moreover, some studies even address the potential benefits of the screening strategy, however, without explicitly relating it to the flexibility strategy. For example, Erickcek et al. (2002) conduct case studies of 18 Midwestern firms in the manufacturing, health care and education sector. The authors find that temporary agency work involves less negative or even positive consequences for TAWs, if the client firm follows a screen-

[5] This point is further examined by other studies. For instance, Kraimer et al. (2005) explore the role of regular employees' perceived job security in explaining their perceptions that TAWs pose a threat to their jobs. Moreover, Svensson and Wolvén (2010) found that TAWs also form a psychological contract (according to Rousseau, 1989) with their co-workers and not only with the hiring organization.
[6] Adverse effects of increasing TAW use on regular employees have recently been found by De Cuyper et al. (2009).

ing strategy, which includes the option of a long-term perspective for the TAWs. Moreover, Tan and Tan (2002) empirically examine the determinants of job satisfaction among 141 TAWs of four Singaporean temporary work agencies. They find that involuntary TAWs – i.e., those TAWs that actually prefer a permanent job, but have provisionally accepted a contract with a temporary work agency – work extra hard in order to signal their capabilities.

On the basis of 174 TAWs of a Midwestern agency, Ellingson et al. (1998) find that involuntary TAWs indeed exhibit a lower level of satisfaction than voluntary TAWs. Their productivity, however, is not significantly affected. Similarly, by examining data on 2,418 TAWs from two large staffing agencies in the US, George et al. (2010) find that involuntary TAWs exhibit a higher level of extra-role behaviour towards the client firm. None of these studies mention the screening strategy explicitly, but there seems to be an evident relationship. Finally, De Cuyper et al. (2009) empirically predict the job insecurity climate among 216 Belgian and 404 Spanish permanent workers in firms that follow either supplementation or substitution motives when using TAWs (and other types of temporary employment). The authors' estimates provide mixed results on the effect of supplementation motives. However, some substitution motives increase permanent workers' job insecurity climate in the Belgian sample, thereby suggesting motive-specific adverse effects.

Given these mixed and less clear-cut results, the empirical evidence so far is not able to shed light on the role that a specific strategy regarding the use of TAWs might have in explaining potential firm performance differences. Furthermore, it must be mentioned that the previously discussed studies suffer from various methodological problems as typical endogeneity issues resulting from an establishment's use of temporary agency work are neglected. For example, none of the studies accounts for unobserved firm characteristics that may substantially bias the estimation results. Moreover, the studies do also not address the problems of reverse causality and selectivity. However, firm performance is also likely to influence the applied strategy in terms of TAW use (flexibility vs. screening), not just vice versa. For example, firms facing short-term fluctuations in sales may prefer employing TAWs as a flexibility device instead of hiring permanent employees. Additionally, rather than being ran-

domly assigned to TAW status firms are also likely to have good reasons of whether or not to employ TAWs at all. Not controlling for reverse causality and establishment self-selection would be associated with the risk of obtaining biased and inconsistent parameter estimates.

Therefore, an important objective of our empirical investigation is to control for unobserved establishment characteristics and other endogeneity issues using panel data and applying appropriate estimation methods. Contrary to previous studies, we thereby aim at discriminating between the performance effects of establishments following the flexibility strategy relative to establishments following the screening strategy. In this sense, our paper should add quite substantially to the empirical literature on the effects of temporary agency work on firm performance.

4. Empirical analysis

4.1. Data, variables and descriptive statistics

In our study, we use the data of the Institute for Employment Research (IAB) Establishment Panel. The IAB Establishment Panel is an annual survey of over 15,000 establishments in Germany. The establishments are selected from a parent sample of all German establishments that employ at least one employee covered by social security. This parent sample can be considered as complete, because establishments have to report on their employees under social security by law. The selection method is stratification with respect to ten categories of establishment size and 16 economic sectors. This is why an establishment's probability of being selected increases with employment. Hence, the IAB Establishment Panel is approximately proportional to employment and therefore representative for the German economy. A large set of information is provided periodically, such as information about employment and wages, sales, investments, export activities, technical innovations, organizational change, worker representation or vocational and continuous training. Additionally, some topics are covered by the questionnaire in selected years. For example, temporary agency work is covered quite extensively in the year 2003.

The dependent variable of our analysis is the natural logarithm of value added (defined as total sales minus material costs) measured in Euro ($\ln VA$). Value added is the most prominent productivity measure in studies on establishment performance. Our key explanatory variables are dummy variables indicating whether an establishment uses temporary agency work either for flexibility reasons ($FLEX$), as a screening device ($SCREEN$), or whether it follows a dual strategy combining both strategies ($FLEX \times SCREEN$). Note that only those establishments employing TAWs at all are considered in this analysis. Establishments are regarded to follow the flexibility strategy, if they have recently adjusted their workforce using TAWs to meet unexpected fluctuations in demand or production. On the other hand, establishments are regarded to follow the screening strategy, if they have recently promoted TAWs to permanent positions. Hence, the corresponding questions in the questionnaire allow for a direct classification of establishments without relying on indirect indicator variables.

