LABOUR TURNOVER, EMPLOYMENT DENSITY AND EMPLOYER PROVIDED TRAINING: EVIDENCE FROM VIENNA

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ABSTRACT

We analyse the impact of regional and sectoral labour market characteristics as determinants of the supply of employer financed training using a unique data set on employer provided training in Vienna. According to the results labour turnover has a robust negative impact and employment density a slightly less robust but also negative impact on the probability of a firm to provide employer financed training. Policies directed at increasing employer provided training may therefore face substantial challenges in sectors and regions with high labour turnover and employment densities. These challenges are likely to be even larger when it comes to providing employer financed training for less skilled workers.

KEY WORDS

employer financed training, urban labour markets, density

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1 INTRODUCTION

One of the central predictions of human capital theory (Becker, 1964) is that employers pay for training in firm specific human capital, while employees pay for training in general skills. Although this prediction has been refuted in many empirical investigations economists until recently did not realize how strongly it hinges on the assumption of a frictionless labour market. If this assumption is relaxed (as for instance in Acemoglu, 1997; Acemoglu and Pischke, 1999) employers will have an incentive to also finance general training. Since these seminal contributions, quite a few articles have attempted to test the so called Acemoglu-Pischke model (see e.g. Brunello et al., 2005 and Leuven, 2005 for surveys). These papers mostly confirm its' predictions.

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One consequence of the Acemoglu-Pischke model is that the incentives for enterprises to finance general training depend on the sector and regional labour market conditions in which employers operate. Brunello and Gambarotto (2007) and Brunello and de Paola (2008) argue this point at the example of employment density. They suggest that a high employment density in a region will generate positive knowledge spillovers, so that – all else equal – firms will be more productive in denser labour markets. If the gains from training are complementary to productivity this will also increase training incentives for firms in denser labour markets. This is, however, countered by the fact that workers are also more likely to be recruited by other employers in denser labour markets. This so called poaching effect (Moen and Rosen, 2004; Majumdar, 2006 and Lene, 2002) reduces employers' training incentives. Both Brunello and Gambarotto (2007) as well as Brunello and de Paola (2008) find a significant negative correlation between local labour market density and employer financed training activities in Italy and Great Britain. The positive effects of knowledge spillovers thus do not seem to be strong enough to dominate the negative effects of the higher poaching risk in denser labour markets.

One contribution of the current paper is to show that similar countervailing tendencies can arise with respect to labour turnover. For instance Fallick et al. (2006) argue that increased labour turnover on the one hand increases the probability of a worker to leave an employment relationship. This would reduce training incentives for firms. On the other hand mobility of in particular high skilled-workers, can act as a form of knowledge transfer. If this knowledge transfer increases the productivity of employers and if, as before, returns to training increase with productivity this will once more increase training incentives. Thus if the positive incentive effects of labour turnover dominate the negative ones, increased labour turnover could also lead to higher employer financed training in a region.

In the face of these countervailing theoretical predictions, a second contribution of this paper is to use a large scale employer level survey to empirically test whether high employment density and/or high labour turnover in an industry is associated with higher or lower training activities of employers. A third contribution is to analyse whether these variables have a differential impact on the probability of an employer providing training for high and low skilled workers, respectively. This has important policy implications as the results inform policy makers whether high employment density and turnover labour markets have particular difficulties in securing a sufficient level of participation in lifelong learning. In the conclusion, aside from providing suggestions for future research, we therefore also discuss whether regional governments in such places need to provide additional incentives for training to firms or individuals to achieve life-long learning goals.

2 THEORY AND HYPOTHESES

The starting point of our analysis is a simplified version of Acemoglu's (1997) model. This models an imperfect labour market on which employers in a first period decide on a training intensity τ, which can be obtained at a cost of $c(\tau)$. After this initial period a share of s workers leaves the firm and is replaced by workers from other firms. In the second period, the (self-trained and newly recruited) workers produce output and receive a share of β of what they produce in the form of wages.[1] Following Brunello and de Paola (2008) we assume that the productivity of workers (y) in this second period depends on a series of region, industry and firm specific characteristics (x) and on the level of training received in the first

[1] This share can be considered to be the result of wage bargaining between employers and workers at the beginning of the second period, with β the bargaining power of workers. It is thus determined by institutional factors.

period such that $y = y(x)\tau$.[2] The separation probability s, by contrast, depends on a number of (potentially different) region, industry and firm specific factors (z), i.e. $s = s(z)$.

Acemoglu (1997) shows that under these assumptions the expected second period profit (β) of employers in the first period can be written as:

$$\prod = \frac{[1 - s(z)](1 - \beta)y(x)\tau}{1 + r} + \\ + \frac{s(z)(1 - \beta)y(x)\overline{\tau}}{1 + r} - c(\tau). \quad (1)$$

Profits thus are equivalent to the, discounted (by the market rate of interest r) and retention probability weighted, sum of the profits when the employee, who received τ units of training in the first period, stays with the employer in the second period $(1 - s)(1 - \beta)y(x)\tau$ and the expected profit if the worker has to be replaced by a worker from another firm, who has the average amount of training prevailing in the region $(\overline{\tau})(s(1 - \beta)y(x)\overline{\tau})$, minus the costs of training $c(\tau)$.

The firm maximizes this expected profit (under the assumption of a given $\overline{\tau}$) by choosing the optimal training level (τ^*). Thus the optimal level of training provided in the first period solves:

$$c'(\tau^*) = \frac{[1 - s(z)](1 - \beta)y(x)}{1 + r}. \quad (2)$$

Under the assumption of positive and increasing marginal costs of training (i.e. $c'(\tau^*) > 0$ and $c''(\tau^*) > 0$), by equation (2), the optimal intensity of training in period one (τ^*) is positively related to the firms' productivity (y) and negatively to its labour turnover (s). As a consequence all elements of the vector x which increase a firm's productivity also increase the intensity of training. By contrast, all elements of the vector z that increase labour turnover reduce the intensity of training.

Different theoretical contributions suggest different factors (x and z) that may impact on productivity and labour turnover. Thus a number of contributions to the theory of economic geography (e.g. Fujita et al., 1999) and urban economics (e.g. Glaeser et al., 1992) propose that different kinds of externalities (triggered by the density of labour markets) drive the localisation of industries and the productivity of firms in a region. Following this proposition Ciccone and Hall (1996) and Ciccone (2002) find that the productivity of firms – all else equal – increases with labour market density, while Glaeser and Mare (2001) show that regions with higher employment density also have more efficient labour market matching and thus also higher labour turnover.

Brunello and Gambarotto (2007) and Brunello and de Paola (2008) build on these findings by presenting a model in which high employment density increases productivity either through specialisation advantages or through knowledge spillovers. This increases firms' incentives to train workers. At the same time, however, the poaching risk is higher in denser labour markets. This reduces training incentives for firms. As a consequence the effect of employment density on firm funded training is ambiguously signed.

