

Schnabel, Claus; Kohaut, Susanne; Brixy, Udo

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**FRIEDRICH-ALEXANDER-UNIVERSITÄT
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Lehrstuhl für VWL, insbes. Arbeitsmarkt- und Regionalpolitik
Professor Dr. Claus Schnabel

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**Employment Stability of Entrants in Newly
Founded Firms: A Matching Approach Using
Linked Employer-Employee Data from Germany**

CLAUS SCHNABEL, SUSANNE KOHAUT AND UDO BRIXY

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Employment Stability of Entrants in Newly Founded Firms: A Matching Approach Using Linked Employer-Employee Data from Germany^{*}

Claus Schnabel^a, Susanne Kohaut^b and Udo Brixy^b

ABSTRACT: Using a linked employer-employee dataset and taking the perspective of individuals rather than firms, this paper analyzes some effects of joining start-ups. We show that entrants in new firms differ from those joining incumbent firms, and we use a matching approach to compare a group of employees joining new firms in 1995/96 with a control group entering incumbent firms. Our results indicate that individuals' employment stability was higher in incumbent than in newly founded firms while their risk of becoming unemployed was lower. In particular in eastern Germany, joining firms that were older than six years was the best strategy.

ZUSAMMENFASSUNG: Diese Arbeit analysiert unter Verwendung eines verbundenen Arbeitgeber-Arbeitnehmer-Datensatzes einige Auswirkungen des Eintritts in Neugründungen, wobei die Sicht von Individuen statt von Firmen eingenommen wird. Wir zeigen, dass Personen, die in neue Firmen eintreten, sich von Eintretenden in bestehende Firmen unterscheiden, und wir verwenden einen Matching-Ansatz, um eine Gruppe von Personen, die 1995/96 in Neugründungen eintrat, mit einer Kontrollgruppe von Eintretenden in bestehende Firmen zu vergleichen. Unsere Ergebnisse deuten darauf hin, dass die Beschäftigungsstabilität der eintretenden Personen in bestehenden Firmen höher als in Neugründungen ausfiel, während ihr Risiko arbeitslos zu werden geringer war. Insbesondere in den neuen Bundesländern bestand die beste Strategie darin, in Firmen einzutreten, die älter als sechs Jahre waren.

Keywords: employment, unemployment, newly founded firms, linked employer-employee data, Germany

JEL classification: J63, J64

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^a University of Erlangen-Nürnberg, IZA and LASER

^b IAB Nürnberg

1. INTRODUCTION

Against the backdrop of high and persistent unemployment, economic policy as well as academic research in Germany has focused on the employment effects of newly founded firms (or start-ups). In the last 15 years, a growing empirical literature has studied the performance of new firms at various levels of aggregation. At the micro level, i.e. using data of individual firms or establishments, quite a few studies have analyzed the success of newly founded firms over the years in terms of survival rates and employment growth (see, e.g., Wagner 1994, Brüderl et al. 1996, Brixly and Kohaut 1999, Almus 2002, Heckmann and Schnabel 2006). From a macro perspective, using the concepts of job creation, job destruction and job turnover, a number of studies have tried to identify the extent to which new firms contribute to aggregate employment growth (see, e.g., Boeri and Cramer 1991, Bellmann et al. 1996, Turk 2002, Brixly and Grotz 2004, Engel and Metzger 2006).¹ Due to data limitations, however, the level of individual workers, that is the employment stability of persons entering newly founded firms, has received little attention so far.

In the vast majority of German as well as international research on employment effects, the unit of observation is the (newly-founded) firm or a cohort of firms. While some studies include and analyze information on the founder or owner of the firm, the employees working in that firm are largely neglected. As a result, researchers have been able to identify some stylized facts such as newly founded firms' high probability of failure within the first year(s) (see Geroski 1995), and there is some knowledge about the factors influencing overall employment growth, such as regional and cohort effects, short- vs. long-term effects and direct vs. indirect effects (see, e.g., Fritsch and Müller 2004). It is an open question, however, whether newly founded firms provide employment opportunities for other sorts of employees than do incumbent firms. More important, we do not know whether it is better for an employee to join a newly founded or an incumbent firm when taking up a new job.

¹ International studies at the micro level include Dunne et al. (1989) for the US and Storey (1994) for the UK; macro analyses are provided, *inter alia*, by Davis et al. (1996) for the US and Barnes and Haskel (2002) for the UK.

In this paper, a new large-scale set of linked employer-employee data enables us to take a different approach and thus fill a gap in the literature. By making individuals the unit of observation and tracing their employment in newly founded (as well as in incumbent) firms over time, we are able to analyze the effects of joining a start-up in terms of employment stability and risk of unemployment. In doing so, we make use of a matching approach and compare a group of employees who joined newly founded firms in Germany in 1995/96 with a control group of “statistical twins” who took up a new job in incumbent firms at the same time. We will show that the outcomes of both groups differ substantially in various aspects and that joining a newly founded firm is a risky strategy in terms of avoiding unemployment.

The paper is organized as follows: Section 2 provides some theoretical considerations that are used to derive testable hypotheses on the characteristics of employees and on their employment prospects in newly founded firms. Our linked employer-employee data set is described in section 3. Section 4 discusses our empirical approach and presents descriptive and econometric evidence on the determinants of entering a new firm as well as on the outcomes of this decision (compared to entering an incumbent firm). Section 5 concludes.