The choice of our control variables is quite typical in a production function framework. Of course, we apply proxies for the Cobb-Douglas input factors, i.e., the natural logarithm of total investments as an indicator for capital stock ($\ln K$) and the natural logarithm of total employment as an indicator for labour ($\ln L$). Furthermore, we augment the Cobb-Douglas specification with control variables capturing the structure of the workforce, technical and organizational innovations, product innovations, international trade activities, the existence of institutions for worker representation, the existence of profit sharing or stock ownership plans, the incidence of continuous training, and other establishment characteristics. Finally, we add controls for regional and sector affiliation[7] as well as a set of time dummies. It is important to note that our key explanatory variables as well as some of the control variables are only available in one panel wave (year 2004),[8] because this data limitation has consequences for our estimation strategy. Table A1 in the appendix displays the definitions and descriptive statistics of the complete set of variables used in this study.

[7] We exclude the public sector as well as the banking and insurance sector. The reason for excluding banks and insurance companies is that their productivity measure is based on total assets instead of total sales. The public sector is excluded because we cannot necessarily assume a profit maximizing behaviour of the concerned institutions.

[8] We transferred the strategy dummy variables *FLEX*, *SCREEN* and *FLEX×SCREEN*, which originally were available in the wave 2003, to 2004. Thereby, we assume that an establishment does not change its TAW related strategy completely during 12 months.

All in all, our sample contains 746 establishments[9] employing TAWs and providing information on their adopted TAW strategies. About 19 % of these establishments apply the flexibility strategy, i.e., they employ TAWs to meet unexpected fluctuations in demand or production. About 14 % of the establishments use TAWs as a screening device and offer long-term perspectives for those workers that passed this kind of probation period as a TAW. Finally, about 7 % of the establishments usually combine both strategies.

4.2. Econometric Model

Our objective in this paper is to examine the performance effects of different firm strategies regarding the use of TAWs. Thereby, we are particularly interested in answering the question whether establishments adopting a flexibility strategy are more or less successful than establishments following a screening strategy. Irrespective of the question whether the use of temporary agency work is beneficial at all, there may be substantial performance differences within the group of TAW employing establishments that depend on the respective strategy underlying TAW use.

In order to detect potential benefits of the flexibility or the screening strategy, we augment a conventional Cobb-Douglas production function for the sub-sample of establishments employing TAWs by the strategy dummy variables introduced above.[10] Thus, our baseline estimation equation is

$$\begin{aligned} \ln VA_{it} = {} & \beta_1 \ln K_{it} + \beta_2 \ln L_{it} + \gamma_1 FLEX_{it} + \gamma_2 SCREEN_{it} + \gamma_3 FLEX \times SCREEN_{it} \\ & + \delta' X_{it} + v_i + \theta_t + u_{it} \ , \end{aligned} \tag{1}$$

where X is a vector of control variables and u is an error term with zero mean and finite variance. Moreover, θ_t represents cyclical fluctuations captured by a set of time

[9] The sample size is subject to the definition of the dependent variable. For example, when we use total sales instead of value added as dependent variable in our sensitivity analysis, sample size increases to 833 establishments.

[10] Hence, the reference group is characterized by establishments responding to apply none of these strategies.

dummies and v_i is a time-invariant establishment-specific fixed effect. Finally, the indexes i and t characterizes establishment and time, respectively. The parameters of interest to be estimated are γ_1, γ_2 and γ_3.

Estimating equation (1) by conventional OLS is likely to involve serious estimation biases, because OLS ignores various endogeneity issues that may result from the use of the TAW strategy variables. First, cross-sectional and pooled OLS estimations can be biased and inconsistent, if some time-invariant unobserved factors v_i influence the dependent variable and one or more explanatory variables simultaneously. In this case, the concerned explanatory variables can no longer be considered as exogenous, which involves inconsistent OLS parameter estimates. A prominent example for unobserved establishment characteristics is management quality. Provided that management quality influences both, i.e., productivity and the adopted strategy in terms of TAW use, our strategy variables in equation (1) cannot be assumed to be exogenous. The conventional proceeding in this case would be to exploit the panel structure of the data and estimate a fixed effects model.

Since the strategy variables and some of the control variables are only available in one year, we cannot estimate a standard fixed effects model to address the issue of unobserved establishment characteristics. However, an appropriate solution in this case has been proposed by Black and Lynch (2001).[11] Their two-step estimation procedure allows us to control for unobserved heterogeneity in a situation, where the core explanatory variables are only available in one panel wave.

The first step of the Black-Lynch approach consists of a within-estimation of a Cobb-Douglas production function, which is augmented by year dummies T to control for cyclical changes. Of course, the variables used in this first-step estimation must be available in more than just one year (here: 2002-2007). The first-step estimation equation can be written as

$$\ln VA_{it} = \beta_1 \ln K_{it} + \beta_2 \ln L_{it} + \alpha' T_t + v_i + u_{it} \; . \qquad (2)$$

[11] The Black-Lynch estimation approach has previously been applied, for example, in Zwick (2004; 2005).

