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Training Propensity of Start-ups in Switzerland

A Study Based on Data for the Start-up Cohort 1996-97

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Aim of the paper / motivation

- Analyzing the determinants of the training propensity in start-ups and how they change with increasing firm age
- Investigating how a firm's training propensity correlates with its labour productivity
- Vocational training is an important pillar of the education system in Switzerland
- Training behaviour of new firms is not much analyzed (Demgenski and Icks 2002 and Sassmannshausen and Reinert 2006)

Conceptual framework

We comprise factors that could influence a firm‘s decision to train apprentices in four main groups (see, e.g., Franz et al. 2000 and Niederalt 2004 for a similar approach):

- Human resources
- Innovation and technology
- Firm activity level
- Market conditions

Human resources

- Education level of the employees: dummies (QUAL_4, …, QUAL_1)
- Shortage of high qualified personnel yes/no (SHORT)
- Firm-initiated further training yes/no (FTRAIN)

Innovation and technology

- Development and introduction of new/modified products yes/no (NP, MP)
- R&D activity yes/no (R&D)
- Strong/weak use of internet/intranet (INTER, INTRA)

Firm activity level

- Demand will increase/decrease (DEMAND)
- Sales increased/decreased (SALES)
- Employment increased/decreased (EMPL)
- Profit break-even point attained yes/no (BREAK)

Market conditions

- Strong/weak price/non-price competition (PCOMP, NPCOMP)
- Exporting firm yes/no (EXPORT)

Additional potential determinants

- Founder characteristics: average age, gender (AGE, GENDER)
- Control variables: size, sector affiliation (SIZE, IND)

Data

- Cohort of Swiss enterprises founded between 1996 and 1997
- Green-field start-ups
- Postal surveys among still “existing” firms in 2000, 2003 and 2006
- Cross-sectional data for three stages in the development of the start-ups

The training propensity equation

- Dependent variable: firm has apprentices yes/no (TRP)
- $TRP = \alpha_0 + \alpha_1\ QUAL\_4 + \alpha_2\ QUAL\_3 + \alpha_3\ QUAL\_2 + \alpha_4\ QUAL\_1 + \alpha_5\ FTRAIN + \alpha_6\ SHORT + \alpha_7\ NP + \alpha_8\ MP + \alpha_9\ R\&D + \alpha_{10}\ INTER + \alpha_{11}\ INTRA + \alpha_{12}\ BREAK + \alpha_{13}\ SALES + \alpha_{14}\ DEMAND + \alpha_{15}\ EMPL + \alpha_{16}\ PCOMP + \alpha_{17}\ NPCOMP + \alpha_{18}\ EXPORT + \alpha_{19}\ AGE + \alpha_{20}\ GENDER + control\ variables + u$
- Found no evidence for a selection bias
- Separate probit models for each cross-section (2000, 2003 and 2006)

Results of the training propensity equation

- Effects of human resources:
  - QUAL_3 positive and QUAL_1 negative in 2000
  - SHORT positive in 2000
  - FTRAIN positive in 2003 and 2006 (no data for cross-section 2000)

- Effects of innovation and technology:
  - NP negative and MP positive in 2000
  - No effect of R&D
  - INTER negative in 2003 (no data for cross-section 2000)

- Effects of firm activity level:
  - DEMAND positive in 2003
  - No effect of SALES, BREAK and EMPL

Results of the training propensity equation

- Effects of market conditions:
  - EXPORT negative in 2000
  - No effects of PCOMP and NPCOMP
- Effects of founder characteristics:
  - AGE negative in 2000, 2003 and 2006
  - No effect of GENDER
- Effects of control variables:
  - SIZE positive in 2000, 2003 and 2006
  - IND_2 negative in 2000, 2003 and 2006

Estimates for cross-section 2000

Explanatory variables	TRP probit	TRP probit	TRP probit	TRP probit me (dy/dx)
QUAL_4	-0.2357			-0.0294
QUAL_3	0.3881***			0.0505
QUAL_2		0.1201		
QUAL_1			-0.5273***	
SHORT	0.2791**	0.2677**	0.2848**	0.0406
FTRAIN				
NP	-0.3433*	-0.4046**	-0.4609**	-0.0389
MP	0.3346**	0.3505**	0.3310**	0.0460
R&D	-0.1615	-0.1573	-0.1861	-0.0205
INTER				
INTRA				
BREAK	-0.1218	-0.1094	-0.1267	-0.0171
SALES	-0.0091	0.0004	0.0142	-0.0012
DEMAND	-0.2563	-0.2326	-0.2433	-0.0387
EMPL	0.1413	0.1639	0.1747	0.0181
PCOMP	0.0425	0.0442	0.0804	0.0057
NPCOMP	-0.0735	-0.0771	-0.0883	-0.0099
EXPORT	-0.3714**	-0.3667**	-0.4255***	-0.0449
GENDER	-0.0073	0.0310	0.0333	-0.0010
AGE	-0.0186**	-0.0174**	-0.0179**	-0.0025
SIZE_1	0.5041***	0.4953***	0.5683***	0.0786
SIZE_2	0.7990***	0.7842***	0.9364***	0.1538
SIZE_3	0.4935	0.4497	0.7313**	0.0910
SIZE_4	1.5725***	1.5530***	1.7960***	0.4608
IND_1	-0.3975	-0.4682	-0.5556*	-0.0419
IND_2	-0.5640**	-0.5875***	-0.7732***	-0.0719
IND_3	-0.1920	-0.1971	-0.2879	-0.0250
N	816	816	816	816
Pseudo R2	0.1773	0.1612	0.1788	
Wald chi2	91.16***	80.92***	93.56***	

Notes: ***, **, * denotes statistical significance at the 1%, 5% and 10% test level, respectively.

