Swiss Leading House
Economics of Education • Firm Behaviour • Training Policies

Firm-sponsored Training and Poaching Externalities in Regional Labor Markets

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Motivation

- Why do firms train?
  - Profit/substitution of other workers (net costs negative)
  - Recruitment of skilled workers (net costs can be positive)
- 2/3 of apprenticeship training programmes in Switzerland are profitable (Muehlemann et al. 2007)
- If net costs > 0, a firm needs to retain the apprentice to recoup investment
- Problem: other firms can poach the trained apprentice
- Question of this paper: the impact of the threat of poaching on firms' training behavior

Literature I

- Acemoglu & Pischke (QJE 1998, JPE 1999)
  - Firms pay for general training if there are frictions in the labor market
- Wolter et al. (GER 2006)
  - Expected net costs of training firms are negative, those of non-training firms are positive
- Muehlemann et al. (Labour 2007)
  - Net costs are an important determinant of the training decision (yes/no), but have no effect at the intensive margin (no. of apprentices)

Literature II

- Brunello & Gambarotto (Labour Economics 2008) and Brunello & de Poala (Regional Science and Urban Economics 2007)
  - Firms provide less training in dense local labor markets where competition is high
- Harhoff & Kane (JPopEcon 1997)
  - Firms train less (yes/no) and have a lower training intensity if there are many other firms in the same industry that could poach trained apprentices

Data

- Two representative surveys of Swiss firms in the years 2000 and 2004
- Data set consists of 4312 training and 3281 non-training firms
- Project funded by the Swiss Federal Office for Vocational Training and Technology, with assistance of the Swiss Federal Statistical Office
- Firms that cannot make independent decisions with regards to vocational training as well as firms that operate nation-wide have been excluded

Regional labor markets

1. Regions based on political borders

   +: Easy to construct

   −: Economic activities can take place across borders

2. Regions based on travel distance

   +: Relatively easy to construct using a coordinate system

   −: Problematic if travel distance does not reflect transportation cost (e.g. mountain range → detour)

3. Regions based on travel time

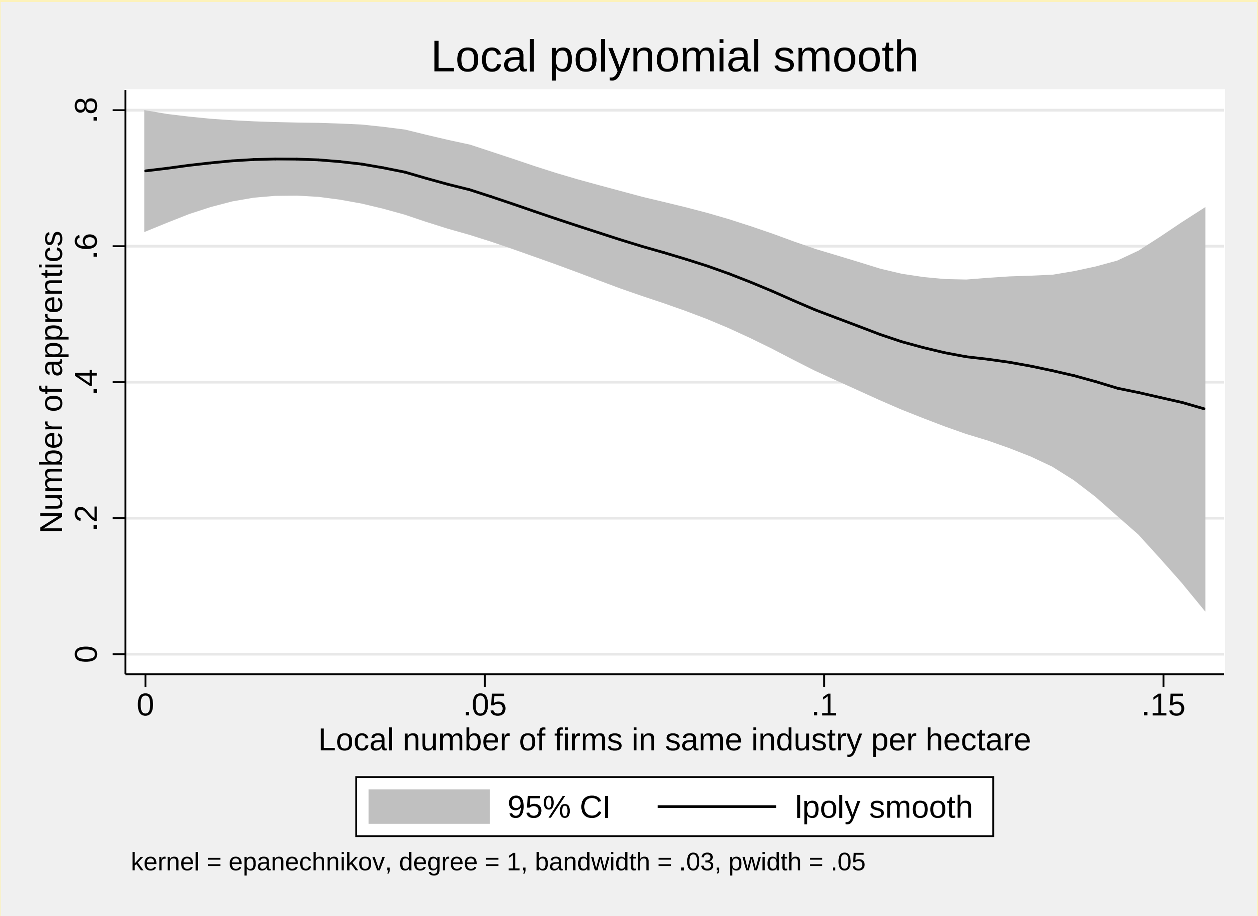
   +: More appropriate measure of transportation costs