2. SOME PROS AND CONS OF JOINING NEW FIRMS

While there is no specific theory of individuals’ decision to join newly founded rather than incumbent firms and of start-ups’ decision to hire employees and offer certain working conditions, standard arguments and insights from labour economics, industrial organization and entrepreneurship research can be used (and modified) to derive some testable hypotheses on employment in newly founded firms.² Two main aspects of interest will be job matching (i.e. what can newly founded firms offer to potential employees and which sort of workers join them?) and the development of (un)employment in start-ups over the first years (including firms’ mortality and individuals’ job mobility).

² Standard presentations of theories of job search, matching and compensating wage differentials can be found in labour economics textbooks such as Cahuc and Zylberberg (2004) and Franz (2006). Relevant insights from industrial organization are discussed, *inter alia*, in Audretsch and Mata (1995), Geroski (1995) and Audretsch et al. (2001).

Before joining a newly founded firm, utility-maximizing individuals will compare the monetary and non-monetary returns from working there with their present situation (for a textbook presentation of job search theory, see Cahuc and Zylberberg 2004, ch. 3). They will join only if the discounted expected life-time utility is higher (taking into account mobility costs). When assessing job quality, employees will not only look at wages and working conditions but also at the (expected) employment stability in new firms. In particular entrants who come from the educational system may hesitate to join start-ups with a high risk of failure because the first job is often an important determinant of future success in the labour market. Additional non-monetary aspects that could be important for joining new firms might be an employee's enthusiasm for the business idea and the attractiveness of a situation with flat hierarchies where structures can still be formed. Some employees could also speculate that they are first in line and therefore in a good position for a career within the new firm.

Potential employees will compare the compensation and prospects offered by the new firm with what they receive from their current employers (or from unemployment insurance) and with what they are offered by other firms. According to human capital theory, their present wages (and thus wage demands) rise with employment experience. If they further take into consideration that new firms are much more likely to expire than older ones, they can be expected to demand higher wages in the sense of a wage differential compensating for the increased risk of a job loss. Wage demands will also be higher if potential employees recognize that newly founded firms offer fewer fringe benefits (such as pension plans) than long-established firms.

Newly founded firms, however, may not be able to pay high wages. Most new firms operate at such a small scale of output that they are confronted with an inherent cost disadvantage and thus need to pursue a strategy of compensating factor differentials, which includes paying lower wages (Audretsch et al. 2001).³ Because of lower wages and a higher risk of failure, the new firm may not be able to poach

³ This sub-optimal scale of operation may be related to the fact that younger firms also face tighter financial constraints (in the form of lower ability to raise funds or higher cost of funds) than older firms. By paying lower wages today in exchange of higher future wages, new firms effectively borrow from their employees (see Michelacci and Quadrini 2005).

experienced employees from other firms but may have to rely to a higher extent on attracting workers who are currently unemployed or out of the labour force. If, however, these people are less able (or willing) to fulfil the requirements of the job, employment terminations may be more likely in newly founded firms. The same holds if the new employees are not satisfied with the relatively low wages paid and leave the young firm as soon as they find a better job elsewhere.

Furthermore, start-ups usually do not have experience in hiring suitable employees and are more likely to make false judgements, so that the matching process characterized by trial and error may have to be repeated more often in new firms. Since newly founded firms also tend to face higher uncertainty and fluctuation in demand for their products while at the same time having less financial resources to hoard labour in periods of slack, they may have to adjust employment more often than incumbent firms. These arguments and the higher risk of failure suggest that employment stability will be lower and the risk of unemployment will be higher in newly founded firms.

Over time, these differences between new and incumbent firms can be expected to become smaller. Once the critical initial period of new employment relationships is over and the economic situation of the new firm stabilizes, employment stability and the risk of unemployment should be similar to that in incumbent firms. The negative wage differential might also decrease since a firm's ability to pay can be expected to rise and since its employees acquire tenure and valuable firm-specific human capital that has to be rewarded. This in turn will reduce employees' propensity to leave the firm.

Taking into account both the perspectives of employees and employers, the following five hypotheses concerning employment can be derived:⁴

⁴ The preceding arguments also imply a sixth hypothesis on differences in wages, which is not postulated and investigated here. Since our data set contains information only on daily but not on hourly wages (there is no exact data on the number of hours worked by full- and part-timers and in different industries), the wage effects of working in new firms cannot be analyzed in this paper. Following an age cohort of firms over time, both Baldwin and Rafiqzaman (1995) for Canada and Brixy et al. (2007) for Germany identify a negative wage differential of start-ups that becomes smaller over time. However, both studies rely on plant-level data and are not able to investigate the impact of working in a newly founded firm on individual employees' wages.

- 1) Entrants in newly founded firms are less likely to have a long experience of employment in the past.
- 2) Entrants in newly founded firms are more likely to have not been employed directly before taking up this job.
- 3) The stability of employment relationships is lower in newly founded firms.
- 4) The risk of becoming unemployed is higher when joining new firms.
- 5) These differences between new and incumbent firms become smaller over time once newly founded firms mature.

3. DATA

The data used in this study is derived from two sources that are closely interrelated and together form an employer-employee data set. The employee side of the data set is the "German Employment Statistics" (sometimes also called the "German Social Insurance Statistics").⁵ It requires all public and private employers to report certain information about every employee who is subject to obligatory social insurance (i.e. health and unemployment insurance along with pension funds). Misreporting is legally sanctioned. The attributes of each individual covered in this database are his/her sex, age and nationality, the formal qualification (five levels) as well as the wages and salaries paid and the exact duration of the engagement in days. In addition, we obtained information about employees' work experience in the previous 20 years (including spells of unemployment). The data also enable us to infer whether an individual was employed or unemployed or in the educational system directly before taking up the job investigated below. Those entrants who do not fall in one of these three categories are recorded as inflows from unknown origin, which includes being out of the labour force or self-employed.

