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

Zentrum für Europäische Wirtschaftsforschung GmbH
Centre for European Economic Research

Udo Brixy, Helmut Fryges and Kathrin Müller

Wage Determination in High-tech Start-ups – Does it Differ for Academic Spin-offs?

– Extended abstract –

Motivation

One of the most important roles that are attributed to newly founded high-tech firms is the commercialisation of new technologies and services. The ideas for these innovations are often developed by the entrepreneur during academic research. Academic spin-offs are a vehicle to transfer these ideas into marketable products and services. They therefore take a special position among high-tech start-ups. A large number of existing empirical studies examined whether or not academic spin-offs outperform other comparable start-ups. Results show that academic spin-offs exhibit better innovation performance (e.g. a higher probability to be granted a patent, Czarnitzki and Toole 2007) but are frequently not found to perform significantly better in terms of employment growth (e.g. Colombo and Piva 2005). There is, however, another way on how academic spin-offs may have a positive impact on employment: Spin-offs may pay higher wages than other high-tech start-ups in order to attract highly qualified and motivated staff who are able to successfully support the process of technology transfer.

Extant literature discusses factors that influence the necessity and the ability of young firms to pay high wages. Since young firms face a high risk of failure employees can be expected to demand high wages in order to compensate for the increased risk of job loss. On the other hand, there may exist non-monetary incentives (e.g. enthusiasm for the business idea) that allow newly founded firms to hire employees in spite of low wages. Moreover, young firms often face tight financial constraints that decrease their ability to pay high wages (cf. Brixy et al. 2007 for a comparison of young and established firms). Since spin-offs use cutting-edge technologies and research results for producing their products and services the risk of failure might be higher even compared to other high-tech start-ups. However in the case of success, spin-offs may gain a high competitive advantage that increases cash-flow and allows spin-offs to pay higher wages. On the other hand, academic spin-offs should have the advantage of a special access to university graduates. Often the founders are well known to the young professionals and enjoy a high reputation. Moreover, frequent possibilities for preparing a master or PhD thesis are offered. The culture of these spin-offs is likely to be very close to the university, what might have a special appeal for many young graduates as well. These are all non-pecuniary advantages that only spin-offs with special relations to a university can offer. Hence, these firms might be able to hire highly-qualified personnel at lower costs.

In this paper, we estimate wage regressions in order to examine whether or not academic spin-offs in Germany pay higher wages than other high-tech start-ups. Our analysis contributes to the literature not only by showing whether potential wage differentials between employees working in newly founded firms can be traced back to the property of the employer to be a spin-off firm but also provide further insights in the wage determination in newly established high-tech firms using a unique linked employer-employee dataset.

Description of the data set

We use a linked employer-employee data set that combines survey data of newly-founded high-tech firms with employee data from the German employment statistics of the Federal Employment Agency. The employer data originate from the ZEW High-tech Start-up Survey conducted in 2007. Computer-aided telephone interviews (CATI) were conducted with about 3,000 young high-tech firms in Germany founded in the period from 1998 to 2005. The survey covers newly founded legally independent firms that are run by at least one full-time entrepreneur. The survey data include information on the year of firm formation, the human capital of firm founders and innovation activities. In order to minimise a potential survival bias, only firms founded in the period from 2003 to 2005 were used to set up the linked employer-employee data set.

The employment statistics of the Federal Employment Agency contains process-produced person-specific data on all employees subject to social insurance contributions in Germany. The data are reported by the employing establishment and collected by the social security agencies. The data on employees encompass, on the one hand, socio-demographic characteristics like gender, age, nationality, school education and professional qualifications. On the other hand, information on employment-related characteristics is covered by the data set: start and end date of employment, gross earnings subject to social security, education, profession and occupational status (including full or part-time employment).

Since there is no unique firm identifier in the two data sets, the individual firms were match via firm names and addresses applying the specialised software "SearchEngine", a programme that has been developed at the ZEW and proved to be efficient in identifying the same firm in different data sets. If a firm turned out to have more than one establishment, the data of the employment statistics were aggregated in order to make them comparable with the firm level data from the ZEW High-tech Start-up Survey. The survey data set contains 1,117 firms founded from 2003 to 2005 of which the number of employees measured at the end of the year 2006 exceeded the number of entrepreneurs.[1] 947 of the firms surveyed could be matched to one or more establishments recorded in the employment statistics. From 2003 to 2008, a total of 11,861 employees subject to social insurance contributions worked in these 947 firms – either part time or full time, for the entire year or for a shorter period.

In order to identify academic spin-offs, the survey questionnaire follows a rather narrow approach. Academic spin-offs are defined as foundations of persons with an academic background (students, graduates and researches) who classified academic skills, new scientific methods or own research results as indispensable for the establishment of their firm. According to the statements of the founders, two types of spin-offs can be distinguished (cf. Egeln et al. 2003):

- Transfer spin-off: At least one of the founders was involved in producing new research results or scientific methods that were indispensable to the creation of the firm.
- Competence spin-off: Specific skills, which at least one of the founders acquired during the time at the public research institute, must have been indispensable to the creation of the firm.