   −: Hard to construct

Definition of a region

- The 67 largest cities or towns in Switzerland build the center of a region
- From such a point, each town that can be reached by car within 30 minutes belongs to a region
- Travel times have been computed using Microsoft Autoroute 2005
- Travel times by car have been used instead of public transportation because regions would become very small in rural areas where public transportation is less available

Local polynomial regression



Count data models

- Poisson regression
- Negative binomial regression
- Poisson hurdle model
- Logit-negative binomial hurdle model

Count data models: Poisson

Let $n_j = 0, 1, 2, \ldots$ denote the number of apprentices employed by firm i, then

$$\text{Prob}(N_i = n_i | x_i) = \frac{e^{-\lambda_i}\lambda_i^{n_i}}{n_i!}, \quad n_i = 0, 1, 2, ...$$

where $\ln \lambda_i = x_i' \beta$ in the standard loglinear version of the Poisson model. β is the coefficient vector of the explanatory variables x_i. The expected number of apprentices hired by a firm is given by

$$E[n_i | x_i] = \text{Var}[n_i | x_i] = \lambda_i = e^{x_i' \beta}$$

Count data models: Negative binomial

The Poisson model requires equidispersion. The negative binomial model overcomes this restriction by allowing more flexibility. It can be interpreted as a generalization of the Poisson model by introducing unobserved heterogeneity, such that $\ln \mu_i = x_i'\beta + \varepsilon_i$. Hence,

$$E[n_i|x_i, \varepsilon_i] = e^{x_i'\beta + \varepsilon_i} = \mu_i = h_i \lambda_i$$

where $h_i = e^{\varepsilon_i}$ is assumed to have a gamma distribution with mean normalized to 1 and variance $1/\delta$, $\delta > 0$. Thus, $E[n_i|x_i, \varepsilon_i] = \lambda_i$ if $E[h_i] = 1$.

”Excess zeros”

While the negative binomial model allows for overdispersion, it cannot predict ”excess zeros”, as it is the case in our data:

Apprentices	0	1	2	3	4	5	6	7+
Frequency	70.05	13.25	9.08	3.61	1.82	0.78	0.43	0.98
Cumulative freq.	70.05	83.30	92.38	96.00	97.82	98.60	99.02	100

Count data hurdle models

- The zero outcomes are determined by a density $f_1(\cdot)$, such that $f(n=0)=f_1(0)$.
- Positive outcomes are determined by a truncated density $f_2(\cdot)$ such that $f(n=k)=\frac{1-f_1(0)}{1-f_2(0)}f_2(k), k=1,2,3,....$
- Hence, the probability distribution of a hurdle-at-zero model is given by

$$g(n)=\begin{cases} f_1(0) & \text{if} \quad n=0 \\ \frac{1-f_1(0)}{1-f_2(0)}f_2(n) & \text{if} \quad n\geq 1 \end{cases}$$

Poisson hurdle model (PH)

A standard model is the PH with f_1 and f_2 being two Poisson distributions, where $\lambda_{1i} = e^{x_i'\beta_1}$ and $\lambda_{2i} = e^{x_i'\beta_2}$. $H_0 : \beta_1 = \beta_2$ can be tested using a Wald test. If H_0 cannot be rejected, the PH reduces to the standard Poisson model since $f_1 = f_2$.

$$
\begin{aligned}
L &= \prod_{i=1}^{k} \exp(-\exp(x_i'\beta_1))^{d_i} [1 - \exp(-\exp(x_i'\beta_1))]^{1-d_i} \\
&\times \left[\frac{\exp(-\exp(x_i'\beta_2)) \exp(n_i x_i'\beta_2)}{n_i! \exp(-\exp(x_i'\beta_2))} \right]^{1-d_i}
\end{aligned}
$$

where $d_i = 1 - \min\{n_i, 1\}$

Elasticities

The main interest of this paper are the elasticity of the firm's demand for apprentices n with respect to the local labor market density d at the extensive margin, which is given by

$$\eta_1 = \frac{\partial P(n > 0)}{\partial d} \frac{d}{P(n > 0)}$$

and the elasticity at the intensive margin, given by

$$\eta_2 = \frac{\partial E(n|n > 0)}{\partial d} \frac{d}{E(n|n > 0)}$$

Overall elasticity $= \eta_1 + \eta_2$ since $E(n) = P(n > 0)E(n|n > 0)$.