Other strands of the regional and industrial economics literature (e.g. Saxenian, 1996) argue that in particular in high technology sectors labour mobility contributes to productivity increases. As non-codified knowledge is bound in workers, mobility of workers between firms leads to knowledge transfer. This will lead to learning effects on the side of the receiving firms and thus increase productivity. Fallick et al. (2006) model this channel of knowledge transfer. In their model increased labour mobility on the one hand, by definition, increases the probability of workers to leave firms, but on the other hand, by fostering exchange of knowledge, increases productivity. Thus the impact of labour turnover on firm level training incentives is also ambiguous, as increased turnover reduces training incentives

[2] The functional form of this production function assumes that more productive firms profit more strongly from training than less productive ones. This complementarity is central to the results below as the positive correlation between productivity and training applies only if the productivity of a firm is determined by a function $\gamma(y, \tau)$ for which $\frac{\partial^2 \gamma}{\partial y \partial \tau} > 0$.

while the increased productivity increases them. Similar arguments could also apply to other variables related to the structure of a sector at a location. For instance Porter (2003) argues that the competitiveness (and productivity) of firms depends on the intensity of product market competition in its location. Yet, higher product market competition is also likely to lead to higher labour market competition which, in turn, may once more increase labour turnover. This will lead to similar countervailing effects of the intensity of product market competition on employer financed training as for employment density.

In addition, the empirical literature has identified a number of further variables that determine the intensity of employer financed training, which will also be considered in the current contribution. For instance many studies (e.g. Katz and Ziderman, 1990; Chang and Wang, 1996) identify firm size as one of the most important determinants of the probability that a firm finances training for its employees. Larger employers provide more training than smaller ones. Some contributions also find a connection between the organisation of a firm and the likelihood that it offers firm provided training. According to Elias and Healy (1994), Schüler and Meyer (2006), and Hughes et al. (2004) multi-enterprise corporations as well as export oriented and foreign owned firms provide more training than others.[3] Similar findings apply to more innovative firms (Arulampalam et al., 2004 and Brunello et al., 2005), with the type of innovation having an important impact on both the type and extent of training, as product and process innovations require different types of training and often have to be targeted at different participants. The link between investments and employer financed training is less clear cut. Schüler and Meyer (2006) find no significant impact of total firm level gross investments on the probability of employer financed training but an important impact of the structure of investments. In particular ICT investments increase the training probability at a firm (see Lynch and Black, 1998 for similar results). In addition Brunello et al. (2005) find important business cycle effects on training probabilities, with training being less frequent in boom phases of the business cycle than in recessions. Mühlemann et al. (2007), by contrast, show that firms facing problems in finding qualified employees train more frequently than others.

A number of analysts also argue for a link of the employment structure of a firm and its probability to provide training to its employees. This applies in particular to the link between the average educational attainment of firms' employees and the probability of employer financed training. From a theoretical perspective this link could be positive (if more highly educated workers are more efficient at learning) or negative (if highly qualified staff needs more expensive trainings to profit from new knowledge). Most of the empirical literature, however, finds a significantly positive correlation (Asplund, 2005).[4]

Finally, regional and sectoral characteristics could also have a differential impact on the provision of employer financed training for high and low skilled workers. In particular – although previous literature has seldom analysed this issue – one could hypothesize that the knowledge externalities that trigger positive effects of labour turnover on firm level productivity are likely to be more relevant for highly qualified workers, that also have more knowledge to share, than the less qualified workers. The negative effects of increased turnover and poaching risks, by contrast, could apply more strongly to less qualified workers. This would lead to a less positive (more negative) impact of all regional variables on the probability of employer financed training for less than for high skilled workers.

The theoretical and empirical literature thus provides two empirically testable hypotheses on the impact of regional and sector labour market characteristics on the supply of employer financed training. The first is that labour

[3] Schüler and Meyer (2006), however, find no significant impact of exports on the probability that a firm offers employer financed training.

[4] As an exception Ariga and Brunello (2006) find a negative correlation in Thailand. This is explained by the specific development of Thailand and the substantial need to train the less qualified in this country.

market density, turnover and labour market competition should have an impact on the supply of employer financed training by the firms in a region, although the sign of this impact is ambiguous. The second is that this impact is smaller for less than for high skilled workers.

3 DATA AND DEFINITIONS

3.1 The Vienna Employment and Qualification Monitor

The current study aims to empirically analyse these hypotheses for the city of Vienna. This case study is of particular interest as Vienna – after taking into consideration interaction with the areas of Lower Austria – is a clearly delimited region that accords more closely to a regional labour market than the countries considered in most other studies. It is also interesting because according to the unanimous results of previous research (e.g. Huber et al., 2002; Mayerhofer, 2007) Vienna is marked by a particularly high employment density, strong labour market competition and a high turnover of workers and thus provides an ideal testing ground for these hypotheses.

We use the Vienna Employment and Qualification Monitor (WAFF-VEQM) as a primary data source. This is a questionnaire conducted by the Vienna Employment Agency (WAFF) among chief personnel managers, persons responsible for personnel management or (plant) managers or owners[5] among 500 Viennese enterprises with at least one employee each month in the time period 2003 to 2007.[6] In telephone interviews, these firms were asked questions referring to their vacancies, personnel management strategies, employee training activities and expectations in the next year. The sampling of this questionnaire – with the exception of a small share of very large enterprises, which were interviewed each time – was based on a revolving random sample drawn from a CD of the telephone numbers of all Viennese enterprises (the Herold Business CD). Enterprises in the non-market service sector (public administration, health and education) were excluded from the sample. Although this excludes a substantial part of the employees in Vienna, the dataset thus collects a representative sample of annually slightly more than 6,000 enterprises, of the Viennese private sector employers. It thus provides information on a large set of enterprises which are arguably most likely to exhibit the behaviour modelled in our underlying theoretical model. In addition the disproportionate stratification, which undersamples employers with up to 5 employees in favour of employers with more than 100 employees, implies that we have a de facto full inventory count of the larger enterprises in Vienna. This is justified by the small number of large enterprises in Vienna, which in total account for only 10% of all employers in the city.

Tab. 1 displays the number of observations and the distribution of the sample by employer characteristics for the years 2003 to 2007. Of the 24,262 interviews conducted in this period around 20% concerned manufacturing employers and around a third was with employers in the trade and repairs sector. A little less than half of the interviewed employers were associated with other service sectors. Comparing this with the Viennese sector structure reported in the Austrian structural enterprise statistics[7], manufacturing and trade enterprises are slightly oversampled at the expense of

[5] In 62% of the cases the owner or chief manger was interviewed, in 17% the personnel manager responded and in 22% the this was the highest ranking person responsible for personnel management.

[6] In 2003 only two waves were collected and in 2004 only 10. Therefore in total 48 waves are available.

[7] This is the only official data source allowing for an evaluation of the enterprise structure on a regional level in Austria. According to this source 12% of the enterprises (including those which have no employees and are thus not sampled in the VEQM) are active in manufacturing and 26% in trade. Around 61% operate in other service industries.