Estimates for cross-section 2003

Explanatory variables	TRP probit	TRP probit	TRP probit	TRP probit me (dy/dx)
QUAL_4	-0.1555			-0.0237
QUAL_3	-0.0523			-0.0084
QUAL_2		0.1628		
QUAL_1			0.1077	
SHORT	0.2458	0.2361	0.2343	0.0419
FTRAIN	0.3829*	0.3432	0.3725*	0.0521
NP	-0.1721	-0.1829	-0.1636	-0.0252
MP	0.0442	0.0418	0.0551	0.0071
R&D	0.1460	0.1399	0.1280	0.0248
INTER	-0.5371***	-0.5590***	-0.5519***	-0.0854
INTRA	-0.1578	-0.1565	-0.1539	-0.0235
BREAK	-0.2842	-0.2786	-0.2806	-0.0505
SALES				
DEMAND	0.3179**	0.3173**	0.3051**	0.0531
EMPL	-0.2365	-0.2633	-0.2397	-0.0393
PCOMP	0.0003	0.0068	0.0133	0.0001
NPCOMP	0.1486	0.1533	0.1461	0.0234
EXPORT	-0.2923	-0.2819	-0.2763	-0.0423

GENDER	0.2895	0.2855	0.2906	0.0426
AGE	-0.0239**	-0.0252***	-0.0254***	-0.0038
SIZE_1	0.9090***	0.9006***	0.8961***	0.1832
SIZE_2	1.3908***	1.3606***	1.3559***	0.3576
SIZE_3	1.3181***	1.2673***	1.2403***	0.3819
SIZE_4	1.8474***	1.7699***	1.7291***	0.5927
IND_1	-0.3999	-0.4031	-0.4112	-0.0506
IND_2	-0.4886*	-0.5109**	-0.5184**	-0.0750
IND_3	-0.0858	-0.0991	-0.1174	-0.0135
N	565	565	565	565
Pseudo R2	0.2195	0.2192	0.2187	
Wald chi2	98.19***	97.30***	98.21***	

Notes: ***, **, * denotes statistical significance at the 1%, 5% and 10% test level, respectively.

Estimates for cross-section 2006

Explanatory variables	TRP probit	TRP probit	TRP probit	TRP probit me (dy/dx)
QUAL_4	-0.0551			-0.0085
QUAL_3	0.3241			0.0490
QUAL_2		0.2707		
QUAL_1			-0.3428	
SHORT	-0.2202	-0.2224	-0.2305	-0.0327
FTRAIN	0.8436**	0.8984**	0.8845**	0.0912
NP	0.4017	0.4189*	0.3729	0.0767
MP	0.1868	0.1629	0.1567	0.0301
R&D	0.1093	0.1292	0.1116	0.0180
INTER	-0.2684	-0.2454	-0.2389	-0.0434
INTRA	-0.1024	-0.1014	-0.1192	-0.0154
BREAK	-0.0281	-0.0050	-0.0132	-0.0045
SALES	0.0220	0.0309	0.0222	0.0034
DEMAND	0.0626	0.0746	0.0717	0.0098
EMPL	0.0808	0.0588	0.0713	0.0126
PCOMP	0.2519	0.2890	0.2762	0.0397
NPCOMP	0.2458	0.2394	0.2585	0.0383
EXPORT	-0.3665	-0.3540	-0.3641	-0.0510

GENDER	0.1469	0.1354	0.0982	0.0221
AGE	-0.0369***	-0.0380***	-0.0370***	-0.0058
SIZE_1	1.1673***	1.2412***	1.2953***	0.2539
SIZE_2	1.3892***	1.4185***	1.5448***	0.3510
SIZE_3	1.9330***	1.9987***	2.1788***	0.6021
SIZE_4	2.0832***	2.1190***	2.4142***	0.6670
IND_1	-0.0514	-0.0178	-0.0754	-0.0078
IND_2	-0.7247**	-0.6426**	-0.8418***	-0.1129
IND_3	-0.3879	-0.3457	-0.4613	-0.0561
N	362	362	362	362
Pseudo R2	0.3032	0.2994	0.3029	
Wald chi2	82.16***	80.70***	82.45***	

Notes: ***, **, * denotes statistical significance at the 1%, 5% and 10% test level, respectively.