From the estimation of equation (2), the establishment fixed effect can be retrieved, i.e.,

$$\hat{v}_i = \overline{\ln VA_i} - \hat{\beta}_1 \overline{\ln K_i} - \hat{\beta}_2 \overline{\ln L_i} - \hat{\alpha}' \overline{T} \ , \tag{3}$$

where the bars over the variables represent the corresponding mean values and the hats refer to estimated values.

In the second step, this fixed effect is regressed on the strategy indicator variables $FLEX$, $SCREEN$, and $FLEX \times SCREEN$ and a set of control variables X:

$$\hat{v}_i = \gamma_1 FLEX_i + \gamma_2 SCREEN_i + \gamma_3 FLEX \times SCREEN_i + \delta' X_i + \xi_i \ , \tag{4}$$

where ξ_i is an i.i.d. random variable. The estimated coefficients γ_1, γ_2 and γ_3 are adjusted from unobserved time-invariant establishment characteristics in the production function (2). They represent the particular effects of the strategy variables $FLEX$, $SCREEN$, and $FLEX \times SCREEN$ on the fixed effect of an establishment's productivity.

The Black-Lynch approach addresses only one particular form of endogeneity, namely unobserved heterogeneity. However, as discussed above, other sources of endogeneity might occur, which refer to a correlation of our strategy variables with the error term u_{it} in equation (1), i.e., reverse causality and sample selection. For example, an establishment's particular strategy underlying the use of TAWs can not only be assumed to influence establishment performance, but may also be driven by establishment performance. As mentioned earlier, establishments that usually have to cope with short-term demand fluctuations are likely to employ TAWs instead of permanent employees in order to gain more flexibility. Moreover, performance issues as well as other observed and unobserved characteristics might determine an establishment's decision whether or not to employ TAWs at all. These potential endogeneity sources are likely to bias the parameter estimates unless the estimation method appropriately takes them into account.

In order to control for the potential endogeneity of the strategy indicator variables, while simultaneously considering the binary nature of these variables, we adopt a two-step endogeneity correction introduced by Dubin and McFadden (1984) and recently applied, for example, in Origo and Pagani (2009). Following this procedure, we firstly generate a new multinomial strategy variable $STRAT$ using the strategy dummy variables introduced above, i.e.,

$$STRAT_i = \begin{cases} 1 \text{ , if } FLEX_i = 1 \\ 2 \text{ , if } SCREEN_i = 1 \\ 3 \text{ , if } FLEX_i \times SCREEN_i = 1 \\ 4 \text{ , otherwise .} \end{cases} \tag{5}$$

Hence, $STRAT_i$ captures the choice of establishment i with regard to j ($j = 1, 2, 3, 4$) considered strategies of TAW use. We can now estimate a model of strategy choice specifying the following multinomial logit model[12]

$$P_{ij} = \Pr\left(STRAT_i = j \mid \ln K_i, \ln L_i, Z_i\right) = \frac{\exp\left(\beta_{1j} \ln K_i + \beta_{2j} \ln L_i + \pi_j' Z_i\right)}{\sum_{k=1}^{4} \exp\left(\beta_{1k} \ln K_i + \beta_{2k} \ln L_i + \pi_k' Z_i\right)} . \tag{6}$$

Here, Z is a vector of observable characteristics with $Z = [X\ I]$, where I is an identifying instrumental variable which is additionally included in order not only to rely on the functional form assumptions for identification. By means of equation (6) a set of correction terms can be calculated to be used as additional control variables in equation (4). According to Dubin and McFadden (1984), the correction terms are obtained by

$$c_{ij} = E\left(\xi_i \mid STRAT_i = j\right) = \sum_{j \neq k}^{4} \frac{P_{ik} \ln P_{ik}}{1 - P_{ik}} + \ln P_{ij} . \tag{7}$$

[12] In order to ensure model identification, β_{1j}, β_{2j} and π_j have to be set to zero for one of the strategy regimes. The estimated coefficients are then interpreted relative to this regime.

The first three correction terms $c_{i1} = E(\xi_i \mid STRAT_i = 1)$, $c_{i2} = E(\xi_i \mid STRAT_i = 2)$, and $c_{i3} = E(\xi_i \mid STRAT_i = 3)$, i.e., one term for each endogenous binary explanatory variable, are then added to the second-stage estimation of the Black-Lynch procedure, so equation (4) augments to

$$\hat{v}_i = \gamma_1 FLEX_i + \gamma_2 SCREEN_i + \gamma_3 FLEX \times SCREEN_i + \delta' X_i + \lambda' c_i + \xi_i \; . \tag{8}$$

Significant parameters in λ would indicate that the endogeneity problem is not exclusively solved by accounting for fixed effects in the production function, so the correction according to Dubin and McFadden (1984) is essential to eliminate any remaining endogeneity bias. Hence, the two-stage estimation approach derived in equations (5)-(8) assures unbiased and consistent estimates of the parameters of interest, i.e., γ_1, γ_2 and γ_3, which can then be interpreted as causal effects. On the other hand, if the parameter estimates λ turn out to be insignificant, the Black-Lynch approach according to equations (2)-(4) would be sufficient to obtain unbiased and consistent estimates of γ_1, γ_2 and γ_3.