Tab. 1: Sample size and distribution of employers in the Vienna Employment and Qualification Monitor

	2003	2004	2005	2006	2007	Total
Sector						
Manufacturing	20.3	19.1	19.9	20.1	19.9	19.8
Trade and repairs	31.8	33.4	33.0	33.9	33.8	33.5
Services	47.9	47.5	47.1	46.0	46.3	46.7
Employer age (in years)						
Less than 5	7.7	5.9	4.1	3.4	2.9	4.2
5 to 10	17.1	21.0	19.4	17.0	17.2	18.5
10 or more	75.2	73.1	76.5	79.6	79.9	77.3
Number of employees (persons)						
Less than 5	32.9	34.6	32.2	35.8	39.0	35.3
5 to 19	33.8	33.1	33.7	32.6	31.8	32.8
20 to 99	23.3	23.6	24.4	22.9	21.7	23.1
100 to 249	6.1	5.1	5.7	5.3	4.7	5.2
250 and more	3.9	3.6	4.0	3.5	2.8	3.5
Total	987	5,077	6,083	6,066	6,049	24,262

Source: WAFFy Vienna Employment and Qualification Monitor (WAFF-VEQM).

enterprises in other services. This can be explained by the large share of enterprises that do not have an employee in the service industries; as such enterprises are not sampled in the WAFF-VEQM. Consistent with the structure of the Viennese economy, the majority of the enterprises sampled have less than 20 employees, with 35% of these enterprises belonging to the group of micro-enterprises (with less than 5 employees). The segment of small firms, which is of particular relevance in the Viennese economy, is thus well represented in the questionnaire with the data providing close to 4,000 observations on such enterprises. The equally important segment of young firms is, however, less well represented. Only around a fifth of the enterprises were founded less than 10 years ago. This is due to many young enterprises not (yet) having an employee and thus not being part of the sampling in the WAFF-VEQM.

The WAFF-VEQM also asked employers on whether they were active internationally or only nationally, whether they had a product or process innovation in the two years preceding the interview or were subjected to a reorganisation, if they were a part of a multi-enterprise corporation and if they employed mainly highly or lowly qualified workers as well as if the majority of their workers had a high school diploma. For the purpose of this study the most important question asked, however, concerned employer provided training. In this employers were asked whether their company had offered professional training courses in the last 12 months. Respondents could answer to this by stating that they had undertaken such courses for highly qualified, for less qualified or for neither, with less qualified workers being defined as workers who had compulsory education or less. We therefore code enterprises that conducted training in the last 12 months for either high or low skilled workers as employers with training and those who had no such training as employers without training. Furthermore, we also code two further variables which separately indicate whether a firm did or did not conduct training for highly or less qualified, respectively. These three variables (i.e. the indicator for providing training overall, for high-skilled, and for low-skilled) are the dependent variable in our econometric analysis below.

In this econometric analysis the WAFF-VEQM is also used to construct a series of control variables. In particular, in accordance with the literature cited in the previous sec-

tion, we use the logarithm of the number of employees and its square, indicator variables for whether the employers existed for 5 to 9 years or 10 or more years (with employers that have existed for less than 5 years as the reference group) and for whether the employer is part of a multi-enterprise corporation or is internationally active. In addition we construct indicator variables for employers that either employ mainly highly qualified or an about equal amount of highly and less qualified employees (with employers employing mainly less qualified as the base category). Similar variables are also included for employers that mainly employ workers with high school diploma or about an equal amount of employees with and without high school diploma (with employers, employing mainly employees without a high school diploma as the base category). Finally, also the economic situation of the employer is considered by including a total of 48 wave dummies (which measure the business cycle situation common to all enterprises), a variable measuring the vacancies as a share of total employment (as an objective indicator of future employment developments) as well as a series of indicator variables on the expected future development of the employer.

3.2 The Austrian Social Security Data

The WAFF-VEQM also collected information on the industry affiliation of employers at the NACE 4-digit level. This allows merging this data with information from the Austrian Social Security Data (ASSD). This is a much used administrative dataset for labour market analysis in Austria (see Card et al., 2007 and Ichino et al., 2007 for applications and Schöberl, 2004 for a description). It reports detailed information on the beginning and end date of all employment relationships held by all Austrian employees since 1970. These data therefore allow for a measurement of labour turnover, as well as the NACE 4-digit and regional affiliation of an employer.[8] For the current paper these data were used to calculate the number of employers and employees in a NACE 4-digit industry and province in Austria as well as the number of employment relationships that were terminated or taken-up within a year in a NACE 4-digit industry and province in Austria. From this we calculated indicators related to the employment density, the intensity of labour market competition and labour turnover of a NACE 4-digit industry in a particular province.

To measure the intensity of labour market competition we on the one hand assume that labour market competition among employers increases with the number of potential employers working in a NACE 4-digit industry in Vienna and use the logarithm of the number of employers located in a province and its' square. On the other hand we use the logarithm of the Herfindahl-Hirschmann-Index (HHI)[9] on employment shares of employers within a NACE 4-digit industry. This is used because previous literature (e.g. Glaeser et al., 1992; Henderson et al., 1995; Combes, 2000) shows that – given the size of an industry – industries with a large number of small firms (i.e. where the HHI is small) experience more intense labour market competition than industries with only a few large and many small employers (where the HHI is large). To measure labour turnover we use the sum of all employment relationships that were either terminated or started in a NACE 4-digit industry in a year in % of the employment of that industry. This indicator (see Huber and Smeral, 2006) is referred to as labour turnover. To measure the employment density, the logarithm of the employment share of a NACE 4-digit industry in total employment in Vienna is used. This variable is referred to as the industry employment share. Finally, to control for time-invariant NACE 4-digit characteristics, which cannot be observed in our

[8] These data are cleaned from labour turnover arising for purely administrative reasons at the Austrian Institute for Economic Research.

[9] The HHI is the sum of the squared employment shares among firms in an industry and region. It thus measures the inequality of the firm size distribution in a region and industry, with the minimal value of $1/n$ (with n the number of firms in the industry of a region) indicating complete equality and the maximum value of 1 indicating strong inequality.

Tab. 2: Descriptive statistics and variance decomposition of sector characteristics

	Total	Variance total	Variance across sectors	Variance across years
Labour turnover	1.094	1.081	0.988	0.435
ln (Industry share)	−6.783	1.792	1.723	0.168
ln (Employers)	3.743	1.591	1.572	0.135
ln (Herfindahl)	−1.887	1.247	1.242	0.181
		Total	**Sectors**	**Years**
Observations		1,305	261	5

Source: Austrian Social Security Data (ASSD)

data, we also include a set of NACE 4-digit industry dummy variables.