The employer side of our data set is given by the "IAB Establishment Panel"⁶, a random sample of establishments from the comprehensive IAB Establishment

⁵ The data generation process is described in more detail by Bender et al. (2000), although they concentrate on the IAB employment subsample, a related, publicly available data set not used here.

⁶ IAB is an acronym for Institut für Arbeitsmarkt- und Berufsforschung, which is the research institute of the Federal Labour Agency in Germany.

Register drawn according to the principle of optimal stratification. The stratification cells are defined by ten classes for the size of the establishment and by 16 economic sectors. Every year since 1993 (1996) the IAB Establishment Panel has surveyed the same establishments from all branches and different size categories in western (eastern) Germany. In order to correct for panel mortality, exits and newly founded establishments, the panel is augmented regularly. The questionnaire covers a variety of questions which can be used in our analysis, such as information on the location of the establishment and on bargaining coverage. Data are collected in personal interviews with the owners or senior managers of the establishments by professional interviewers.⁷

In 1997, a representative sample of establishments that reported under a new firm-identification-number in the employment statistics was drawn and integrated into the IAB Establishment Panel. From this sample, 742 newly founded establishments that provide sufficient information on their employees can be used in our analysis. Each of these newly founded establishments hired its first employee between 1 July, 1995 and 30 June, 1996. Our sample was restricted to establishments that were in private ownership of one or more founders but were not owned by other firms, so there are no derivative foundations. The development of these newly founded establishments is contrasted with 4,399 incumbent establishments from the private sector that already existed in 1996 and employed at least one person in 1997.

The employee and the employer data are linked through a plant identifier that is available in both data sets. We concentrate on those 2,627 employees who were hired by one of the 742 newly founded firms between 1 July, 1995 and 30 June, 1996. We will contrast employment and unemployment of these employees until 2001 with that of all other employees who were hired by one of the other firms in the representative IAB Establishment Panel in the same period of observation.

Put differently, we have a large pool of 115,958 individuals who were either employed or unemployed or who came from the educational system or from an un-

⁷ Details regarding the IAB Establishment Panel are given in Kölling (2000).

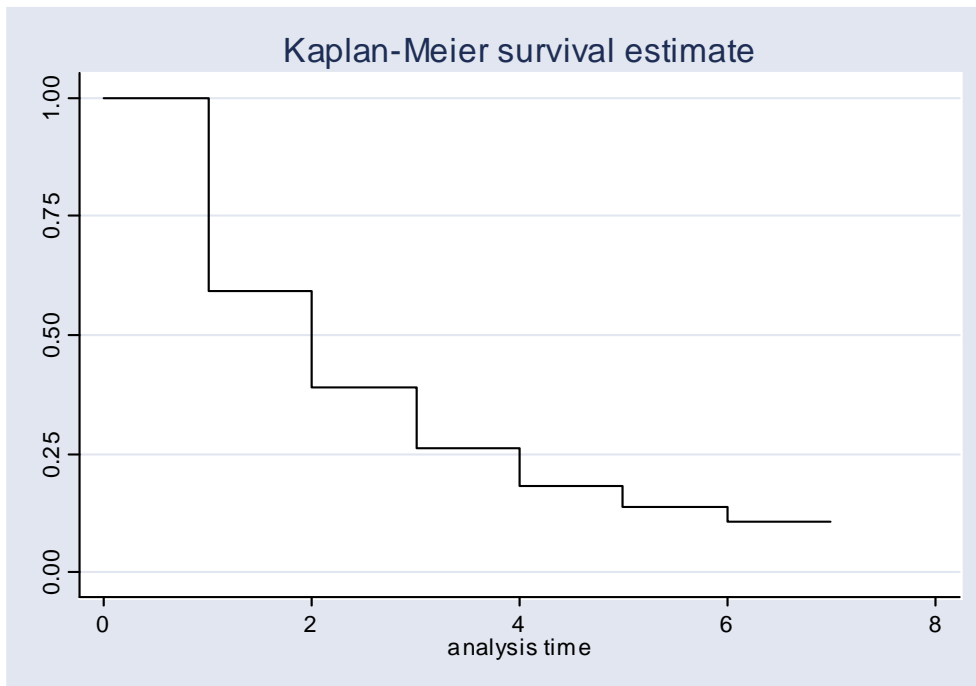
known origin, all of which took up a new job in 1995/96. From this pool, 2,627 individuals joined newly founded firms and 113,331 individuals were hired by incumbent firms. Missing data for some of the explanatory or outcome variables reduce these samples to 2,048 and 103,578 individuals, respectively. We will be able to investigate the five hypotheses derived above by comparing the origin of new employees in new and incumbent firms and by analyzing the development of (un)employment over the years in those two groups, making use of a statistical matching approach. In doing so, we distinguish between western and eastern Germany since the economic and labour market situation has been quite different in both regions even several years after unification. Furthermore, previous research for the 1990s has shown that in terms of survival rates and employment growth newly founded firms in eastern Germany have differed from their western counterparts (see Brixy and Grotz 2004), and our research will also identify substantial differences.

4. EMPIRICAL ANALYSIS

In the empirical analysis, we investigate where the employees in new firms come from and we compare their employment stability in newly founded firms with that in incumbent firms over the first years. We have data on the number of newly hired employees who are still working in the firm or who have become unemployed, and we know their length of employment. Whether these indicators differ between jobs in newly founded and incumbent firms has received little attention in empirical research so far.⁸ It should also be interesting to know whether such differences – if they exist – vanish over time once the new firm matures.