The productivity equation

- Dependent variable: logarithm of total sales per employee (LQ/L)
- $LQ/L = \beta_0 + \beta_1\ LCAP + \beta_2\ FIN + \beta_3\ R\&D + \beta_4\ QUAL + \beta_5\ TRP + control\ variables + u$
- Separate Full Information Maximum Likelihood models (TRP endogenized) for each cross-section (2000, 2003 and 2006)

Results of the productivity equation

- Negative effects of TRP in 2000, 2003 and 2006
- Same result with alternative estimation methods (OLS, 2SLS, 2SMLE, Bootstrap estimations of standard errors)
- Same result with alternative dependent variable: logarithm of total sales per employee excluding apprentices
- Weaker negative effect when a time lag of one period was taken into consideration

Estimates of the productivity equation

Year	2000	2003	2006
Explanatory variables			
LCAP	0.065***	0.012	0.000
FIN	0.004	-0.125	-0.163*
QUAL	0.054	-0.092	-0.045
R&D	-0.182**	-0.041	0.036
SIZE_1	0.070	0.214*	0.185*
SIZE_2	0.001	0.360***	0.517***
SIZE_3	0.111	0.157	0.621***
SIZE_4	0.431*	0.416	0.763**
IND_1	0.023	0.252	0.096
IND_2	0.081	-0.025	-0.176
IND_3	0.241**	0.096	0.022
TRP	-1.012***	-0.617***	-1.073***
N	582	442	320
Wald chi2	50.96***	35.01***	76.31***
rho	0.462	0.173	0.819
Wald test of rho=0: Prob > chi2	0.002	0.188	0.000

Notes: ***, **, * denotes statistical significance at the 1%, 5% and 10% test level, respectively; this model also includes controls for geographical region.

Conclusions

- In the first years the training propensity is determined by a series of structural factors at firm level and appears to be independent of demand conditions
- Afterward training propensity is primary determined by firm size and sector affiliation
- Negative effect of training propensity on labour productivity

Thanks for your attention!

Training propensity of start-ups by industry

Year	2000		2003		2006	
Industry / sector	Percentage of enterprises having apprentices	N	Percentage of enterprises having apprentices	N	Percentage of enterprises having apprentices	N
Food	0.0	5	0.0	2	-	0
Textiles, clothings, leather	20.0	5	0.0	3	0.0	3
Wood processing, paper, printing	12.0	25	0.0	11	30.0	10
Chemicals, plastics, glass	0.0	12	12.5	8	33.3	6
Metal, metalworking	8.3	12	11.1	9	25.0	4
Machinery, vehicels	0.0	4	33.3	3	33.3	3
Electrical mechinery, electronics, watches	9.1	11	28.6	7	40.0	5
Other manufacturing	9.1	11	25.0	4	0.0	2
Manufacturing	8.2	85	12.8	47	27.3	33
− High-tech manufacturing	4.2	24	25.0	16	38.5	13
− Low-tech manufacturing	9.8	61	6.5	31	20.0	20
Construction	22.6	102	28.6	63	31.3	48
Wholesale trade	12.9	85	17.3	52	13.3	30
Retail trade	18.1	127	24.7	81	23.9	46
Hotels, catering	5.6	18	10.0	10	0.0	4
Transport, telecommunication	3.9	26	9.5	21	25.0	8
Banks, insurance	17.7	17	12.5	8	33.3	3
Real estate, leasing, computer services	3.7	108	7.0	57	13.0	46
Business services	7.0	301	10.0	221	11.7	162
Educational system	0.0	11	0.0	7	0.0	5
Health care	16.7	18	28.6	14	18.2	11
Other services	18.5	27	18.2	11	0.0	8
Culture/sport/amusement	16.7	12	0.0	3	0.0	1
Services	9.9	750	13.4	485	13.9	324
− Modern services	6.9	376	9.1	254	12.4	193
− Traditional services	12.8	374	18.2	231	16.0	131
Total	11.1		15.0		17.0	
N	937	937	595	595	405	405

Training propensity of start-ups by firm size

Year	2000		2003		2006	
Firm size	Percentage of enterprises having apprentices	N	Percentage of enterprises having apprentices	N	Percentage of enterprises having apprentices	N
1 up to and including 2 employees	5.2	445	4.7	257	2.3	176
2 up to and including 4 employees	12.7	276	17.5	183	21.8	110
4 up to and including 10 employees	20.9	163	29.5	112	29.5	78
10 up to and including 20 employees	14.3	35	27.6	29	44.8	29
more than 20 employees	38.9	18	28.6	14	41.7	12
Total	11.1		15.0		17.0	
N	937	937	595	595	405	405

Training propensity of start-ups by region

Year	2000		2003		2006	
Region	Percentage of enterprises having apprentices	N	Percentage of enterprises having apprentices	N	Percentage of enterprises having apprentices	N
Lac Léman region	15.7	102	26.6	64	18.8	32
Espace midland	12.3	187	17.9	134	21.7	97
North-western Switzerland	10.2	137	13.2	76	17.7	62
Zurich	9.5	222	9.5	137	9.2	98
Eastern Switzerland	9.3	140	14.5	83	19.2	52
Central Switzerland	11.3	124	11.4	79	18.4	49
Ticino	12.0	25	18.2	22	20.0	15
Total	11.1		15.0		17.0	
N	937	937	595	595	405	405