

**Firm-sponsored Work-Related Training in  
Frictional Labour Markets  
An empirical analysis for Switzerland**

Michael Gerfin

03-17

October 2003



**Firm-sponsored Work-Related Training**  
**in Frictional Labour Markets**  
**An empirical analysis for Switzerland**

Michael Gerfin

Volkswirtschaftliches Institut, Universität Bern and IZA, Bonn

[michael.gerfin@vwi.unibe.ch](mailto:michael.gerfin@vwi.unibe.ch)

This version: October 2003

*Acknowledgements:* This paper is part of the National Research Project “Education and Employment” (NFP 43). I would like to thank the Swiss Science Foundation for financial support (Grant 610-062887), the Swiss Office of Statistics for data provision, and Robert Leu and Reto Nyffeler for helpful discussions. All errors are mine.

**Abstract:** *Work-related training is considered to be very important for providing the workforce with the necessary skills for maintaining and enhancing the competitiveness of the firms and the economy. According to the classical human capital theory general training is entirely financed by workers. This prediction is at odds with the empirical evidence. This observation inspired new theoretical models with frictional labour markets aiming at explaining the empirical evidence. These frictions create incentives for firms to invest in general training. Most important from a policy point of view is that the amount of training in this frictional world is below the optimal first-best solution achieved in the classical human capital model. Instruments to increase investment in training depend on the dominating kind of friction. This paper tries to identify the sources of frictions in the Swiss labour market. The results indicate that internal wage guarantees (minimum wages set in labour contracts) may play an important role.*

JEL: I2, J31, C33

Keywords: Training, Wages, Market Imperfections, Mobility

## 1. Introduction

According to the classical human capital theory general training is entirely financed by workers who in turn reap all the returns as well (Becker, 1964). This prediction, however, is at odds with the empirical evidence. Many studies show that firms often fully finance training of their workers that is general in nature. Not surprisingly, there is also evidence of small returns of general training to workers and relatively large returns to firms. These observations inspired new theoretical models aiming at explaining the empirical evidence. Acemoglu and Pischke (1999a,b), among others, developed a model with frictional labour markets. These frictions create incentives for firms to invest in general training. Most important from a policy point of view is that the amount of training in this frictional world is below the optimal first-best solution achieved in the classical Becker model. Given the importance of training for productivity and growth it is natural to ask whether the amount of investment can be improved. Since we are in a world of second-best policy interventions may improve welfare. Which instrument is most effective in increasing training investments depends on the kind of friction predominant in the labour market. If information asymmetries play an important part a more regulated training system with credentials providing more information might be helpful. If training costs are too high relative to the returns training subsidies might be useful in increasing training investment. However, at the moment neither the theoretical nor the empirical knowledge is sufficient for clear policy recommendations.

The aim of this paper is to provide further empirical evidence by trying to identify the kind of frictions that are predominant in the Swiss labour market. The empirical strategy relies on possibly differential returns to training for workers staying with or quitting the training firm. The classical human capital theory predicts that these returns should be equal if training is purely general, and higher for the stayers if training has a firm-specific component. Most of the frictional models predict smaller returns for movers. Larger returns for movers are predicted by models where firms face an internal minimum wage, either for contractual reasons (a wage “guarantee”) or due to moral hazard (e.g. efficiency wages). The empirical evidence is mixed. For male workers there is evidence for higher returns at new firms which supports the models with wage guarantees. This in turn suggests that training subsidies might be effective in increasing the level of training investment. However, for female workers there is no evidence for

higher returns at outside firms. In fact, all estimated returns to training are not significantly different from zero. Overall, the empirical evidence is inconclusive.

The paper is organised as follows: section 2 sketches the main aspects of the new training literature and its implications for empirical research. The econometric approach is outlined in section 3, and section 4 discussed the data used in this paper. Section 5 presents the estimation results, section 6 concludes.