Finally, our estimation approach calls for some explanations concerning the identification strategy. Contrary to conventional instrumental variables estimation techniques like two-stage least squares, the Dubin-McFadden approach does not necessarily require one or more strictly exogenous variables that are correlated with the potential endogenous explanatory variables but uncorrelated with the error term of the estimation equation of interest. However, in order to improve the efficiency of parameter estimates, the identification of suitable exclusion restrictions is typically recommended. In the present case, therefore, we should identify at least one exclusion restriction to be correlated with P_{ij} without having a direct influence on value added, given the specified covariates.[13]

[13] Note that although there are originally three explanatory dummy variables to be instrumented, we actually do not need likewise three exclusion restrictions that determine P_{ij}.

In the present case, we use a dummy variable indicating whether or not an establishment currently offers apprenticeship training as an exclusion restriction in equation (6). The rationale behind using this dummy variable is that the incidence of apprenticeship training is likely to be inconsistent with both the flexibility strategy and the screening strategy. Recall that in Germany apprenticeship training is usually firm-sponsored, i.e., training firms face net costs during the training period, while their subsequent returns to apprenticeship training are insecure (e.g., Acemoglu and Pischke, 1999; Mohrenweiser and Zwick, 2009). In this scenario, establishments applying the flexibility strategy are likely to desist from offering apprenticeship training, because their flexibility requirements may not fit well to the long-term perspective implied by human capital investments. On the other hand, establishments using temporary agency work as a screening device may indeed be interested in long-term employment relationships. However, due to the substantial net costs associated with firm-sponsored training, they might prefer testing TAWs for this purpose rather than apprentices. As a consequence, we assume that establishments following a certain strategy with regard to their TAW use are less likely to offer apprenticeship training than establishments following neither the flexibility nor the screening strategy.[14]

4.3. Estimation Results

Table 1 displays the results of the three specifications elaborated above: a cross-section OLS model that serves as a reference, a model using the Black-Lynch procedure, and a model using the Black-Lynch procedure extended by the endogeneity correction according to Dubin and McFadden (1984).[15] First of all, looking at the first-stage estimates displayed in Table A2 in the appendix, we see that our exclusion restriction is significant with the anticipated negative sign in two of the three multinomial logit model equations. Furthermore, a diagnostic χ^2 test strongly rejects the null hypothesis that the exclusion restriction is jointly insignificant in all three equa-

[14] This reasoning applies to the group of TAWs employing establishments. Note that herewith we do not rule out a potential complementary relationship between apprenticeship training and TAW use.

[15] The estimates of the input factors and the covariates not displayed in Table 1 are available from the authors upon request. The corresponding first-stage estimates of the main explanatory variables are displayed in Table A2 in the appendix. The estimates of the remaining covariates in the multinomial logit model are available from the authors upon request.

tions displayed. Hence, we conclude that our applied exclusion restriction meets the required condition of instrument relevance.

Since applying the Dubin-McFadden approach entails a deviation from the conventional instrumental variables estimation strategy by means of two-stage least squares, we cannot directly test whether or not our exclusion restriction also meets the second validity condition, i.e, the exogeneity assumption. However, we can check whether or not our exclusion restriction has a direct influence on value added. If the apprenticeship dummy was insignificant in the cross sectional version of production function (1) and if adding this dummy did not alter the estimates of the other covariates substantially, we would have an indication for our exclusion restriction to be exogenous.[16] In fact, we find that the apprenticeship dummy turns out to be insignificant in the production function ($p = 0.371$) without changing the remaining parameter estimates noticeably. All in all, therefore, we consider our exclusion restriction to be sufficiently valid.

Now, turning to the estimation results displayed in Table 1, we firstly see that the diagnostic F test strongly indicates joint significance of the correction terms c_j. This means that solely accounting for unobserved establishment characteristics by means of the Black-Lynch approach fails to eliminate the suspected endogeneity bias entirely. In other words, correcting for any remaining endogeneity bias such as reverse causality and selectivity is strongly recommended. For this reason, our preferred specification is the Black-Lynch approach extended by an endogeneity correction according to Dubin and McFadden (1984). This combined approach simultaneously takes unobserved establishment characteristics and remaining endogeneity issues into account.