⁸ Brixy et al. (2007) find that start-ups are characterized by higher labour fluctuation than incumbent establishments. However, they rely on plant-level data and are not able to investigate the impact of working in a newly founded firm on individual employees.

4.1 DESCRIPTIVE EVIDENCE

Figure 1: Kaplan-Meier survival estimate for entrants in new firms

While it is one of the stylized facts in the literature on newly founded firms that start-ups have a high probability of failure within the first years (see Geroski 1995), the failure of employment relationships in these firms has not been investigated so far.⁹ Figure 1 provides Kaplan-Meier survival function estimates for the 2,627 individuals who joined one of the 742 new firms in 1995/96. It can be seen, that about 40 per cent of employment relationships were terminated in the first year, and 74 per cent did not last longer than three years. These low survival rates reflect not only the fact that employees joining new firms face a high risk of losing their job due to firm failure. Employment relationships may also end in surviving firms if employees are laid off or if they quit voluntarily. Unfortunately we do not have information on this in our data set. Nevertheless, it is interesting to see that employment stability in newly founded firms seems to be relatively low. What is more important to know, however, is whether employment stability is lower compared to that of individuals joining incumbent firms.

⁹ Using the employer side of our data set, Heckmann and Schnabel (2006) report that 22 per cent of firms that hired their first employee in 1995/1996 and were then integrated into the IAB Establishment Panel in 1997 do not survive from 1997 to 1998, and 43 per cent do not reach the year 2000.

Table 1: Mean values of variables for individuals joining new or incumbent firms, before and after matching (Western Germany, all establishments)

	(1)	(2)	(3)	(4)	(5)
Groups of entrants	Individuals joining new firms (treatment group)	All individuals joining incumbent firms	t-test (2)-(1)	Matched individuals joining incumbent firms (control group)	t-test (4)-(1)
Number of cases N	427	62,128		427	
Variables					
Percentage of persons becoming unemployed in the first year	13.11	8.35	-2.91	8.20	-2.33
Percentage of persons still employed in the same firm after one year	60.89	63.68	1.17	60.66	-0.07
Total number of days in employment in the same firm (after 6½ years)	860.70	1048.18	4.92	981.12	2.11
Sex (1=male)	0.61	0.69	3.17	0.62	0.35
Age (years)	33.96	32.19	-3.94	33.52	-0.68
Nationality (1=German)	0.88	0.86	-1.05	0.86	-0.92
Secondary schooling, no vocational training	0.08	0.20	8.85	0.11	1.17
Secondary schooling, vocational training	0.80	0.56	-12.18	0.80	0.00
High school graduate, no vocational training	0.01	0.03	2.69	0.01	-0.71
High school graduate, vocational training	0.04	0.06	1.91	0.04	0.17
University or polytechnic degree	0.07	0.16	7.01	0.05	-1.28
No. of jobs before joining	2.95	2.51	-4.40	3.04	0.55
Total employment experience (days)	1917.14	1818.89	-1.69	1892.82	-0.29
No. of unemployment spells	0.92	0.73	-3.26	0.99	0.80
Total unemployment experience (days)	187.82	161.50	-1.78	208.67	0.89
Inflow from employment	0.69	0.67	-0.74	0.69	-0.07
Inflow from unemployment	0.24	0.23	-0.48	0.23	-0.32
Inflow from educational system	0.01	0.05	8.44	0.01	-0.38
Inflow of unknown origin	0.06	0.05	-1.18	0.05	-1.18

Table 2: Mean values of variables for individuals joining new or incumbent firms, before and after matching (Eastern Germany, all establishments)

	(1)	(2)	(3)	(4)	(5)
Groups of entrants	Individuals joining new firms (treatment group)	All individuals joining incumbent firms	t-test (2)-(1)	Matched individuals joining incumbent firms (control group)	t-test (4)-(1)
Number of cases N	1,621	41,450		1,621	
Variables					
Percentage of persons becoming unemployed in the first year	14.62	24.02	10.41	24.98	7.47
Percentage of persons still employed in the same firm after one year	64.16	44.31	-16.32	43.06	-12.32
Total number of days in employment in the same firm (after 6½ years)	861.72	710.47	-8.02	717.09	-5.46
Sex (1=male)	0.70	0.58	-10.19	0.70	0.23
Age (years)	36.34	37.49	4.46	36.15	-0.52
Nationality (1=German)	0.98	0.97	-3.11	0.98	0.27
Secondary schooling, no vocational training	0.03	0.09	15.32	0.03	0.52
Secondary schooling, vocational training	0.89	0.75	-17.55	0.90	0.86
High school graduate, no vocational training	0.001	0.005	3.52	0.004	1.42
High school graduate, vocational training	0.02	0.03	2.19	0.01	-1.40
University or polytechnic degree	0.06	0.12	10.34	0.05	-1.06
No. of jobs before joining	2.74	2.36	-8.67	2.75	0.08
Total employment experience (days)	1157.66	1138.80	-1.29	1128.48	-1.35
No. of unemployment spells	1.07	0.95	-4.45	1.12	1.22
Total unemployment experience (days)	294.95	325.48	3.03	323.03	1.96
Inflow from employment	0.58	0.57	-0.73	0.55	-1.95
Inflow from unemployment	0.39	0.38	-0.83	0.42	1.75
Inflow from educational system	0.01	0.02	5.62	0.01	0.71
Inflow of unknown origin	0.02	0.03	1.64	0.03	1.64

A first look at the descriptive data in the top panel of Table 1 indicates that in western Germany workers who join newly founded firms (column 1) are more likely to become unemployed in the first year than those who enter incumbent firms (column 2). The reverse is true for eastern Germany (see Table 2), what underscores the importance of treating both regions separately. Employment stability also differs substantially between new and incumbent firms and between western and eastern Germany.