Tab. 2 shows the descriptive statistics for these variables. These confirm the high labour turnover prevailing in Vienna also found in other studies (e.g. Huber et al., 2002). In the average of all NACE 4-digit industries this labour turnover exceeds 100%, with the average labour turnover being driven up by the high turnover in a number of important industries (such as for instance construction or tourism). In addition these statistics also show that the industry characteristics used in this study do not vary very strongly across time periods, as only around 10% to 40% of the total variance in all indicators is due to the variability of the indicators over time.[10]

3.3 Descriptive Analysis

Tab. 7 (in the Annex) provides a detailed definition of for all variables in our analysis (except for wave and industry dummies) and Tab. 3 shows the descriptive statistics separately for all employers, employers with training and employers without training. It also reports results of a t-test testing for whether enterprises with and without training statistically significantly differ from each other for these variables. Due to the large number of observations, these t-tests indicate statistically significant differences for all variables. Consistent with previous results, the quantitatively most important of these are that employers providing training are larger and have better qualified employees than employers not providing training. Among the employers providing training, the share of employers that mainly employ employees with a high school diploma is 44%, among employers not providing training it is only 29%. Employers providing training are also more often a part of a multi-enterprise corporation (39%) and are more often active on international markets (40%) than employers not providing training. In addition employers providing training are also more innovative (both in terms of product and process innovation), have experienced restructuring more often, invest more often (in particular in ICT) and are also more optimistic about their future. In terms of firm age and the share of vacancies in total employment the differences between employers providing and not providing training are, however, somewhat smaller. With respect to the variables of central interest for this paper (industry share, labour turnover, HHI and number of enterprises) employers without training more often operate in NACE 4-digit industries with higher labour turnover, lower industry share, more employers and a lower Herfindahl-Hirschmann-Index.

[10]This low variability over time causes analytic problems as our industry characteristics are highly correlated with other time invariant NACE 4-digit characteristics (captured by industry dummies). As a consequence similar estimations as below were also conducted including only NACE 3-digit industry dummies. This leaves qualitative results unchanged. We, however, give preference to the specifications reported in this paper, since the Akaike information criterion suggest controlling for NACE 4-digit dummies. In section 4.3 we, however, also report one additional specification using NACE 3-digit dummies to illustrate the robustness of our results.

Tab. 3: Descriptive statistics

	All		With training		Without training	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Training	0.44	0.50				
Turnover	1.19	1.00	1.07***	0.87	1.28	1.08
ln (Industry share)	−0.14	0.75	−0.05***	0.76	−0.20	0.74
ln (Herfindahl)	−3.22	1.44	−3.08***	1.39	−3.32	1.47
ln (No. employers)	5.58	1.66	5.48***	1.63	5.67	1.67
ln (Size)	2.28	1.53	2.98***	1.53	1.73	1.30
Employees mostly High School Dipl.	0.35	0.23	0.44***	0.25	0.29	0.20
Employees mostly without High School Dipl.	0.54	0.50	0.44***	0.50	0.62	0.49
Employees about equal with & without	0.11	0.31	0.12***	0.33	0.10	0.29
Employees mostly low qualified	0.13	0.11	0.06***	0.06	0.17	0.14
Employees mostly highly qualified	0.72	0.45	0.80***	0.40	0.66	0.47
Employees about equal high and low qualified	0.15	0.36	0.13***	0.34	0.17	0.38
Part of a company	0.27	0.44	0.39***	0.49	0.18	0.39
Internationally active	0.29	0.45	0.40***	0.49	0.21	0.41
Firm age <5 years	0.04	0.04	0.03***	0.03	0.05	0.05
Firm age 5–9 years	0.19	0.39	0.17***	0.38	0.19	0.40
Firm age 10 and more years	0.77	0.42	0.79***	0.41	0.76	0.43
Invested in computers	0.47	0.50	0.62***	0.48	0.36	0.48
Invested in production	0.06	0.23	0.08***	0.27	0.04	0.20
Other investments	0.28	0.45	0.38***	0.49	0.21	0.41
Product innovation	0.16	0.37	0.23***	0.42	0.11	0.32
Process innovation	0.09	0.29	0.14***	0.35	0.06	0.24
Firm reorganisation	0.25	0.43	0.36***	0.48	0.16	0.37
Vacancies/employee	0.02	0.07	0.016**	0.07	0.018	0.08
Very optimistic about future	0.17	0.14	0.22***	0.17	0.12	0.11
Optimistic about future	0.49	0.50	0.52***	0.50	0.47	0.50
Less optimistic about future	0.24	0.43	0.19***	0.40	0.27	0.45
Not optimistic about future	0.08	0.27	0.04***	0.19	0.12	0.32
Expectation about future unknown	0.02	0.13	0.02***	0.13	0.02	0.14
Number of observations	24,109		10,510		13,599	

Source: WAFF-VEQM and ASSD, own calculations.
Notes: Std. Dev. = Standard Deviation; *t*-test for difference between employers with and without training is significant at the 1% (***), 5% (**) or 10% (*) level.

4 METHOD AND RESULTS

4.1 Aggregate Results

Using this data Tab. 4 reports marginal effects[11] of a number of different probit estimates with the probability of an enterprise to have offered training in the last 12 months as a dependent variable. The first column reports results when regressing the dependent variable on all

[11] These report the estimated percentage point change of an otherwise average firm to provide training if the respective independent variable increases by one unit. The underlying regression coefficients are available from the authors upon request.

independent variables in Tab. 3 and 260 NACE 4-digit industry dummies as well as 48 wave dummies. The results suggest a statistically highly significant relationship between labour turnover and the industry employment share in a NACE 4-digit industry and the probability of a firm to provide employer financed training. An increase in the labour turnover by one percent reduces the probability of an (otherwise average) employer to provide training by three percentage points. An increase in the industry employment share by one percent, by contrast, reduces the training probability by 6 percentage points. This suggests that the effect of increased worker mobility on training probabilities dominates any positive effects arising from increased productivity. Similar observations apply to the industry employment share. Here the negative impact of the increased poaching risk on training probabilities also dominates any positive effects resulting from increased productivity. Our results are therefore in line with those of Brunello and Gambarotto (2007) and Brunello and de Paola (2008). This is interesting as these authors use the variance in industry share across regions to identify effects, while we use the variance across industries within a region. Yet, despite these different approaches results are comparable. The other industry characteristics (i.e. the number of employers and the Herfindahl-Hirschmann-Index) are insignificant, however. This suggests a rather weak impact of product market competition on training probabilities.

There are a number of reservations that could be held against these baseline results. For instance one could argue that the city of Vienna is likely not to be an isolated area both in terms of the labour market and localisation conditions, on account of the substantial linkages of the city with its' environs. This would imply that results could be driven by a wrong delimitation of the regional labour market. To assess the potential error from this, column 2 of Tab. 4 shows a similar regression as in column 1 in which Vienna and Lower Austria (which is the province that surrounds Vienna) are considered to be one region. In this regression, industry characteristics (i.e. labour turnover, industry share, HHI and number of enterprises) are measured for both Vienna and Lower Austria in sum.