[Insert Table 1 about here]

According to the endogeneity-corrected Black-Lynch estimates, establishments applying the flexibility strategy exhibit a significantly lower productivity level than the

[16] An analogous proceeding with regard to testing the exogeneity assumption for an identifying instrumental variable in the absence of a formal test can be find, e.g., in Jirjahn (2010).

establishments in the reference category (i.e., establishments that do not follow any of the two strategies concerning temporary agency work), while the coefficients for establishments employing the screening or the dual strategy are insignificant. In order to assess the relative productivity effects of all TAW strategies considered, Table 1 displays a set of F tests that enable pairwise comparisons between the strategies in terms of their productivity effects. The main result of these F tests is that the coefficient for *FLEX* significantly differs from the coefficient for *SCREEN* ($p = 0.052$). All in all, therefore, the point estimates joint with the F test results confirm the relative productivity advantage of establishments that screen their TAWs for permanent positions over establishments which use their TAWs as a pure flexibility device. The estimates for the Black-Lynch model are consistent with this interpretation as they also demonstrate the superiority of the screening strategy relative to the flexibility strategy.

Hence, we can conclude that establishments following the screening strategy are likely to perform much better than establishments solely following the flexibility strategy. Based on our preferred specification displayed in the last column of Table 1, the productivity differential is about 15 %. This estimate is slightly higher than the corresponding productivity differential obtained from OLS (13 %) but considerably lower than the productivity differential obtained from the Black-Lynch approach, where the endogenous nature of the strategies in terms of TAW use is not explicitly addressed (23 %).

Finally, it seems that the flexibility strategy does not harm an establishment's productivity, if it is accompanied by the screening strategy. Hence, if both strategies are used simultaneously in an establishment, the screening part obviously has the potential to outweigh the negative effects of the flexibility part.

5. Sensitivity analysis

In this section we conduct additional analyses that are intended to check the robustness of our estimation results presented in the previous section. Thereby, we proceed in three steps. First, we examine the performance effects of establishments with a

flexibility strategy relative to establishments with a screening strategy applying two alternative performance measures instead of value added: total sales and profitability (defined as total sales divided by wage bill). Second, we specify an endogenous switching regression model as an alternative to the Dubin-McFadden approach to test whether our results are subject to the method of how to address the endogeneity problem. Finally, we check whether our results regarding the relative productivity disadvantage of the flexibility strategy are affected, when we change the exclusion restriction.

5.1. Alternative performance measures

In order to check whether or not our estimation results are subject to the performance measure used, we run the regressions reported in the previous section employing the natural logarithm of total sales ($\ln Y$) on the one hand and the natural logarithm of profitability ($\ln(Y/W)$)[17] on the other hand instead of $\ln VA$.[18] The relative performance differences of the TAW strategies are summarized in the first two columns of Table 2.[19] Note that in the following we only present and discuss the estimates resulting from our preferred model specification described by equations (5)-(8).

[Insert Table 2 about here]

The results support the estimates of our baseline model with the natural logarithm of value added as the dependent variable. Specifically, the estimates confirm a significant performance disadvantage of the flexibility strategy relative to the screening strategy. Precisely, establishments adopting the flexibility strategy are about 23 % less productive in terms of total sales than establishments adopting the screening strategy. Similarly, flexibility establishments are about 17 % less profitable than

[17] W denotes the yearly wage bill of the establishments considered.
[18] For example, one could argue that using value added instead of total sales is associated with a serious item non-response bias which is attributed to the fact that some establishments indeed provide information about their total sales but are unable or unwilling to provide information about their material costs. The estimation results would suffer from an item non-response bias, if the sample size reduction caused by using value added instead of sales was non-randomly.
[19] The tables in this section contain only the key results. The remaining estimates are available from the authors upon request.

screening establishments. Finally, the dual strategy turns out to be beneficial relative to the flexibility strategy in terms of both total sales and profitability.[20]

5.2. Alternative approach to account for selectivity

The nature of our data allows for another estimation strategy to address endogeneity issues. Recall that our sample is restricted to establishments that employ at least one TAW. However, the vast majority of the establishments in our data set do not employ TAWs at all. Of course, there are good reasons for establishments whether or not to employ TAWs, so the decision regarding the employment of TAWs is unlikely to be random. In this subsection, we tackle the endogeneity problem regarding TAW use in a different manner compared to our proceeding in Section 4. More precisely, we account for a potential sample selection bias specifying an endogenous switching regression model according to Madalla (1983) and using the estimated inverse Mill's ratio as a selectivity correction term in equation (4).

In a first step, we therefore estimate a conventional probit model

$$\Pr(TEMP_i = 1 \mid \ln K_i, \ln L_i, Z_i) = \Phi(\beta_1 \ln K_i + \beta_2 \ln L_i + \pi' Z_i), \tag{9}$$

where $TEMP$ is a dummy variable capturing whether or not an establishment employs TAWs and $\Phi(\cdot)$ represents the standard normal distribution. The right hand side variables are identical to the regressors of the multinomial logit model (6) including the identifying instrumental variable I (i.e., the apprenticeship dummy) integrated in Z. They capture the establishment characteristics that are relevant for the decision of whether to employ TAWs or not.