However, there are some marked differences between the two groups of workers that joined start-ups or incumbent firms, respectively. The lower panels of Tables 1 and 2 examine these differences for several employee characteristics. It can be seen that the group of workers joining new firms contains more individuals with a German passport, and its average age is slightly higher in western but lower in eastern Germany compared to the groups of individuals joining incumbent firms. The skill composition of the two groups also differs: In western Germany, 80 per cent of entrants in new firms but only 56 per cent of entrants in incumbent firms have obtained secondary schooling and vocational training resulting in a skilled workers' certificate. In contrast, 16 per cent of entrants in incumbent firms but only 7 per cent of individuals joining a new firm have a university or polytechnic degree. Similar differences can be found in eastern Germany.

Looking at the work history of individuals, it can be seen that those joining new firms had more jobs in the past and record a higher average number of unemployment spells whereas there are no significant differences concerning those individuals' total days in employment. Finally, only about 1 per cent of entrants in new firms come directly from the educational system, whereas this inflow is 5 and 2 per cent for the group of workers joining incumbent firms in western and eastern Germany, respectively. It will be interesting to see whether these relationships also hold in the multivariate analysis conducted below.

The implication of this descriptive material is that joining a newly founded or an incumbent firm is not a random occurrence. The different starting conditions imply that observed differences in the employment security of employees that did or did not join a start-up cannot be interpreted unambiguously as a causal effect of joining.

If employees from both groups of entrants differ significantly at a point in time when none of them had yet entered their new firms, one would expect them also to display differences in (un)employment some years later. These different starting conditions are explicitly taken into account and eliminated in the matching approach below.

4.2 THE MATCHING APPROACH

The matching approach is a nonparametric (or semi-parametric) method to identify the impact of a specific treatment on certain outcomes which allows a causal interpretation of treatment effects.¹⁰ In our case, the treatment is joining a newly founded firm in 1995/96, and employees who joined an incumbent firm in the same period form our control group. Our outcome variables are the shares of newly hired employees who are still working in the firm or who have become unemployed as well as the length of employment in the years following the treatment. The (average) treatment effect is identified by choosing a subset of the control group of untreated individuals (those who joined incumbent rather than new firms) having observable characteristics in 1995 as similar as possible to the treated group (those individuals who joined start-ups). Conditioning on the observables, the method assumes that the only remaining difference between the two groups of employees is the treatment status. Accordingly, the average impact of the treatment can be recovered through a comparison of means of the outcome variables of both groups.¹¹

In our particular context, the identifying assumption when using matching methods (i.e. the conditional independence assumption) is that workers joining a newly founded firm would have experienced the same employment stability as the control group in the (hypothetical) case that they had not done so. To satisfy this condition,

¹⁰ Matching analysis and the causal interpretation of the effects identified can be traced back to Rubin (1974). Latterly, the approach has become very popular in the evaluation of labour market programs; see, for example, Heckman, LaLonde and Smith (1999).

¹¹ In contrast to traditional OLS or 2SLS regression, the matching analysis is restricted to the region of common support, which means that the estimated treatment effect is restricted to the so-called region where data on the treated individuals as well as those from the control group are observed. Note also that the matching analysis (as well as OLS regression analysis) requires the decision to join a newly founded firm, conditional on the covariates, to be independent of the unobservables.

we must take into account all variables that are expected to exert an influence on the decision to join and on employment stability. The credibility of our assumption that joining a newly founded firm only depends on observable but not on unobservable factors crucially depends on the quality of the set of matching variables. Although we cannot completely rule out that variables not included in our data set (such as the number of children an employee has, or soft characteristics like motivation and risk aversion) could play a role for joining a new firm, we believe that the quality of our data set and the large number of matching variables we have allows us to maintain this assumption. Since we are able to include indicators of an individual's previous (un)employment history in the last 20 years as well as a number of socio-demographic and educational characteristics of an individual, we are confident that the most important factors which potentially affect both the joining of new firms and the outcome variables are taken into account in this study.

We apply propensity score matching, wherein the selection of the control group is carried out on the basis of the probability that an individual has received treatment, conditional on the observed variables. The propensity score is obtained from a probit regression of a dummy variable indicating whether or not a worker has joined a newly founded firm on a vector of covariates consisting of the following arguments: the number of jobs an individual had before, the number of days he/she was employed, the number of unemployment spells an individual experienced in the past, the total number of days he/she spent in unemployment, whether the entrant was unemployed directly before taking up this job, came from the educational system or was recorded to come from an unknown origin (having been employed is the reference group), sex, age, German nationality, and five levels of education.

For each treated entrant (in a newly founded firm) we search for the most similar entrant in terms of the propensity score (obtained from the probit regression) in the control group of entrants in incumbent firms, thus performing a nearest neighbour matching.¹² Note that in this process each matched entrant from the control group is

¹² Since our control groups consists of 62,128 and 41,450 individuals in western and eastern Germany, respectively, and are thus much larger than our groups of treated individuals, nearest neighbour matching without replacement is feasible and appropriate. Matching was performed in Stata 9.2 using the PSMATCH2 command (Leuven and Sianesi 2003).

never used more than once to form a statistical twin (one-to-one matching), so that the results reported below are based on totally different pairs of treated and non-treated individuals. The matched non-treated entrants form the new control group. The lower panels of Tables 1 and 2 indicate that the matching was successful. A comparison of the mean values of variables for the pairs of treated (column 1) and non-treated entrants (column 4) shows no statistically significant differences at the 1 per cent level.¹³ In other words, the respective groups of entrants in new and in incumbent firms are very similar. This allows us to go on and compare the means of several indicators of entrants' performance in newly founded firms with the corresponding means of the matched non-treated individuals.