## 2. The “new” training literature

To set out the main principles of the new training literature (Acemoglu and Pischke, 1998, 1999) consider a simple two period model. The focus is on general training, i.e. human capital that can be transferred across firms. The classical human capital model (Becker, 1964) can be summarised as follows:

- At time  $t = 0$  there is an initial production of  $y_0$ , and the firm decides on the level of training  $\tau$ , with  $\tau \in (0, \infty)$ . Training costs are  $c(\tau)$  with  $c(0) = 0$ ;  $c'(\cdot) > 0$ ;  $c''(\cdot) < 0$ . The second assumption assures that it is always socially beneficial to have some amount of positive training.
- At time  $t = \frac{1}{2}$  the firm makes a wage offer  $w$  to the worker, and other firms compete for the worker. The worker decides whether to quit and work for another firm. Assume there are many identical firms who can use the general skills of the worker, and the worker does not incur any costs in the process of changing firms. This assumption makes the labour market essentially competitive.
- At time  $t = 1$  there is a second and final period of production, where output is equal to  $y_1 + f(\tau)$ , with  $f(0) = 0$ ,  $f'(\cdot) > 0$ , and  $f''(\cdot) < 0$ . Discounting is ignored for simplicity.

The socially optimal level of training is given by the condition  $c'(\tau^*) = f'(\tau^*)$ . Becker has shown that the equilibrium is achieved when the second period wage  $w_1 = y_1 + f(\tau^*)$  and the first period wage  $w_0 = y_0 - c(\tau^*)$ . Therefore, in this economy the efficient level of training will be achieved with firms bearing none of the cost of training, and workers financing training by taking a wage cut in the first period of employment. If workers face credit constraints or binding

contracts are not possible training investment will be below the social optimum. The general conclusion that firms will not bear any costs still holds in these cases.

Empirically, there is a lot of evidence against this prediction of the classical human capital model. Table 1 summarises some of this evidence. According to the subjective evaluation of workers 70 – 85% of all training courses are viewed as being general training. The majority of these courses are at least partially financed by the firms (see e.g. Loewenstein and Spletzer, 1998, for the USA, Booth and Bryan, 2002, for the UK, and Backes-Gellner und Schmidtke, 2000, for Germany). The German apprenticeship system is also mentioned as an example against the predictions of the classical model. The same can be argued for the Swiss apprenticeship system which is very similar to the German system.

The “new training literature” attempts to explain these observed facts. The central deviation from the classical model concerns frictions in the labour market. Consider the following simple two period model: in the first period the worker or the firm decide how much to invest in the worker’s general human capital,  $\tau$ . For simplicity normalise output in the first period to zero. In the second period the worker either stays with the firm and produces output  $y = f(\tau)$ . The worker will be paid a wage rate  $w(\tau)$  as a function of his skill levels  $\tau$ . If he quits he will receive an outside wage  $v(\tau)$ . Costs of training are again given by  $c(\tau)$ . Training is assumed to be technologically general, i.e.  $f(\tau)$  is the same for all firms. Now assume that there are frictions in the labour market such that  $v(\tau) < f(\tau)$ , i.e. if the worker quits he will get an outside wage below his marginal product. This creates a surplus  $f(\tau) - v(\tau)$  that can be shared between the current firm and the worker. Assuming Nash bargaining the wage of the worker is

$$(1) \quad w(\tau) = v(\tau) + \beta [f(\tau) - v(\tau)],$$

where  $\beta \in [0,1]$  is the bargaining power of the worker. Note that training costs do not affect the equilibrium wage.

Under the assumption that  $\tau$  is determined by the investments of the firm and the worker, who independently choose their contributions to costs,  $c_f$  and  $c_w$ , i.e.  $\tau$  is given by  $c(\tau) = c_f + c_w$ . Now firm and worker bargain over the second period wage  $w(\tau)$ , where the threat point for the worker is the outside wage  $v(\tau)$ , and the threat point of the firm is not to produce. Acemoglu and

Pischke (1999a) show that if there is training either the firm or the worker will bear all costs. Since we are interested in firm financed general training we focus on this case.