Estimating equation (9) allows us to calculate the normal hazard function (inverse Mill's ratio) which is finally added to equation (4) as a selectivity correction term for establishments with TAWs. Hence, our estimation model that simultaneously ac-

[20] Again, the exclusion restriction (apprenticeship dummy) turns out to be highly relevant in the first-stage multinimial logit models. At first, in each case it is significant in two of the three equations. Moreover, the respective results of the diagnostic test of joint insignificance in all three equations are $\chi^2 = 12.35$, $p = 0.006$ and $\chi^2 = 11.81$, $p = 0.008$.

counts for unobserved establishment characteristics in the production function and selectivity can be written as

$$E(v_i \mid TEMP_i = 1) = \gamma_1 FLEX_i + \gamma_2 SCREEN_i + \gamma_3 FLEX \times SCREEN_i + \sigma \frac{\phi(\psi' M_i)}{\Phi(\psi' M_i)} + \delta' X_i \ . \tag{10}$$

Here, M contains all the right hand side variables specified in equation (9). $\phi(\cdot)$ represents the density function of the standard normal distribution, while $\phi(\cdot)/\Phi(\cdot)$ is inverse Mill's ratio. The parameter σ measures the covariance between the error terms in equation (4) and the selection equation (9). All in all, therefore, γ_1, γ_2 and γ_3, can then be interpreted as causal effects.

The estimation results of equation (10) are displayed in the third column of Table 2.[21] Most importantly, we obtain a significant productivity differential of about 24 % meaning that establishments following the screening strategy in terms of TAW use are about 24 % more productive than establishments following the flexibility strategy. According to the results of an F test on $\gamma_1 = \gamma_2$, this productivity differential is highly significant. Moreover, it is about 9 percentage points larger than the corresponding productivity differential resulting from equation (8), where the Dubin-McFadden endogeneity correction terms are added to the specification instead of inverse Mill's ratio.[22] We ascribe the deviating productivity gaps to the different estimation strategies for dealing with the endogeneity problem. However, our main result is not at risk. Provided that establishments decide to employ TAWs, they are much better off with a screening strategy than with a flexibility strategy.

[21] The apprenticeship dummy used as the exclusion restriction in equation (9) is highly significant, where the estimated coefficient is $\pi_I = 0.151$ ($p = 0.006$).

[22] Note that the estimated coefficient for inverse Mill's ratio is highly significant indicating the importance of accounting for selectivity. The negative sign of the selectivity correction term implies that especially establishments with a productivity advantage make use of employing TAWs.

5.3. Alternative instrumental variable

Although the exclusion restriction is not very crucial for identifying the parameters in a scenario, where the Black-Lynch approach is combined with the Dubin-McFadden endogeneity correction method, we additionally check the robustness of our results displayed in the last column of Table 1 by using an alternative instrumental variable instead of the apprenticeship dummy. Since finding a convincing exclusion restriction is always a challenging task, we decided to apply an exclusion restriction which is related to our previously applied apprenticeship dummy. Hence, a natural candidate is the share of apprentices within an establishment. As a matter of fact, we find that similar to the apprenticeship dummy the share of apprentices is significant in two of the three equations of the multinomial logit model and additionally turns out to be jointly significant considering all equations ($\chi^2 = 15.29$, $p = 0.001$). The estimates of equation (8) using the share of apprentices as exclusion restriction in (6) instead of the apprenticeship dummy are displayed in the last column of Table 2.

All in all, the estimation results are very similar to those displayed in Table 1. Hence, the estimates appear to be robust to the choice of the exclusion restriction. Most importantly, the relative productivity loss associated with using the flexibility strategy remains quite stable at about 14 %.

6. Conclusion

In this paper, we empirically investigate the performance effects of different firm strategies potentially underlying the use of temporary agency workers (TAWs). Specifically, we address the issue of whether there are performance differences between establishments using TAWs for flexibility reasons and establishments that use these workers for screening purposes. For this purpose, we apply German establishment-level panel data.

Our findings suggest that establishments using TAWs as a flexibility buffer perform significantly worse than establishments using TAWs as a screening device. This could be explained by the fact that the former explicitly do not offer the opportunity of

long-term employment perspectives to their TAWs. Such establishments are therefore vulnerable to adopt a system of first- and second-class employees among their workforce with permanent workers belonging to the privileged group and TAWs being assigned to the disadvantaged group of second-class workers. In building such a segmented labour market employers may therefore suffer from their unequal treatment of workers who actually should cooperate with each other. If TAWs feel disadvantaged relative to the core workers their motivation is likely to be crowded out, so establishment performance itself might be negatively affected.

The key result of our study implies important recommendations for establishments using the services of temporary work agencies by employing TAWs. Although the screening strategy is not unlikely to involve a threatening scenario for permanent workers, the incentive effect for TAWs participating in the up-or-out tournament obviously outweighs the threatening effect. Similarly, the benefits of the flexibility strategy, e.g., rapid adjustments to demand fluctuation and cost reductions, appear to be outperformed by the drawbacks, which are associated with this strategy, namely the motivational problems caused by the formation of a segmented labour market within an establishment. In either case, we would advise employers using TAWs to follow a screening strategy rather than solely relying on a flexibility strategy. The screening strategy announces the TAWs concerned the opportunity of a long-term perspective within the firm and thus avoids the negative consequences of internally formed segmented labour markets, which are associated with the implementation of a system of first- and second-class employees.