4.3 RESULTS

Before analyzing the results of the matched pairs, a brief look at the results of the probit regressions used for estimating the propensity score may be worthwhile. This may improve our understanding of the factors that influence individuals' decision to join newly founded rather than incumbent firms and firms' decision to hire employees with certain characteristics. These results are presented in Table 3 in the form of marginal effects (reflecting the effects on the probability of entering a newly founded firm of a one-unit change in a continuous explanatory variable at its mean or of a discrete change of a dummy variable from 0 to 1 with all other variables set at their sample means). Note that an individual's average probability of joining a new rather than an incumbent firm is about 4 per cent in eastern and less than 1 per cent in western Germany in our sample.

¹³ In addition to our t-tests there exist other tests on balancing covariates in propensity score models, but in their comparative survey Smith and Todd (2005, 371) show and conclude that "these tests have a number of limitations".

Table 3: Factors influencing individuals' probability of joining a newly founded firm

(results of probit analyses, marginal effects; dependent variable: entrant in incumbent/new firm = 0/1)

	Western Germany	Eastern Germany
Sex (1=male)	-0.0018 (-2.92) ^{***}	0.0139 (7.63) ^{***}
Age (years)	0.0001 (4.08) ^{***}	-0.0003 (-3.45) ^{***}
Nationality (1=German)	-0.0009 (-0.98)	0.0146 (2.11) ^{**}
Secondary schooling, vocational training (1=yes)	0.0074 (7.77) ^{***}	0.0410 (9.49) ^{***}
High school graduate, no vocational training (1=yes)	-0.0018 (-0.69)	0.0008 (0.04)
High school graduate, vocational training (1=yes)	0.0031 (1.90) [*]	0.0261 (3.69) ^{***}
University or polytechnic degree (1=yes)	0.0013 (0.95)	0.0146 (2.78) ^{***}
Number of jobs before joining	0.0004 (3.15) ^{***}	0.0030 (5.20) ^{***}
Total employment experience (days)	-9.93 e-07 (-3.18) ^{***}	-0.00001 (-7.00) ^{***}
Number of unemployment spells	0.0006 (1.65) [*]	0.0025 (2.28) ^{**}
Total unemployment experience (days)	-1.82 e-06 (-1.50)	-0.00002 (-5.13) ^{***}
Inflow from educational system (1=yes)	-0.0050 (-2.00) ^{**}	-0.0239 (-2.89) ^{***}
Inflow of unknown origin (1=yes)	0.0012 (0.79)	-0.0098 (-1.41)
Inflow from unemployment (1=yes)	-0.0005 (-0.65)	0.00002 (0.01)

Notes: heteroscedasticity-consistent z-values in brackets; ^{***}/^{**}/^{*} denote statistical significance at the 1/5/10 per cent level; estimations also contain a constant and a variable controlling for the quarter in which entrants joined the firms

From Table 3 it can be seen that in eastern Germany the probability of joining a new firm is about 1.4 percentage points higher for male compared to female employees and is about 1.5 percentage points higher for German rather than foreign individuals: In contrast, in western Germany men are less likely to join newly founded firms, and nationality does not play a significant role. Having had vocational training significantly increases the probability of joining a new firm in both western and eastern Germany. While coming directly from the educational system

reduces the probability of entering a new firm, inflows from unemployment do not differ significantly between both groups of firms. Concerning the work history of the entrants it can be seen that both in eastern and western Germany the probability of joining a new firm significantly rises with the number of jobs an individual has had whereas it falls with his or her total days in employment (holding age constant).

Although our results are a sort of reduced-form estimates and do not enable us to clearly distinguish between the decision of an individual or a firm, they could be interpreted from the perspectives of employees and employers used in the theoretical analysis as follows: Individuals with a good employment record (i.e. many days in employment in the last 20 years) are less likely to join a newly founded firm, probably because they regard it as not attractive in terms of wages and employment security.¹⁴ Newly founded firms do not mind hiring individuals who are currently unemployed, but they avoid hiring individuals who recorded many days in unemployment in the past (significantly so in eastern Germany). They also do not take in individuals who come directly from the educational system, but prefer to hire experienced employees that have had several jobs before. This evidence is consistent with hypothesis 1) postulating that workers hired by newly founded firms are less likely to have a good employment record. In contrast to hypothesis 2), however, there is no evidence that entrants in new firms are more likely to have been not employed directly before taking up this job.

The most interesting question, of course, is whether there are substantial differences in terms of employment stability for entrants in newly founded and in incumbent firms. Mean values of our outcome variables for the respective groups of entrants are reported in Tables 4 and 5.

¹⁴ Note that employees who are frequent "job hoppers" (i.e. are characterized by a high number of jobs before or by many unemployment spells) can be expected to have (for purely technical reasons, but perhaps also due to a lower risk aversion) a higher probability of ending up once in a newly founded firm, so that the positive coefficients of these characteristics are not surprising.