As can be seen from this column results with respect to labour turnover hardly differ from those in column one. Even when the labour market characteristics of Lower Austria are included in the analysis, the correlation between labour turnover and training probability remains highly significantly negative. The correlation between the industry share and training probability, by contrast, remains negative but turns insignificant, while the HHI is weakly negatively significant. This on the one hand indicates strong competitive relationships between the Viennese and Lower Austrian labour markets. On the other hand it also hints at a less robust relationship between industry employment share and training probabilities than between labour turnover and training probabilities.

A further reservation could be the potential endogeneity of the industry variables. This is particularly worrying in the case of the industry employment share, as this is also determined by the mobility of enterprises across regions. Column 3 in Tab. 4 thus instruments industry share in Vienna by the density in all provinces other than Vienna and NACE 2-digit dummies.[12] These results also suggest an effect of labour turnover on enterprise level training probabilities but a weaker one with respect to labour market density. The co-efficient of labour turnover remains highly significant and negative in this specification, while the industry employment share is only weakly significant and the HHI turns strongly significantly negative.

The other explanatory variables in the estimates are highly robust. They suggest that employers who employ mainly workers without a high school diploma have a 5 to 14 percentage

[12]The rational for using this instrument is that the employment density in other provinces is strongly correlated to that in Vienna, but that it should not have any effect of the training probability in Vienna. Results of the first stage equation suggest a highly significant negative correlation between employment density in Vienna and the rest of Austria. The instrument explains 45% of the variance in the industry level employment density and the R^2 value of the first stage regression is 0.95.

Tab. 4: Marginal effects for probit results (dependent variable: training)

	Regional variables Vienna		**Regional variables Lower Austria**		**Instrumented Industry share**[a]	
	Coef.	**S. E.**	**Coef.**	**S. E.**	**Coef.**	**S. E.**
ln (Turnover)	−0.03***	0.01	−0.03**	0.01	−0.02**	0.01
ln (Industry share)	−0.06**	0.02	−0.02	0.07	−0.02*	0.01
ln (Herfindahl)	0.01	0.02	−0.02*	0.01	−0.07***	0.02
ln (No. employers)	0.11	0.11	0.13	0.12	−0.04	0.06
ln (No. employers)^2	−0.01	0.01	−0.01	0.01	0.01	0.00
ln (Size)	0.18***	0.01	0.18***	0.01	0.47***	0.02
ln (Size)^2	−0.01***	0.00	−0.01***	0.00	−0.03***	0.00
Employees mostly High School Dipl.	*Base category*		*Base category*		*Base category*	
Employees mostly without High School Dipl.	−0.05***	0.01	−0.05***	0.01	−0.14***	0.03
Employees about equal with & without	−0.06***	0.01	−0.06***	0.01	−0.15***	0.03
Employees mostly low qualified	*Base category*		*Base category*		*Base category*	
Employees mostly highly qualified	0.17***	0.02	0.17***	0.01	0.43***	0.04
Employees about equal high and low qualified	0.07***	0.02	0.07***	0.02	0.16***	0.04
Part of a company	0.08***	0.01	0.08***	0.01	0.20***	0.03
Internationally active	0.04***	0.01	0.04***	0.01	0.09***	0.02
Firm age <5 years	*Base category*		*Base category*		*Base category*	
Firm age 5–9 years	0.04**	0.02	0.04***	0.02	0.11**	0.05
Firm age 10 and more years	0.03*	0.02	0.03***	0.02	0.08***	0.05
Invested in computers	0.13***	0.01	0.13***	0.01	0.33***	0.02
Invested in production	−0.03	0.02	−0.03	0.02	−0.09*	0.05
Other investments	0.05***	0.01	0.05***	0.01	0.14***	0.02
Product innovation	0.08***	0.01	0.08***	0.01	0.20***	0.04
Process innovation	0.05***	0.02	0.05***	0.02	0.12***	0.04
Firm reorganisation	0.07***	0.01	0.07***	0.01	0.19***	0.02
Vacancies/employee	0.08	0.05	0.08	0.05	0.20	0.13
Very optimistic about future	*Base category*		*Base category*		*Base category*	
Optimistic about future	−0.08***	0.01	−0.08***	0.01	−0.21***	0.03
Less optimistic about future	−0.09***	0.01	−0.09***	0.01	−0.25***	0.03
Not optimistic about future	−0.15***	0.02	−0.15***	0.02	−0.40***	0.04
Expectation about future unknown	−0.15***	0.02	−0.15***	0.02	−0.41***	0.07
Wave	Yes		Yes		Yes	
Sector	NACE 4-digit		NACE 4-digit		ÖNACE 4-digit	

Source: WAFF-VEQM and ASSD.
Notes: Coef = Marginal Effect; S. E. = Cluster robust standard errors of the estimate; t-test is significant at the 1% (***), 5% (**) or 10% (*) level; [a]Industry share instrumented with Austrian industry share and NACE 2-digit dummies, fixed effects for waves and NACE 4-digit industries not reported.

point lower probability to offer training than employers whose personnel mainly consists of workers with high school diploma, which are the reference category. Similarly employers with mainly highly qualified personnel have a 17 to 43 point higher training probability than employers with mainly less qualified personnel. Employers that are part of a multi-enterprise corporation and that are active internationally have a (8 to 20, respectively 4 to 9 percentage

point) higher probability to offer a training to their employees, than independent employers and employers that are only nationally active. Investments in computers also increase the training probability (by 12 to 33 percentage points) as do other investments (by 5 to 14 percentage points). Only investments in production have no significant impact on the training probability in all regressions except for when instrumenting the industry employment share. Furthermore innovative employers have higher training probabilities throughout. Different forms of innovation, however, have a rather different impact. Employers facing a reorganisation in the previous year have a 7 to 19 percentage point higher training probability, employers with a process innovation a 5 to 12 percentage point higher training probability and employers with a product innovation an 8 to 20 percentage point higher training probability, than employers without an innovation.

The training probability also decreases with reduced optimism about the future and depends on the age of employers in a nonlinear manner. Employers that have existed for 4 to 9 years are most likely to offer training to their employees. Their training probability is 4 to 11 percentage points higher than among employers that have existed for less than 5 years. Employers that have existed for 10 or more years have a 3 to 8 percentage points higher training probability than employers that have existed for less than 5 years. Employers who are not optimistic about the future have an up to 40 percentage point lower training probability than very optimistic employers. The only variable that remains insignificant throughout is the number vacancies as a percentage of total employment.

4.2 Results by Qualification Groups

Tab. 5 extends these findings to a separate analysis for employers that financed training for less and for highly skilled workers, respectively. According to these results the industry employment share and labour turnover have a much stronger negative impact on the probability that firms provide training for the less qualified, while for the highly qualified the impact of labour turnover is only weakly significant and that of the industry employment share – following the lower robustness of the variable – is insignificant throughout. This could be explained by the knowledge externalities that trigger positive effects of labour turnover on firm level productivity being less relevant for less qualified workers. Alternatively it could also be indication of higher marginal costs of training for less skilled workers. Irrespective of the concrete reason for these results, this does suggest that high density and high turnover industries and regions are particularly likely to face problems in motivating firms to finance training for low skilled workers.