The firm maximises profits by choosing  $\tau$ , where profits are given by

$$(2) \quad \pi(\tau) = [f(\tau) - w(\tau)] - c(\tau) = (1 - \beta)[f(\tau) - v(\tau)] - c(\tau).$$

First order conditions are

$$(3) \quad (1 - \beta)[f'(\tau) - v'(\tau)] - c'(\tau) = 0 \quad .$$

If  $f'(\tau) - v'(\tau) = 0$  the firm will not invest in training and the worker will bear all training costs. This is the case of perfectly competitive labour markets. Firms will only invest in training if  $f'(\tau) - v'(\tau) > 0$ . Hence it is not sufficient that outside wages are below the worker's productivity in order to generate firm financed training. It is necessary that productivity increases more than outside wages with increasing human capital. Acemoglu and Pischke call this situation a compressed wage structure. The external compressed wage structure will translate into an internal wage structure implying that  $f'(\tau) - w'(\tau) > 0$  as well.<sup>1</sup> One of the most important implications of this model is that investment in training will be less than in the frictionless world, i.e.  $\tau < \tau^*$ .

Acemoglu and Pischke show that a variety of labour market frictions can lead to wage compression. These include search costs, asymmetric information, complementarity of general and firm-specific skills, efficiency and minimum wages. While the first three directly compress the external wage structure (and the internal wage structure only indirectly) the latter two directly compress the internal wage structure. Loewenstein and Spletzer (1998) develop a contractual model which has the same implications as the efficiency wage model. The main idea of this kind of model is that firms set an internal minimum wage (a wage guarantee) below which wages cannot fall. The reason for this wage guarantee is a signal to employers that firms will not extract excessive returns to training from workers. This wage guarantee is binding for workers whose productivity is below the minimum wage. If firms invest in training of these workers they can increase their productivity without having to increase the wage as long as productivity remains lower than the wage guarantee. This mechanism creates the compressed internal wage structure.

The important implication for the following empirical analysis is that this model implies that workers may be able to increase their wages by changing firms because the wage guarantee may not be binding at an outside firm. Hence the central question of the empirical analysis is whether workers who received training in the past year and changed jobs after training have higher returns to training than those workers who stayed with the training firm. The classical human capital model and the other sources of labour market frictions are not compatible with this prediction.

### 3. Econometrics

In order to analyse the predictions from the previous section I specify the following wage equation (similar specifications are used by Loewenstein and Spletzer, 1998, and Booth and Bryan, 2002).

$$(4) \quad \begin{aligned} w_{ijt} &= x_{ijt}' \beta + T_{ijt}' \alpha + \xi_{ijt} \\ \xi_{ijt} &= \mu_i + \nu_{ij} + \varepsilon_{ijt} \end{aligned} ,$$

where

$w_{ijt}$ : log of monthly earnings of worker  $i$  in firm  $j$  in period  $t$

$x_{ijt}$ : vector of worker and firm characteristics (age (cubic), tenure (cubic), education, job position, sex, nationality, indicators for sectors, regions, and time)

$T_{ijt}$ : training indicators, training of worker  $i$  in firm  $j$  in period  $t$

$\mu_i$ : permanent worker-specific effect (unobserved)

$\nu_{ij}$ : match-specific component (unobserved)

$\varepsilon_{ijt}$ : transitory random effect

Estimating the model by fixed effects will eliminate  $\mu_i$ . This will also solve the endogeneity of  $T_{it}$  caused by a possible correlation between training participation and unobserved ability or motivation contained in  $\mu_i$ . Previous training is also contained in  $\mu_i$ , and there is evidence in the data that training participation is strongly correlated over time.

---

<sup>1</sup> This follows from the derivative of  $w(\tau) = v(\tau) + \beta[f(\tau) - v(\tau)]$ , which is  $w' = v' + \beta[f' - v'] = \beta f' + (1 - \beta)v'$ , as long as  $\beta < 1$ .

The employer-match effect  $\nu_{ij}$  is also likely correlated with  $T_{it}$  because the probability of training will be higher if the match is good. Following Loewenstein and Spletzer (1998) the employer-specific effect  $\nu_{ij}$  is approximated by a dummy variable taking the value of one in case of a job change.<sup>2</sup> The base case is the job in the first observation period.