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Table 1

Productivity effects of TAW employing establishments: Flexibility vs. screening strategy.

Estimation strategy	OLS	Black-Lynch approach	Black-Lynch approach, endogeneity-corrected
Estimation equation	(1); cross-sectional setting	(4)	(8)
$FLEX$	-0.125* (0.063)	-0.079 (0.272)	-0.146** (0.021)
$SCREEN$	0.002 (0.979)	0.148* (0.056)	0.001 (0.984)
$FLEX \times SCREEN$	-0.063 (0.532)	0.081 (0.437)	-0.047 (0.609)
$c_1 = E(\xi \mid STRAT = 1)$			-0.080 (0.236)
$c_2 = E(\xi \mid STRAT = 2)$			0.151*** (0.000)
$c_3 = E(\xi \mid STRAT = 3)$			0.205*** (0.000)
R^2	0.840	0.461	0.567
F test ($FLEX = SCREEN$)	2.27 (0.132)	6.39** (0.011)	3.78* (0.052)
F test ($SCREEN = FLEX \times SCREEN$)	0.33 (0.565)	0.32 (0.569)	0.22 (0.637)
F test ($FLEX = FLEX \times SCREEN$)	0.32 (0.574)	1.92 (0.165)	0.94 (0.332)
F test (joint insignificance of the c_j)			54.08*** (0.000)
Number of observations	746	746	746

Note: The dependent variable is $\ln VA$ (column 1) and $\hat{v}_i$ according to (4) and (8), respectively (columns 2 and 3). * / ** / *** denotes significance at the 10 % / 5 % / 1 % level. The values in parentheses represent the p-values based on heteroskedasticity-robust standard errors. The model specifications additionally contain a set of control variables (including regional and sector dummies) explained in Table A1 and Section 4.1.

Source: IAB Establishment Panel, waves 2002-2007, own calculations.

Table 2

Sensitivity checks.

Dependent variable	$\ln Y,\ \hat{v}_i$	$\ln(Y/W),\ \hat{v}_i$	$\ln VA,\ \hat{v}_i$	$\ln VA,\ \hat{v}_i$
Estimation strategy	Black-Lynch approach, endogeneity-corrected	Black-Lynch approach, endogeneity-corrected	Endogenous switching regression model	Black-Lynch approach, endogeneity-corrected
Estimation equation	(8)	(8)	(10)	(8)
$FLEX$	-0.182***	-0.137**	-0.081	-0.137**
	(0.003)	(0.016)	(0.264)	(0.031)
$SCREEN$	0.054	0.034	0.159**	0.008
	(0.385)	(0.547)	(0.040)	(0.908)
$FLEX \times SCREEN$	0.017	0.065	0.073	-0.040
	(0.858)	(0.456)	(0.481)	(0.662)
$c_1 = E(\xi \mid STRAT = 1)$	-0.082	-0.112		-0.072
	(0.235)	(0.104)		(0.160)
$c_2 = E(\xi \mid STRAT = 2)$	0.119***	0.026		0.086
	(0.001)	(0.373)		(0.179)
$c_3 = E(\xi \mid STRAT = 3)$	0.256***	0.091***		0.263***
	(0.000)	(0.000)		(0.000)
$\phi(\cdot)/\Phi(\cdot)$			-1.439***	
			(0.003)	
R^2	0.631	0.305	0.468	0.565
F test ($FLEX = SCREEN$)	10.65***	6.38**	7.14***	3.61*
	(0.001)	(0.011)	(0.007)	(0.057)
F test ($SCREEN = FLEX \times SCREEN$)	0.13	0.11	0.56	0.22
	(0.718)	(0.741)	(0.456)	(0.639)
F test ($FLEX = FLEX \times SCREEN$)	3.75*	4.51**	1.79	0.91
	(0.053)	(0.034)	(0.181)	(0.339)
F test (joint insignificance of the c_j)	58.34***	7.18***		54.45***
	(0.000)	(0.000)		(0.000)
Number of observations	833	782	746	746

Note: * / ** / *** denotes significance at the 10 % / 5 % / 1 % level. The values in parentheses represent the p-values based on heteroskedasticity-robust standard errors. The model specifications additionally contain a set of control variables (including regional and sector dummies) explained in Table A1 and Section 4.1.

Source: IAB Establishment Panel, waves 2002-2007, own calculations.

Appendix

Table A1

Definition and descriptive statistics of the variables.