In addition the results also point to some interesting differences in the firm level determinants of the training probability of firms for less and high qualified workers. Thus the impact of firm size, positive expectations about the future and investments as well as internationalisation and reorganisation on the probability to offer employer financed trainings is substantially larger for highly qualified than for the less qualified. This suggests that in particular investments and internationalisation tend to increase training requirements among the high skilled. By contrast, product innovations are more closely linked to increased training requirements of the less skilled. Furthermore, as could be expected, also firms with a higher share of highly qualified workers provide more training for highly qualified workers, while they provide less training for less qualified workers.

4.3 Robustness

In sum, our results suggest a negative impact of labour turnover on firm provided training that is most pronounced for the low skilled. Results pertaining to our measure of employment density (the industry employment share) are somewhat less robust but also mostly suggest a negative impact that is more pronounced for the training probability of the low skilled. This could, however, be due to a number of idiosyncratic developments of individual industries in the Viennese labour market or to the specifics of our data. For instance, as mentioned above, the

Tab. 5: Probit results for high and less qualified workers (dependent variable: training of high and less skilled workers)

	Training for less skilled				Training for high skilled			
	Regional variables Vienna		Regional variables Lower Austria		Regional variables Vienna		Regional variables Lower Austria	
	Coef.	S. E.	Coef.	S. E.	Coef.	S. E.	Coef.	S. E.
ln (Turnover)	0.12**	0.05	−0.18**	0.09	−0.04*	0.02	−0.08*	0.05
ln (Industry share)	−0.22**	0.10	−0.26*	0.14	−0.16	0.10	−0.16	0.20
ln (Herfindahl)	0.11	0.09	−0.05	0.06	0.00	0.04	−0.03	0.02
ln (No. employers)	−0.63	0.57	−0.20	0.78	0.35	0.28	0.38	0.32
ln (No. employers)^2	0.07	0.06	0.01	0.07	−0.04	0.03	−0.04	0.03
ln (Size)	0.36***	0.04	0.36***	0.04	0.48***	0.02	0.48***	0.02
ln (Size)^2	−0.02***	0.00	−0.02***	0.00	−0.03***	0.00	−0.03***	0.00
Employees mostly High School Dipl.	*Base category*		*Base category*		*Base category*		*Base category*	
Employees mostly without High School Dipl.	0.17***	0.05	0.17***	0.05	−0.15***	0.03	−0.15***	0.03
Employees about equal with & without	0.24***	0.06	0.24***	0.06	−0.16***	0.03	−0.16***	0.03
Employees mostly low qualified	*Base category*		*Base category*		*Base category*		*Base category*	
Employees mostly highly qualified	−0.48***	0.05	−0.48***	0.05	0.69***	0.04	0.69***	0.04
Employees about equal high and low qualified	−0.27***	0.05	−0.27***	0.05	0.35***	0.05	0.36***	0.05
Part of a company	0.18***	0.03	0.18***	0.03	0.20***	0.03	0.20***	0.03
Internationally active	0.01	0.03	0.01	0.03	0.10***	0.02	0.10***	0.02
Firm age <5 years	*Base category*		*Base category*		*Base category*		*Base category*	
Firm age 5–9 years	0.08	0.08	0.07	0.08	0.10*	0.06	0.10*	0.06
Firm age 10 and more years	0.01	0.07	0.01	0.07	0.07	0.05	0.07	0.05
Invested in computers	0.13***	0.03	0.13***	0.03	0.32***	0.02	0.32***	0.02
Invested in production	−0.02	0.06	−0.02	0.06	−0.07	0.05	−0.07	0.05
Other investments	0.03	0.03	0.03	0.03	0.14***	0.02	0.14***	0.02
Product innovation	0.33***	0.05	0.33***	0.05	0.13***	0.03	0.13***	0.03
Process innovation	0.02	0.06	0.02	0.06	0.14***	0.04	0.14***	0.04
Firm reorganisation	0.073**	0.03	0.07**	0.03	0.20***	0.02	0.20***	0.02
Vacancies/employee	0.68***	0.20	0.68***	0.20	0.19	0.13	0.19	0.13
Very optimistic about future	*Base category*		*Base category*		*Base category*		*Base category*	
Optimistic about future	−0.06	0.04	−0.06	0.04	−0.16***	0.03	−0.16***	0.03
Less optimistic about future	0.02	0.04	0.02	0.04	−0.22***	0.03	−0.22***	0.03
Not optimistic about future	−0.09	0.07	−0.09	0.07	−0.37***	0.05	−0.37***	0.05
Expectation about future unknown	−0.02	0.09	−0.03	0.09	−0.39***	0.07	−0.39***	0.07
Wave	Yes		Yes		Yes		Yes	
Sector	NACE 4-digit		NACE 4-digit		NACE 4-digit		NACE 4-digit	
Number of observations	23,490		23,490		24,109		24,109	

Source: WAFF-VEQM and ASSD.
Notes: Coef = Coefficient; S. E. = Cluster robust standard errors of the estimate; t-test is significant at the 1% (***), 5% (**) or 10% (*) level; fixed effects for waves and NACE 3 or 4-digit industries not reported.

time variation of the industry characteristics included in our data is rather low on account of the short time dimension. This could lead to biased results due to the co-linearity of the data with industry fixed effects. In addition, as also mentioned above, the high labour turnover in Vienna is due to the very high levels of turnover in a few industries. This may bias results if these industries are outliers with respect to training. Finally our data is also less representative for newly founded enterprises, which may once more lead to biased results when inferring to the population of Viennese firms.

Tab. 6 therefore reports results for a number of additional specifications, which were estimated to check for the robustness of results to these caveats. In these specification we first replaced NACE 4-digit by NACE 3-digit dummies (col. 1) to increase the within group variance of the time varying industry characteristics. In a second step, we excluded the construction sector from the data (col. 2) to assess the potential impact of this high turnover industry on results and finally in a further specification (col. 3) we also excluded firms that have existed for less than 5 years from the sample.