Poisson regression model

Dependent variable:	Number of apprentices	
	Coeff.	Std.err.
Local number of firms in industry per hectare	-6.3872	(1.1323)
Ln(Number of skilled workers in training profession)	0.7761	(0.0295)
Ln(Number of other employees in firm)	0.0431	(0.0047)
Foreign firm-ownership	-0.5782	(0.0995)
French part of Switzerland	-0.5550	(0.0957)
Italian part of Switzerland	-0.5293	(0.1059)
Survey in year 2000 (1=yes/0=no)	-0.0747	(0.0491)
Industry dummies	Yes	
Job dummies	Yes	
Constant	-0.5357	(0.0967)
Log pseudolikelihood	-435,083.6	
Observations	7593	

Standard errors in parentheses are adjusted for clustering. Number of clusters: 67. The reference category is a firm in the German part of Switzerland in the trade, retail and whole sale industry surveyed in the year 2004.

Poisson hurdle model

Dependent variable:	Training yes/no		No. of app. 1+	
	Coeff.	Std.err.	Coeff.	Std.err.
Local number of firms in industry per hectare	-8.3443	(1.2824)	-1.1474	(0.7552)
Ln(Number of skilled workers in training prof.)	0.5896	(0.0369)	0.5982	(0.0339)
Ln(Number of other employees in firm)	0.0338	(0.0057)	0.0422	(0.0051)
Foreign firm-ownership	-0.9205	(0.1110)	-0.0315	(0.0709)
French part of Switzerland	-0.5370	(0.0801)	-0.2851	(0.1161)
Italian part of Switzerland	-0.2575	(0.1231)	-0.4810	(0.0987)
Survey in year 2000 (1=yes/0=no)	-0.1407	(0.0697)	0.0309	(0.0449)
Industry dummies	Yes		Yes	
Job dummies	Yes		Yes	
Constant	-0.4437	(0.1038)	-0.2773	(0.0924)
Log pseudolikelihood	-400,328.0			
Observations	3281		4312	

Standard errors in parentheses are adjusted for clustering. Number of clusters: 67. The reference category is a firm in the German part of Switzerland in the trade, retail and whole sale industry surveyed in the year 2004.

Logit-negative binomial hurdle model

Dependent variable:	Training yes/no		No. of app. 1+	
	Coeff.	Std.err.	Coeff.	Std.err.
Local number of firms in industry per hectare	-10.1379	(1.5411)	-1.5669	(0.8362)
Ln(Number of skilled workers in training prof.)	0.7246	(0.0679)	0.6052	(0.0341)
Ln(Number of other employees in firm)	0.0492	(0.0069)	0.0453	(0.0053)
Foreign firm-ownership	-1.1021	(0.1365)	-0.0991	(0.0721)
French part of Switzerland	-0.6538	(0.0971)	-0.2845	(0.1165)
Italian part of Switzerland	-0.2420	(0.1521)	-0.4693	(0.0988)
Survey in year 2000 (1=yes/0=no)	-0.1432	(0.0824)	0.0119	(0.0470)
Industry dummies	Yes		Yes	
Job dummies	Yes		Yes	
Constant	-0.0925	(0.1324)	-0.3440	(0.0935)
Log pseudolikelihood	-393,715.7			
$\ln \alpha$			-1.4726	(0.1663)
Observations	3281		4312	

Standard errors in parentheses are adjusted for clustering. Number of clusters: 67. The reference category is a firm in the German part of Switzerland in the trade, retail and whole sale industry surveyed in the year 2004.

Elasticities

Model	Elasticity	Controls			
		Industry	Job	Canton	Region
Poisson	-0.227	Yes	Yes	No	No
	-0.175	Yes	Yes	Yes	No
	-0.175	Yes	Yes	No	Yes
Negative binomial	-0.248	Yes	Yes	No	No
	-0.212	Yes	Yes	Yes	No
	-0.225	Yes	Yes	No	Yes
Poisson Hurdle					
-Training yes/no	-0.267	Yes	Yes	No	No
	-0.203	Yes	Yes	Yes	No
	-0.213	Yes	Yes	No	Yes
-No. of apprentices 1+	-0.037	Yes	Yes	No	No
	-0.047	Yes	Yes	Yes	No
	-0.057	Yes	Yes	No	Yes
Logit-negative binomial					
-Training yes/no	-0.293	Yes	Yes	No	No
	-0.228	Yes	Yes	Yes	No
	-0.246	Yes	Yes	Yes	Yes
-No. of apprentices 1+	-0.050	Yes	Yes	No	No
	-0.065	Yes	Yes	Yes	No
	-0.081	Yes	Yes	No	Yes

Conclusions

- Firms have a higher demand for apprentices in more isolated local labor markets, where the possibility that other firms can poach their apprentices is lower
- The effect of local labor market density is strongest at the extensive margin, i.e. whether firms train or not, but small at the intensive margin.
- The threat of poaching is only relevant for firms that have to bear positive net costs. Hence, it is important that training regulations allow firms to train apprentices in a cost efficient manner.