Table 4: Mean values of outcome variables for entrants in newly founded and in incumbent firms, matched pairs (western Germany, N = 427)

Outcome variables	Individuals joining new firms (treatment group)	Matched individuals joining incumbent firms (control group)	differences	t-test of differences
Percentage of persons becoming unemployed until				
- end of year 1	13.11	8.20	-4.91	-2.33**
- end of year 2	18.50	11.01	-7.49	-3.10***
- end of year 3	20.61	11.94	-8.67	-3.45***
- end of year 4	22.95	12.18	-10.77	-4.17***
- end of year 5	24.12	12.41	-11.71	-4.47***
- end of year 6	24.36	13.11	-11.24	-4.25***
Percentage of persons still employed in the same firm after				
- year 1	60.89	60.66	-0.23	-0.07
- year 2	39.34	44.50	5.15	1.53
- year 3	28.81	37.94	9.13	2.84***
- year 4	22.95	29.27	6.32	2.11**
- year 5	16.39	23.19	6.79	2.50**
- year 6	14.75	20.37	5.62	2.16**
Total number of days in employment in the same firm (after 6½ years)	860.70	981.12	120.42	2.11**

Note: ***/**/* denote statistical significance at the 1/5/10 per cent level

Table 5: Mean values of outcome variables for entrants in newly founded and in incumbent firms, matched pairs (eastern Germany, N = 1,621)

Outcome variables	Individuals joining new firms (treatment group)	Matched individuals joining incumbent firms (control group)	differences	t-test of differences
Percentage of persons becoming unemployed until				
- end of year 1	14.62	24.98	10.36	7.47***
- end of year 2	22.21	29.86	7.65	4.98***
- end of year 3	26.84	31.33	4.50	2.83***
- end of year 4	29.73	32.26	2.53	1.56
- end of year 5	31.34	32.70	1.36	0.82
- end of year 6	33.93	33.06	-0.86	-0.52
Percentage of persons still employed in the same firm after				
- year 1	64.16	43.06	-21.10	-12.32***
- year 2	43.62	29.36	-14.25	-8.52***
- year 3	29.24	23.57	-5.68	-3.67***
- year 4	20.17	17.33	-2.84	-2.07**
- year 5	15.98	13.82	-2.16	-1.73*
- year 6	11.91	11.91	0.00	0.00
Total number of days in employment in the same firm (after 6½ years)	861.72	717.09	-144.64	-5.46***

Note: **/* denote statistical significance at the 1/5 per cent level

Starting with western Germany (Table 4), it can be seen that the risk of unemployment is significantly higher for individuals joining new rather than incumbent firms. In the first year, 13 per cent of entrants in new firms but only 8 per cent of entrants in incumbent firms become unemployed. After four years, the respective shares have risen to 23 and 12 per cent. This is mirrored by the fact that after four years just 23 per cent of entrants are still employed in their newly founded firm, whereas this is the case for 29 per cent of entrants in incumbent firms. Correspondingly, the average number of days in employment in the firm in our period of observation covering about 6½ years is significantly lower for entrants in newly founded firms in western Germany.¹⁵ Interpreting these results in terms of our hypotheses, we can confirm hypotheses 3) and 4) stating that employment stability is lower in newly founded firms while the risk of becoming unemployed is higher. Since these differences between new and incumbent firms do not become smaller over time, hypothesis 5) cannot be confirmed.

In eastern Germany, however, the picture is completely different – at least at first sight. Table 5 shows that in contrast to western Germany, the risk of becoming unemployed is significantly lower when joining a new firm (in the first three years). Furthermore, the percentage of entrants still employed in the same firm and the average length of employment are significantly higher in newly founded firms. Interpreting these results in terms of our hypotheses, we would have to reject hypotheses 3) and 4), whereas we could confirm hypothesis 5) that differences between employees in new and incumbent firms become smaller and insignificant over time.

Since the results for eastern Germany are in stark contrast to those obtained for western Germany and to theoretical expectations, a closer investigation is advisable. This shows that the group of incumbent firms, which form the control group of our study, is composed differently in western and eastern Germany with respect to the age of incumbents. Our data contain information on whether a firm was founded before 1990 or not. In western Germany, this is case for 344 out of the 427 firms that

¹⁵ The lower employment stability in newly founded firms is also confirmed by the fact that the employment length of the median entrant is 575 days in new and 607 days in incumbent firms. This shorter length of employment in new firms should not be interpreted negatively since it may reflect employees' move to other firms which offer better pay and working conditions.

form the control group of incumbents. As expected, the majority of incumbent firms are older than six years. In eastern Germany, however, just 169 out of 1,621 incumbent firms were founded before 1990. This reflects the fact that not many firms were able to survive after, in 1989, German unification put an end to the communist regime and to central planning, exposing eastern German firms to the chilly winds of international (and western German) competition. The majority of eastern German firms in our control group are thus young firms not more than six years old which may not differ too much from the newly founded firms that form our treatment group.

In order to better distinguish between new and older firms, we repeat our analysis focussing on those matched pairs of individuals in which the statistical twin in the control group entered a firm that was founded before 1990.¹⁶ Table 6 shows that this does not change our insights concerning western Germany (which is not surprising given that 344 out of 427 matched pairs can be used for this analysis): As before, employment stability is lower in newly founded firms while the risk of becoming unemployed is higher. What does change, however, is the picture for eastern Germany. Although the relatively small number of just 169 observations suggests that the results should be interpreted cautiously, Table 7 indicates that the risk of becoming unemployed is significantly higher in new compared to older firms. Employment stability is lower in newly founded firms, although the differences are not always statistically significant. Taken together, Tables 6 and 7 demonstrate that the results are quite similar for western and eastern Germany and are in accordance with hypotheses 3) and 4) once we focus on incumbent firms which are older than six years.¹⁷ Hypothesis 5) postulating vanishing differences between new and older firms, however, cannot be confirmed.