Tab. 6: Probit results (dependent variable: training, regional variables Vienna)

	NACE 3-digit controls		Excluding construction		Excluding 1–4 year old employers	
	Coef.	**S. E.**	**Coef.**	**S. E.**	**Coef.**	**S. E.**
ln (Turnover)	−0.19***	0.04	−0.09**	0.04	−0.10***	0.04
ln (Industry share)	−0.06*	0.03	−0.15*	0.08	−0.16*	0.09
ln (Herfindahl)	0.01	0.02	0.04	0.04	0.04	0.05
ln (No. employers)	−0.15**	0.06	0.31	0.28	0.21	0.29
ln (No. employers)^2	0.02***	0.01	−0.02	0.03	−0.01	0.03
ln (Size)	0.47***	0.02	0.472***	0.02	0.476***	0.02
ln (Size)^2	−0.03***	0.01	−0.0280***	0.00	−0.0287***	0.00
Employees mostly High School Dipl.	*Base category*		*Base category*		*Base category*	
Employees mostly without High School Dipl.	−0.14***	0.03	−0.14***	0.03	−0.14***	0.03
Employees about equal with & without	−0.14***	0.03	−0.15***	0.03	−0.15***	0.03
Employees mostly low qualified	*Base category*		*Base category*		*Base category*	
Employees mostly highly qualified	0.46***	0.04	0.45***	0.04	0.49***	0.04
Employees about equal high and low qualified	0.18***	0.04	0.17***	0.04	0.15***	0.04
Part of a company	0.20***	0.03	0.19***	0.03	0.19***	0.03
Internationally active	0.08***	0.02	0.09***	0.02	0.09***	0.02
Firm age <5 years	*Base category*		*Base category*		*Base category*	
Firm age 5–9 years	0.11**	0.05	0.10*	0.05	0.03	0.03
Firm age 10 and more years	0.08*	0.05	0.07	0.05		
Invested in computers	0.32***	0.02	0.32***	0.02	0.33***	0.02
Invested in production	−0.07	0.05	−0.09*	0.05	−0.08*	0.05
Other investments	0.14***	0.02	0.13***	0.02	0.13***	0.02
Product innovation	0.21***	0.03	0.21***	0.04	0.21***	0.04
Process innovation	0.13***	0.04	0.11***	0.04	0.14***	0.04
Firm reorganisation	0.18***	0.02	0.18***	0.02	0.19***	0.02
Vacancies/employee	0.21	0.13	0.22	0.14	0.19	0.13
Very optimistic about future	*Base category*		*Base category*		*Base category*	
Optimistic about future	−0.20***	0.03	−0.22***	0.03	−0.22***	0.03
Less optimistic about future	−0.24***	0.03	−0.25***	0.03	−0.25***	0.03
Not optimistic about future	−0.39***	0.04	−0.44***	0.05	−0.42***	0.05
Expectation about future unknown	−0.41***	0.07	−0.45***	0.07	−0.42***	0.07
Wave	Yes		Yes		Yes	
Sector	NACE 4-digit		NACE 4-digit		ÖNACE 4-digit	

Source: WAFF-VEQM and ASSD.
Notes: Coef = Coefficient; S. E. = Cluster robust standard errors of the estimate; t-test is significant at the 1% (***), 5% (**) or 10% (*) level; fixed effects for waves and NACE 3 or 4-digit industries not reported.

These changes in specification reconfirm the robustness of the results. When including only NACE 3-digit fixed effects the only differences relative to the baseline specification are a significant positive effect of the number of enterprises in an industry on the training probability. This can be explained by the extremely low variation of this variable over time. When excluding the construction sector from the sample, by contrast employers that have existed for more than 10 years do not differ in their training probability from employers that have existed for less than 5 years any more. Finally an exclusion of the employers that existed for less than 5 years leads to very similar results as in the baseline specification, but suggests that employers which have existed for 10 years or more do not differ significantly from employers that have existed for 5 to 9 years any more.[13]

[13] Additional robustness checks (available from the authors) included changes in the functional form by including levels rather than logs of the industry employment share and the HHI. These changes lead to qualitatively similar results but once more highlight the lower robustness of the industry employment share.

5 SUMMARY AND DISCUSSION

In times of continued technical progress as well as changing demands on qualifications of employees training is a prerequisite for the competitiveness of enterprises and regions. Therefore, appropriate economic policies to increase both privately as well as employer financed training are important elements of consistent life-long learning strategies. To understand the determinants of enterprise financed training a number of models such as the model by Acemoglu and Pischke (1999) can be used. One consequence of these models is that the incentives of employers to finance training will depend on regional and sector labour market characteristics. Two important labour market characteristics in this respect are the industry share and labour turnover. The direction of the impact of these variables on training probabilities is, however, indeterminate from a theoretical perspective. With respect to the industry share one could on the one hand argue that this variable increases labour productivity and thus also increases incentives for employer financed training. On the other hand a negative impact could be predicted if localisation of an industry in a region leads to an increased poaching risk. Similar arguments apply to labour turnover. A higher turnover of workers increases the exit probability of workers and thus reduces incentives for employers to finance training. At the same time higher mobility may also lead to knowledge spillovers between firms. This increases productivity and training incentives.

This paper aimed to empirically analyse the industry specific effects of employment density (as measured by the industry employment share) and labour turnover on the supply of employer financed training at the example of the city of Vienna. The results show a robust negative effect of labour market turnover and a somewhat less robust negative impact of the industry employment share on employer financed training activity levels, with both of these effects being more pronounced for training probabilities of the less skilled. The positive incentive effects on employer financed training arising from knowledge spillovers are thus dominated by the negative effects of increased poaching. Similarly the advantages of increased knowledge spillovers through labour mobility are not sufficient to countervail the negative effects of an increased separation rate of workers from their employer.

The results therefore confirm the hypothesis that the decision of employers to pay for training of their employees, next to being determined by firm level characteristics, also depends on regional and sector labour market characteristics. High labour turnover and potentially high density are a disadvantage in this respect. This implies that policies aimed at increasing employer financed training are up against serious challenges in industries and regions with high labour turnover and high employment density. These challenges are likely to be even larger when it comes to providing employer financed training for less skilled workers. Policy makers may thus consider providing additional incentives for firm financed training in such regions or industries. Alternatively they could also strengthen incentives for privately financed training.

Determining which of these alternatives is more efficient in high labour turnover, high employment density industries and regions could thus be a rewarding topic for future research. Furthermore, our results with respect to employment density and even more so the Herfindahl index and the number of employers in a region remain less conclusive than for labor turnover. Future research, therefore, could also explore the role of density and competition between employers and training by either using alternative measures of these variables or by exploring the appropriate level of sector aggregation (which was the NACE 4 digit level in this paper) in more detail.

6 REFERENCES

Acemoglu, D. 1997. Training and Innovation in an Imperfect Labour Market. *Review of Economic Studies*, 64 (3), 445–464.

Acemoglu, D. and Pischke, J. 1999. The Structure of Wages and Investment in General Training. *Journal of Political Economy*, 107 (3), 539–572.

Arulampalam, W. et al. 2004. Training in Europe. *Journal of the European Economic Association*, 2 (2–3), 346–360.

Ariga, K. and Brunello, G. 2006. Are Education and Training Always Complements? Evidence from Thailand. *Industrial and Labour Relations Review*, 59 (4), 613–629.

Asplund, R. 2005. The Provision and Effects of Company Training: A Brief Review of the Literature. *Nordic Journal of Political Economy*, 31, 47–73.

Becker, G. S. 1964. *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education*. University of Chicago Press, Chicago.

Brunello, G. et al. 2005. *Workplace Training in Europe*. IZA Discussion Paper No. 1640.

Brunello, G. and de Paola, M. 2008. Training and Economic Density: Some Evidence Form Italian Provinces. *Labour Economics*, 15 (1), 118–140.