## 4. Data

I employ data from the Swiss Labour Force Survey (SLFS). The SLFS is conducted by the Swiss Federal Statistical Office on a yearly basis. Each year about 18'000 households are interviewed. The SLFS is designed as a rotating panel, i.e. individuals are interviewed at most in 5 consecutive years. In the years 1996 and 1999 there were special questionnaires relating to vocational training. The questions determine who had any training in the past twelve months, who had work-related training, whether this training was financed by the firm or took place during work time, whether training ended with a certificate, and duration of training. From these questions I constructed indicator variables for work-related training, work-related training (at least partially) sponsored by the firm, certified work-related training. In addition, all waves of the SLFS contain information on work-related training in the past twelve months.

Unfortunately, there was a significant change in the questionnaire regarding income between 1995 and 1996.<sup>3</sup> Since the estimation method is based on the incomes before and after training it is impossible to use the 1995/1996 waves for the analysis. Hence I focus on the 1999 wave. I constructed a balanced 2-years panel covering the years 1998/1999.

Only full-time workers are included in the sample. Work-related training is defined as training in the past 12 months that is either employer-financed or self-financed. Training duration must be at least a week, and only completed training spells are considered. There is no way to identify general and firm-specific training in the data. Hence I assume that the training measured by these indicators is at least partially general in nature.

Table 2 breaks down training frequency by socio-demographic characteristics. Almost half of all full-time workers participated in some work-related training. Roughly two third are firm

---

<sup>2</sup> There is still a possibility of a correlation between  $\nu_{ij}$  and  $T_{it}$ . Loewenstein and Spletzer show that the differential return between stayers and movers will be underestimated in that case, independent of the sign of the correlation.

<sup>3</sup> Until 1995 respondents were asked to state their full labour income, including income from jobs other than their main job. Since 1996 the questionnaire differentiated between main and additional jobs.

financed. There is a clear difference by gender: 50% of the women have to finance work-related training themselves. Firm-sponsored training is above average for better qualified workers and workers in large firms. On the other hand, the variation with age or tenure is relatively low. Only for workers with more than ten years of tenure there is a somewhat larger probability of firm-sponsored training.

The dependent variable is the log of monthly earnings. I trimmed the sample by excluding the top and bottom percentile of the earnings distribution in order to avoid that results are driven by outliers. Movers and stayers are identified by an indicator variable “job change”. Furthermore, it is possible to split the movers into quits and lay-offs. The descriptive statistics of these variables can be found in Tables 3 and 4 in the next section.

## 5. Results

Tables 3 and 4 show the estimation results of the central parameters for men and women. All coefficients are multiplied by 100, hence the figures represent the effect in %. The full set of estimation results is presented in Appendix A. In column (1) there is no distinction between movers and stayers in the returns to training. Column (2) shows the results when returns to firm-sponsored training are allowed to differ between movers and stayers. Finally, in column (3) the movers are split into quits and lay-offs. Returns to self-financed training are not differentiated between movers and stayers.

Column (1) of Table 3 indicates that for men there is a significant return to training of roughly 1.5% - 2%. The returns do not differ significantly between firm-sponsored and self-financed training. The effect of a job change is about 3%. These results conform to those in Gerfin et al. (2003). Separating the returns to firm-sponsored training for stayers and movers clearly indicates that the returns are larger for movers by a factor of 3. This is what would be expected according to the models with wage guarantees. Further differentiating job changes into quits and lay-offs (column 3) yields the expected result that only quitters benefit from a job change, both in terms of the match component and of the returns to training. Note however that the fraction of workers who quit and especially who are laid off after training is very small. Overall, the results in Table 3 support the theoretical model with internal wage guarantees. Similar results have been found by Loewenstein and Spletzer (1998) for the USA and by Booth and Bryan (2002) for the UK.