¹⁶ Another possible approach might have been to restrict (before matching) the sample for the control group to firms founded before 1990, so that all individuals joining a newly founded firm would only be matched to individuals entering older firms. Such a severe restriction, however, would not adequately reflect the decision of individuals to enter different sorts of firms, which is the main focus of our analysis, and it would result in using statistical twins who are not really nearest neighbours in terms of individual characteristics, work history etc.

¹⁷ One reason why the results are totally different once we include young firms of age one to six may be that these young firms were in a very special situation in eastern Germany during our period of observation. They had been founded after unification with massive financial support from German and EU sources which may have helped them to survive the first year(s) even if their business did not prosper. Once financial resources dried up and the eastern German economy began to stagnate in 1997, however, employees in these firms experienced a high probability of being laid

Table 6: Mean values of outcome variables for entrants in newly founded and in incumbent firms founded before 1990, matched pairs (western Germany, N = 344)

Outcome variables	Individuals joining new firms (treatment group)	Matched individuals joining incumbent firms founded before 1990 (control group)	differences	t-test of differences
Percentage of persons becoming unemployed until				
- end of year 1	13.08	9.01	-4.07	-1.70*
- end of year 2	18.31	11.63	-6.69	-2.47**
- end of year 3	20.93	12.79	-8.14	-2.86***
- end of year 4	23.55	12.79	-10.76	-3.69***
- end of year 5	24.71	13.08	-11.63	-3.93***
- end of year 6	25.00	13.95	-11.05	-3.69***
Percentage of persons still employed in the same firm after				
- year 1	63.37	61.63	-1.74	-0.47
- year 2	41.57	45.35	3.78	1.00
- year 3	30.23	38.37	8.14	2.25**
- year 4	23.55	31.10	7.56	2.23**
- year 5	16.86	25.00	8.14	2.63***
- year 6	14.83	21.80	6.98	2.37**
Total number of days in employment in the same firm (after 6½ years)	883.02	1007.00	123.98	1.95*

Note: ***/**/* denote statistical significance at the 1/5/10 per cent level

off (or quitting voluntarily), which dominated the results of our mixed control group of entrants in older and younger incumbent firms.

Table 7: Mean values of outcome variables for entrants in newly founded and in incumbent firms founded before 1990, matched pairs (eastern Germany, N = 169)

Outcome variables	Individuals joining new firms (treatment group)	Matched individuals joining incumbent firms founded before 1990 (control group)	differences	t-test of differences
Percentage of persons becoming unemployed until				
- end of year 1	13.61	11.83	-1.78	-0.49
- end of year 2	21.89	14.20	-7.69	-1.84*
- end of year 3	24.85	14.79	-10.06	-2.33**
- end of year 4	26.63	14.79	-11.83	-2.71***
- end of year 5	27.81	14.79	-13.02	-2.95***
- end of year 6	28.99	14.79	-14.20	-3.19***
Percentage of persons still employed in the same firm after				
- year 1	65.09	65.09	0.00	0.00
- year 2	43.20	52.07	8.88	1.64*
- year 3	31.36	44.38	13.02	2.48**
- year 4	24.26	34.32	10.06	2.04**
- year 5	21.89	27.22	5.33	1.14
- year 6	18.34	23.67	5.33	1.20
Total number of days in employment in the same firm (after 6½ years)	928.99	1091.64	162.65	1.76*

Note: ***/**/* denote statistical significance at the 1/5/10 per cent level

Although the focus of our analysis is on the decision of individuals and not on the firm or industry they enter, we took account of information on the size and sector affiliation of the firms entered in order to see whether these influence our results. Comparing only pairs of entrants who joined firms with less than 100 employees showed that the results do not reflect a firm size effect (i.e. entrants in incumbent firms do not fare better or worse just because they entered larger firms). Reducing sample heterogeneity by using four sectoral sub-samples (construction, manufacturing, private services and others) when matching entrants also did not change our insights (results are available from the authors on request).

5. CONCLUSIONS

Using a large-scale set of linked employer-employee data from Germany, this paper has analyzed the effects of joining a start-up in terms of employment stability and risk of unemployment. We made use of a matching approach and compared a group of employees who joined newly founded firms in 1995/96 with a control group of “statistical twins” with similar characteristics and work history who took up a new job in incumbent firms at the same time. This approach was taken because usually the individuals joining new firms differ from those joining incumbent firms in various respects such as skills and work history. In our sample, for instance, workers hired by newly founded firms were more likely to have vocational training and less likely to come directly from the educational system. They were also less likely to have a good employment record in that they had experienced a lower amount of days in employment (but more different jobs) in the last 20 years.

Looking at the outcome in terms of employment effects, we found that individuals’ employment stability was higher in incumbent than in newly founded firms while their risk of becoming unemployed was lower, which is in accordance with our hypotheses. While these results are clearly visible in western Germany, they only hold in eastern Germany for a group of incumbent firms which are more than six years old. Entrants in younger incumbent firms were even worse off than those in start-ups, which probably reflects the special situation in eastern Germany following unification.

By making individuals rather than firms the unit of observation and tracing their employment over time, we could investigate for the first time whether it is better for an employee to join a newly founded or an incumbent firm when taking up a new job. Our results suggest that for the cohort hired in 1995/96 and in terms of employment stability, the best strategy was to join incumbent firms that were founded before 1990; this proved particularly important in eastern Germany. Before our insights can be generalized, however, they should be replicated for other cohorts of entrants (which is not possible with our data set). The advantage of joining mature firms may even be higher when in addition to employment wages are taken into account. While the individual wage effects of entering new firms could not be analyzed in this paper due to lack of suitable data, the lower average wages in newly founded firms identified by Brixy et al. (2007) point in this direction.

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