7% of the firms in the sample belong to the group of transfer spin-offs, 6% of the firms are competence spin-offs.

Empirical methodology and results

In order to investigate a potential wage differential between spin-offs and other high-tech start-ups we estimate random-effects GLS regressions and pooled OLS regressions. The dependent variable of the wage regressions is the (logarithmic) daily salary, the unit of observation is the individual employee. In both the random effects GLS and the pooled OLS regressions standard errors are clustered by the individual.

[1] The questionnaire of the ZEW High-tech Start-up Survey did not distinguish between different groups of employed persons. Thus, employees working in the surveyed firms are not necessarily subject to social insurance contributions but might be freelancers or family members who do not receive payment.

The purpose of this paper is an analysis of the relationship between employees' wages and the property to work in a spin-off. Thus, the independent variables of main interest are two dummy variables indicating whether or not the employing firm was founded as a transfer spin-off or a competence spin-off respectively. Since the business idea of a spin-off is the exploitation and commercialisation of new technologies, research results or specific skills, we expect that an employee's qualification is decisive for being recruited by a spin-off. Therefore, we further interact the spin-off dummies with two dummy variables reflecting employees' level of education (vocational training, university degree, and no formal qualification as the reference category).

As additional independent variables we include employee-specific, entrepreneur-specific and firm-specific variables. As employee-specific variables we consider the employee's age and its squared value, level of education, field of education (e.g. technical, engineering, managerial education), occupational status ("minijob", part time, full time), job tenure, unemployment status before entering the start-up, and two dummy variables indicating female gender and German citizenship respectively. Entrepreneur-specific variables are measured at the time of firm foundation and include the entrepreneur's industry experience in the same sector the start-up is operating in, the entrepreneur's level of education, and a dummy variable taking the value one if the entrepreneur set up her/his firm with a team of founders and zero otherwise. The firm-specific variables include firm size and firm age, R&D activities (occasionally or continuously), the share of apprentices and the share of employees with a university degree in total employees.

The regression results show that employees working in a transfer spin-off earn indeed higher wages than employees working in other start-ups. After controlling for employee-specific, entrepreneur-specific and firm-specific variables, wages paid by transfer spin-offs exceed those paid by otherwise created firms by 4%. The interactions terms between the dummy variable indicating a transfer spin-off and dummies measuring the employees' level of education further show that there are positive and significant wage differentials for employees with a university degree (10%) and those without a formal qualification (8%) but not for employees with a vocational training. The wage differential for employees without a formal qualification might result from the fact that transfer spin-offs often employ students or university dropouts. On the contrary, competence spin-offs do not pay higher wages, not even for employees with a university degree.

We conclude that transfer spin-offs that are characterised by a high level of technology transfer from public research institutions to the newly founded firm are able to pay higher wages. This result has important implications for an assessment of academic spin-offs from a political point of view since the effect of spin-offs on employment might not be reflected by higher employment growth rates but by higher wages.

References

Brixy, U., S. Kohaut and C. Schnabel (2007), Do Newly Founded Firms Pay Lower Wages? First Evidence from Germany, Small Business Economics, 29, 161-171.

Colombo, M. G., and E. Piva (2005), Academic start-ups and new technology-based firms: A matched pair comparison, 5th Triple Helix Conference, 18–21 May, Turin.

Czarnitzki, D., and A. Toole (2007), Biomedical Academic Entrepreneurship Through the SBIR Program, Journal of Economic Behavior and Organization, 63, 716-738.

Egeln, J., S. Gottschalk, C. Rammer and A. Spielkamp (2003), Spinoff-Gründungen aus der öffentlichen Forschung in Deutschland, ZEW Wirtschaftsanalysen, Vol. 68, Baden-Baden: Nomos.

Contact:

Udo Brixy

Institute for Employment Research (IAB)
Research Department B2
Regensburger Str. 104
90478 Nuremberg
Germany

Phone: +49/911/179-3254
Fax: +49/911/179-3258
E-Mail: udo.brixy@iab.de

Helmut Fryges

Centre for European Economic Research
Department of Industrial Economics
and International Management
P.O. Box 10 34 43
68034 Mannheim
Germany

Phone: +49/621/1235-189
Fax: +49/621/1235-170
E-Mail: fryges@zew.de

Kathrin Müller

Centre for European Economic Research
Research Group Competition and Regulation
P.O. Box 10 34 43
68034 Mannheim
Germany

Phone: +49/621/1235-385
Fax: +49/621/1235-170
E-Mail: kathrin.mueller@zew.de