Table 4 reveals that the results are much less clear cut for women. Column (1) indicates that there are no significant returns to both firm-sponsored and self-financed training. Again, this result corresponds to the results in Gerfin et al (2003). There is a significant positive effect of a job change of about 3%. Estimating differential effects of firm-sponsored training for stayers and movers does not change the results at all. Still all returns are insignificant and have counterintuitive signs. The estimation results in column (3) are not reported because there is only one laid-off worker with firm-sponsored training in the sample. Overall, for women the estimation results are difficult to assess.

## **6. Conclusions**

This paper addressed the empirical question whether there are differential returns to general training at the firm providing the training and at outside firms. The evidence is mixed. For female workers there are no significant effects of training on wages at all. For male workers, on the other hand, there is clear evidence that returns are larger at outside firms. This evidence is consistent with recent theoretical models of training in frictional markets where the frictions are introduced through internal minimal wage floors, due to wage guarantees in labour contracts or efficiency wages. Given that the models with labour market frictions imply training investments below the social optimum achieved in the classical human capital model the question arises whether there policy instruments to improve training investments. In the case of internal wage guarantees theory indicates that training costs are too high to achieve higher investment. This suggests that training subsidies might be a useful instrument. This conclusion, however, is still rather tentative given that the empirical evidence is not clear-cut. Further work, both theoretical and empirical, is necessary in order to provide more reliable answers to this very important problem.

## Literature

- Acemoglu, D. und J-S Pischke (1999a), „The Structure of wages and Investment in General Training“, *Journal of Political Economy* 107, 539-572.
- Acemoglu, D. und J-S Pischke (1999b), „Beyond Becker: Training in imperfect labor markets“, *Economic Journal*, 109, F112-F142
- Arulampalam, W. and A. Booth (2001), “Learning and Earning: Do Multiple Training Events Pay? A Decade of Evidence from a Cohort of Young British Men”, *Economica* 68, 379-400.
- Backes-Gellner, U. and X.Schmidke, (2001), „Kündigungs- und Entlassungsverhalten nach beruflicher Weiterbildung“, in: Uschi Backes-Gellner and Petra Moog (eds.): *Bildungssystem und betriebliche Beschäftigungsstrategien. Beiträge der Jubiläumstagung "25 Jahre Bildungsökonomischer Ausschuß"*. Berlin: Duncker & Humblot 2001
- Bänziger, A, (1999), *Weiterbildung und Lohnunterschiede zwischen Frauen und Männern*, Chur/Zürich: Verlag Rüegger.
- Barron, J.M., M.C. Berger and D.A. Black (1999), “Do Workers Pay for On-The-Job Training”, *Journal of Human Resources* 34, 235-252.
- Becker, G. (1964), *Human Capital*, Chicago: University of Chicago Press
- Booth, A. and M. L. Bryan (2002), “Who pays for General Training? testing some predictions of human capital theory”, mimeo, Australian National University.
- Booth, A. and G. Zoega (2001), “Is Wage Compression a Necessary Condition for Firm-Financed General Training?”, CEPR Discussion Paper 2845.
- Gerfin, M (2003), “Work-related training and wages – An empirical analysis for male workers in Switzerland”, Discussion Paper, Economics Department, University of Bern.
- Gerfin, M, R. E. Leu and R. Nyffeler (2003), “Determinanten und Wirkung beruflicher Weiterbildung in der Schweiz”, Discussion Paper, Economics Department, University of Bern.
- Goux, D. and E. Maurin (2000), “Returns to Firm-Provided Training: Evidence from French Worker-Firm Matched Data”, *Labour Economics* 7, 1-19.
- Groot, W (1995), “The Wage Effects of Investments in Enterprise-Related Training”, *Empirical Economics* 20, 133-147.
- Loewenstein, M.A. and J.R. Spletzer (1998), Dividing the Costs and Returns to General Training”, *Journal of Labor Economics* 16, 142-171.
- Pischke, J.S. (2001), “Continuous Training in Germany”, *Journal of Population Economics* 14, 523-548.
- Stevens, M. (1994), „A theoretical model of on-the -job training with imperfect competition“, *Oxford Economic Papers*, 46, 537-562.