Brunello, G. and Gambarotto, F. 2007. Do Spatial Agglomeration and Local Labour Market Competition Affect Employer-Provided Training? Evidence from the UK. *Regional Science and Urban Economics*, 37 (1), 1–21.

Card, D. et al. 2007. Cash-on-Hand and Competing Models of Intertemporal Behavior: New Evidence from the Labour Market. *Quarterly Journal of Economics*, 122 (4), 1511–1560.

Chang, C. and Wang, Y. 1996. Human capital investment under asymmetric information: the Pigovian conjecture revisited. *Journal of Labour Economics*, 14 (3), 505–509.

Ciccone, A. 2002. Agglomeration Effects in Europe. *European Economic Review*, 46 (2), 213–227.

Ciccone, A. and Hall, R. 1996. Productivity and the Density of Economic Activity. *American Economic Review*, 86 (1), 54–70.

Combes, P. P. 2000. Economic Structure and Local Growth: France, 1984–1993. *Journal of Urban Economics*, 47 (3), 329–355.

Elias, P. and Healey, M. 1994. The Provision and Impact of Job-Related Formal Training in a Local Labour Market. *Regional Studies*, 28 (6), 577–590.

Fallick, B., Fleischmann, C. A. and Rebitzer, J. A. 2006. Job Hopping in Silicon Valley: Some Evidence Concerning the Micro-Foundations of a High Technology Cluster. *Review of Economics and Statistics*, 88 (3), 472–481.

Fujita, M. et al. 1999. *The spatial economy: Cities, regions, and international trade*. Cambridge and London: MIT Press.

Glaeser, E. L. et al. 1992. Growth in Cities. *Journal of Political Economy*, 100 (6), 1126–1152.

Glaeser, E. L. and Mare, D. C. 2001. Cities and Skills. *Journal of Labour Economics*, 19 (2), 316–342.

Henderson, V. et al. 1995. Industrial Development in Cities. *Journal of Political Economy*, 103 (5), 1067–1090.

Huber, P. and Smeral, K. 2006. Measuring Worker Flows. *Applied Economics*, 38 (14), 1689–1695.

Huber, P. et al. 2002. *Analyse der Wiener Wirtschaftsaktivitäten. Teil I: Analyse, Studie des Österreichischen Instituts für Wirtschaftsforschung*. WIFO, Wien.

Hughes, G. et al. 2004. Company Training and Low-Skill Consumer-Service Jobs in Ireland. *International Journal of Manpower*, 25 (1), 17–35.

Ichino, A. et al. 2007. *Too Old to Work, Too Young to Retire?* CEPR Discussion Papers 6517.

Katz, E. and Ziderman, A. 1990. Investment in general training: the role of information and labour mobility. *The Economic Journal*, 100, 1147–1158.

Lene, A. 2002. *Enterprise Related Training and Poaching Externalities*. Paper Presented at the 14th EALE conference, September 2002, Paris.

Leuven, E. 2005 The economics of private sector training: A survey of the literature. *Journal of Economic Surveys*, 19 (1), 91–111.

Lynch, L. M. and Black, S. E. 1998. Beyond the Incidence of Employer-Provided Training. *Industrial and Labour Relations Review*, 52 (1), 64–81.

Majumdar, S. 2006. Market Conditions and Worker Training: How Does it Affect and Whom? *Labour Economics*, 14 (1), 1–23.

Mayerhofer, P. 2007. Stadtwirtschaft im Umbruch – Wiens Beschäftigungssystem unter neuen Rahmenbedingungen. *Wirtschaft und Gesellschaft*, 33 (1), 1–11.

Moen, E. R. and Rosen, A. 2004. Does Poaching Distort Training? *Review of Economic Studies*, 71 (4), 1143–1162.

Mühlemann, S. et al. 2007. An empirical analysis of the decision to train Apprentices. *Labour*, 21 (3), 419–441.

Porter, M. E. 2003. The Economic Performance of Regions. *Regional Science*, 37 (6–7), 549–578.

Saxenian, A. L. 1996. *Regional advantage: Culture and competition in Silicon Valley and Route 128*. Second edition. Cambridge and London: Harvard University Press.

Schöberl, M. 2004. *Das Datenverarbeitungssystem der WIFO-Arbeitsmarktanalyse auf der Basis von Individualdaten (WABI)*. WIFO, Vienna.

Schüler, A. and Meyer, J. 2006. *Die Entscheidung über Betriebliche Weiterbildungsivestitionen: eine empirische Analyse mit dem Mannheimer Innovationspanel*. ZEW Discussion Paper 06-089.

7 ANNEX

Tab. 7: Variable definitions

Variable	Definition	Source
Dependent variables		
Training	Indicator variable if firm undertook employee training in last 12 months	WAFF-VEQM
Training for skilled	Indicator variable if firm undertook employee training in last 12 months for high skilled	WAFF-VEQM
Training for unskilled	Indicator variable if firm undertook employee training in last 12 months for low skilled	WAFF-VEQM
Independent variables		
ln (Turnover)	(log of) sum of separation and hires in a year relative to total employment in a (3- or 4-digit) in Vienna	ASSD
ln (Industry share)	(log of) share of all employed working in a (3- or 4-digit) industry in Vienna	ASSD
ln (Herfindahl)	log of herfindahl index over firm level employment shares in an (3- or 4-digit) industry	ASSD
ln (No. employers)	log of Number of employers (firms) in a (3- or 4-digit) industry in Vienna	ASSD
ln (Size)	log of number of employees at the firm	WAFF-VEQM
Average education of employees	Indicator variables if firm employs mostly employees with high school diploma or without high school diploma or equal shares of both, respectively	WAFF-VEQM
Average qualification of employees	Indicator variables if firm employs mostly lowly or highly qualified employees or equal shares of both, respectively	WAFF-VEQM
Part of a company	Indicator variables equal to one if firm is part of a larger company and zero else	WAFF-VEQM
Internationally active	Indicator variables equal to one if firm is internationally active (i.e. an exporter) and zero else	WAFF-VEQM
Firm age	Indicator variables for firms aged less than 5 years or 5–9 years or 10 or more years respectively	WAFF-VEQM
Invested in computers	Indicator variable if firm invested in computers in the last year	WAFF-VEQM
Invested in production	Indicator variable if firm invested in machinery in the last year	WAFF-VEQM
Other investments	Indicator variable if firm had other investments in the last year	WAFF-VEQM
Product innovation	Indicator variable if firm claimed a product innovation in the last year	WAFF-VEQM
Process innovation	Indicator variable if firm claimed a process innovation in the last year	WAFF-VEQM

(to be continued on the next page)

Variable	Definition	Source
Firm reorganisation	Indicator variable if firm underwent a major reorganisation in the last year	WAFF-VEQM
Vacancies/employee	Number of open positions per employee at the firm	WAFF-VEQM
Expectations about the future	Indicator variables for firms that are very optimistic, optimistic or not optimistic about the future	WAFF-VEQM
Expectation about future unknown	Indicator variable for firms that had no expectation about the future or did not respond to the question on expectations about the future	WAFF-V

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