Variable	Definition	N	Mean	Std.dev.	Min – Max
ln VA	Natural logarithm of value added	746	16.14	1.73	10.95 – 21.93
ln Y	Natural logarithm of total sales	833	17.12	1.78	11.84 – 23.09
ln (Y/W)	Natural logarithm of total sales divided by wage bill	782	1.64	0.69	-1.15 – 5.48
FLEX	Dummy variable indicating whether or not an establishment uses temporary agency work exclusively as a flexibility device	746	0.19	0.39	0 – 1
SCREEN	Dummy variable indicating whether or not an establishment uses temporary agency work exclusively as a screening device	746	0.14	0.35	0 – 1
FLEX x *SCREEN*	Dummy variable indicating whether or not an establishment uses temporary agency work both as a flexibility and screening device (dual strategy)	746	0.07	0.25	0 – 1
ln K	Natural logarithm of total investments	746	12.60	3.95	0 – 20.21
ln L	Natural logarithm of the number of employees	746	5.22	1.36	1.38 – 9.54
Skilled workers	Share of skilled and high skilled workers based on regular workforce (%)	746	71.03	24.11	2.15 – 100
Female workers	Share of female employees based on regular workforce (%)	746	24.19	19.18	0 – 95.96
Technical status	Standardized variable originally ranging between 1 (establishment uses obsolete technologies) and 5 (establishment uses state-of-the-art technologies)	746	0.00	1.00	-2.76 – 1.52
IT investments	Share of investments in information and communication technologies (%) based on total investments	746	0.81	0.39	0 – 1
Exports	Export share on the basis of total sales (%)	746	25.82	29.31	0 – 100
Product innovations	Standardized variable originally ranging between 0 and 3 indicating the amount of product innovation (product improvements, me-too-products, real product innovation)	746	0.00	1.00	-1.31 – 2.08
Collective wage bargaining	Dummy variable indicating whether or not an establishment commits to collective wage bargaining at the industry or establishment level	746	0.68	0.46	0 – 1
Works council	Dummy variable indicating whether or not an establishment has a works council	746	0.72	0.45	0 – 1
Establishment age	Dummy variable indicating whether or not an establishment is founded before 1990	746	0.61	0.48	0 – 1

Incorporated company	Dummy variable indicating whether or not an establishment belongs to an incorporated firm	746	0.93	0.25	0 – 1
Private company	Dummy variable indicating whether or not an establishment has the legal form of a private company	746	0.05	0.21	0 – 1
Foreign ownership	Dummy variable indicating whether or not an establishment has a non-domestic owner	746	0.18	0.38	0 – 1
Organisational change 1	Standardized variable originally ranging between 0 and 4; 0 = establishment has neither realized outsourcing, spin-offs, plant closings, or insourcing within the considered time interval; 1 = establishment has realized one of those strategies; 2 = establishment has realized two of those strategies; 3: f establishment has realized three of these strategies; 4 = establishment has realized all four strategies	746	0.00	1.00	-0.34 – 5.48
Organisational change 2	Standardized variable originally ranging between 0 and 10 indicating the amount of organizational change (e.g., reorganization of the supply chain, improvement of quality management, improvements of ecological standards, increasing decentralization, introduction of team work, introduction of profit centres, and reorganization of departments)	746	0.00	1.00	-1.34 – 4.17
Incentive pay	Dummy variable indicating whether or not an establishment offers pay for performance (stock ownership plans or profit sharing)	746	0.41	0.49	0 – 1
Continuous training	Dummy variable indicating whether or not an establishment offers or pays for continuous training	746	0.88	0.31	0 – 1
Apprenticeship training	Dummy variable indicating whether or not an establishment currently employs apprentices	746	0.77	0.41	0 – 1
Apprentices	Share of apprentices based on total employment (%)	746	4.09	4.99	0 – 62.68
TEMP	Dummy variable indicating whether or not an establishment employs temporary agency workers	5,456	0.16	0.37	0 – 1

Note: N is number of observations. The calculations are restricted to establishments that do not provide item non-responses for the regression analyses. In order to save space the information for the regional, sector, and time dummies are not displayed.

Source: IAB Establishment Panel, wave 2004, own calculations.

Table A2

First-stage regressions.

Estimation strategy	Fixed effects model	Multinomial logit model		
Model specification	(2)	(6)		
		$STRAT = 1$	$STRAT = 2$	$STRAT = 3$
$\ln K$	0.005 (0.114)	0.025 (0.425)	-0.021 (0.577)	-0.021 (0.688)
$\ln L$	0.631*** (0.000)	0.273** (0.029)	0.615*** (0.000)	0.492*** (0.004)
Year 2003	-0.003 (0.904)			
Year 2004	0.049** (0.048)			
Year 2005	0.078*** (0.004)			
Year 2006	0.166*** (0.000)			
Year 2007	0.211*** (0.000)			
Apprenticeship training		-0.532* (0.068)	-1.056*** (0.002)	0.196 (0.673)
R^2 (overall) / Pseudo-R^2	0.802		0.118	
χ^2 (joint insignificance of Apprenticeship training)			11.99*** (0.007)	
Number of observations	3,552		746	
Number of groups	746			

Note: The dependent variable is $\ln VA$ (fixed effects model) or P_{ij} (multinomial logit model), respectively. * / ** / *** denotes significance at the 10 % / 5 % / 1 % level. The values in parentheses represent the p-values based on heteroskedasticity-robust standard errors. The multinomial logit model additionally contains a set of control variables (including regional and sector dummies) explained in Table A1 and Section 4.1.

Source: IAB Establishment Panel, waves 2002-2007, own calculations.