## Tables

*Table 1: International Comparisons*

Country	Proportion of workers receiving training (in %)	of these financed by firm (completely or partially) (in %)	Proportion of general training (subjective view of workers)
USA (1993)	18	60-80	70-85
UK (1998)	31	62	85
Germany I(1986-88)	28	62	-
Germany II(1990-92)	24	66	70
Switzerland (1999)	32	80	-

*Sources: Loewenstein und Spletzer (1998a,b) for USA; Booth and Bryan (2002) for UK, Pischke (2001) for Germany I, Backes-Gellner und Schmidtke (2000) for Germany II, Gerfin et al (2003) for Switzerland*

*Table 2: Incidence of training (private sector)*

	Total	High educational level	female	Age			Tenure					firm size > 100	supervisory position
				25-35	35-45	45-60	0-2	2-5	5-10	10+			
Firm-sponsored	32	44	28	30	35	32	31	30	29	36	43	41	
self-financed	17	20	24	19	14	13	19	20	18	14	16	18	

Own calculations' SLFS 1999. Sample consists of full-time workers, excluding self-employed

Table 3: Estimation Results, males (all coefficients multiplied by 100), 1998-1999

Variable	Mean	(1)	(2)	(3)
<b>Training, firm sponsored</b>	0.369	<b>1.498</b> (0.511)	-	-
<b>Training, self-financed</b>	0.130	<b>1.959</b> (0.734)	<b>1.997</b> (0.733)	<b>1.986</b> (0.734)
<b>Training stayers</b>		-		
firm-sponsored,	0.345	-	<b>1.298</b> (0.528)	<b>1.299</b> (0.529)
<b>Training movers</b>		-		
firm-sponsored,	0.025	-	<b>4.152</b> (1.844)	
firm-sponsored (quits)	0.017	-		<b>4.764</b> (2.197)
firm-sponsored (lay-offs)	0.008	-		2.779 (3.356)
<b>Match-component</b>				
job change	0.077	<b>3.206</b> (1.162)	2.309 (1.307)	
quit	0.054	-		2.752 (1.465)
lay-off	0.023	-		1.340 (2.083)
Number of obs		3958	3958	3958
Number of persons		1979	1979	1979
R-squared – within		0.08	0.08	0.08
R-squared– between		0.11	0.11	0.11
R-squared – overall		0.11	0.11	0.10

Notes: Own calculations, SLFS 1998/1999. Fixed Effects estimation. Coefficients in **bold** are significant on the 5% level, coefficients in *italic* are significant on the 10% level. Sample is male full-time workers, not self-employed

Additional control variables: cubic in age and tenure, years of education, marital status, number of children, ISCO skill levels, job position, temporary contract, overtime, firm size, nationality, industry dummies, regional dummies.

Table 4: Estimation Results, females (all coefficients multiplied by 100), 1998-1999

Variable	Mean	(1)	(2)	(3)
<b>Training, firm sponsored</b>	0.319	-0.014 (0.914)	-	-
<b>Training, self-financed</b>	0.210	-1.501 (1.040)	-1.497 (1.041)	-
<b>Training stayers</b>				
firm-sponsored,	0.293	-	0.136 (0.946)	-
<b>Training movers</b>				
firm-sponsored,	0.026	-	-1.853 (3.070)	-
firm-sponsored (quits)	0.023	-	-	-
firm-sponsored (lay-offs)	0.003	-	-	-
<b>Match-component</b>				
job change	0.101	<i>3.118 (1.748)</i>	<i>3.576 (1.895)</i>	-
quit	0.079	-	-	-
lay-off	0.022	-	-	-
Number of obs		1504	1504	
Number of persons		752	752	
R-squared – within		0.15	0.15	
R-squared– between		0.03	0.03	
R-squared – overall		0.03	0.03	

Notes: Own calculations, SLFS 1998/1999. Fixed Effects estimation. Coefficients in **bold** are significant on the 5% level, coefficients in *italic* are significant on the 10% level. Sample is male full-time workers, not self-employed

Additional control variables: cubic in age and tenure, years of education, marital status, number of children, ISCO skill levels, job position, temporary contract, overtime, firm size, nationality, industry dummies, regional dummies.