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Part-time work and employer-provided training: boon to women and bane to men?

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Leading House Working Paper No. 58

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March 2011

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Previous studies on employer-provided training have consistently shown a gap in training participation between part-time and full-time workers. This study examines whether the training disadvantage for part-time workers differs by gender. To capture the uncertainty in the firm's training decision and to factor in heterogeneity among part-time workers, our analysis draws not only on human capital but also on statistical discrimination theory. Our empirical results indicate that gender plays a role in determining part-time/full-time training differences. Whereas for women working part-time or full-time makes only a minor difference, for men working part-time constitutes a serious disadvantage in access to employer-provided training. The results remain consistent among different subsamples.

JEL classifications: I21; J16; M53

1. Introduction

A common and persistent finding in the training literature is that participation in training is typically lower for part-time than for full-time workers (e.g. Maximiano and Oosterbeek, 2007; for an overview see Blundell *et al.*, 1996). Studies show that the lower the number of working hours the more the training probability decreases (e.g. Oosterbeek, 1998), a finding consistent with standard human capital theory. As part-time workers spend less time in the labour market, they have less time in which to make the training investment worthwhile. The part-time status thus discourages both firms and part-time workers from investing in training. Yet training-related studies have thus far neglected whether the part-time/full-time training gap differs for women and men. Such a difference is important, given that first, a much higher share of working women than working men is part-time employed (OECD, 2010) and second, both rapid technological change and demographic trends make investments in human capital –

and thus in training – equally essential for both women and men in part-time and full-time employment, as well as for firms (e.g. Blundell *et al.*, 1999).

Most studies focus on average part-time vs. full-time effects and find part-time employment to be generally negatively related with labour market outcomes.[1] However, recent literature already points to significant differences between female and male part-time workers in terms of earnings. Mumford and Smith (2009) find the part-time/full-time earnings gap to be substantially negative for male workers but essentially zero for female workers. Hirsch (2005) shows similar results, identifying a substantial part-time wage penalty for male workers but only a minor one for female workers. We therefore assume that part-time workers are not a homogeneous group and argue that female and male workers should be considered separately in analyses of differences in part-time and full-time labour market outcomes (including training participation).

This paper analyses whether the part-time/full-time training gap is different for female and male workers. We focus on employer-provided training, as firms – funding most of the work-related training (Leuven and Oosterbeek, 1999) – are important players in determining workers' probability of participating in training. Thus far none of the studies on training have shown whether women who work part-time suffer from a cumulative disadvantage in lower training probabilities that might stem from the generally found negative part-time effect and/or the negative female effect (Bassanini *et al.*, 2007). Hence, training-related studies have thus far analysed the two key characteristics – being female and working part-time – separately. Therefore, the first contribution of our study is to identify a joint effect of being female and working part-time on the probability of receiving employer-provided training.

To analyse the part-time/full-time training difference separately for female and male workers, we draw on human capital and statistical discrimination theory. This theoretical setting is innovative allows us to factor in firms' taking training decisions under uncertainty and to account for the heterogeneity of part-time workers. Women and men in part-time and full-time employment might differ in their future firm attachment, which is the expected period of return of a training investment and thus a highly training-related but unobservable characteristic. Drawing on standard human capital theory (Becker, 1964), we expect higher future firm attachment to be positively correlated with an increasing training probability. As, however, workers' future firm attachment is an unobservable characteristic, and as human

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[1] Some training-related studies (e.g. Arulampalam and Booth, 1998) conduct separate analyses by gender and find that the part-time effect differs in size. However, they neither provide a theoretical framework nor test whether the training disadvantage in part-time employment differs for women and men.

capital theory does not provide a framework for analysing training decisions in environments with asymmetric information, we additionally draw on statistical discrimination theory (Phelps, 1972; Aigner and Cain, 1977). We thus expect firms to use workers' observable individual characteristics as indicators (e.g. Altonji and Blank, 1999) to obtain an accurate appraisal of workers' future firm attachments. We argue that part-time/full-time employment is a potential indicator for future firm attachment and assume that the information it reveals differs by gender. While for male workers part-time employment is a predictive indicator for future firm attachment, for female workers future firm attachment does not systematically vary by current labour market status, i.e. by working part-time or full-time. Therefore, the second contribution of this study is to provide a theoretical framework for analysing training decisions in a situation of asymmetric information about workers' future firm attachment.

To test our theoretical predictions we need a data set that provides information on the workers' number of contracted working hours, and that allows us at the same time to identify whether the training of the worker is employer-provided. We use the Swiss Labour Force Survey (SLFS), a representative survey conducted by the Swiss federal statistical office, which is a perfect match for testing our hypotheses.

Our findings emphasize the importance of looking at female and male workers separately when examining the part-time/full-time training difference. We show that being female and working part-time have a significant positive joint effect on the probability of receiving employer-provided training. The part-time effect thus differs by gender: whereas for women working part-time or full-time makes only a minor difference, for men working part-time constitutes a serious disadvantage in access to employer-provided training.

The paper is structured as follows. Section 2 provides the theoretical model. Section 3 describes our data set, gives some descriptive statistics, and presents the estimation model. Section 4 provides estimation results, lists predicted probabilities for employer-provided training and contains robustness analysis. Section 5 concludes.

2. A model of the firm's decision to provide training under uncertainty

As in the standard economic model, we analyse the firm's decision to provide training opportunities as an investment decision. Human capital theory, as pioneered by Becker (1964), states that firms will invest in workers' human capital only if the expected rate of return exceeds the costs of investment. Human capital theory clearly predicts that the return

period is the crucial factor that differentiates female and male part-timers and full-timers.[2] The particularity of our model analysing the firm's training decision is the focus on worker's firm attachment, which is the main determinant of the return period. We define firm attachment as depending on two factors: first, the length of time a worker will stay with the current firm (expected tenure minus actual tenure) and second, the worker's future contracted number of working hours (expected labour market status). Therefore, future firm attachment is a highly training-related but unobservable characteristic. Our model goes beyond the usual models, which have thus far only considered the part-timers' lower working hours. These lower working hours would directly result in a lower return period for part-time workers.

The higher the expected future firm attachment, the longer the period over which firms receive returns on training investments and thus the more likely firms invest in training (e.g. Frazis *et al.*, 2000). Given part-timers' lower contracted working hours and therefore lower firm-attachment, firms have less time to reap the returns of training investments. Both direct fixed costs and the time that workers spend away from productive work while attending training are proportionally higher for part-time than for full-time workers (Oi, 1962). Human capital theory thus predicts that firms, for reasons of economic efficiency, will invest less in part-time workers.

The underlying assumption of human capital theory is that firms, when deciding on training investments, are fully informed about workers' future firm attachment. However, this assumption on full information is critical for two reasons: first, firms may have limited information as to a worker's intention to remain with the firm (i.e. unknown expected tenure). Second, a worker's being a part-timer today does not predict that he or she will be a part-timer tomorrow and vice versa (i.e. unknown expected labour market status). We argue, given the situation of asymmetric information (i.e. firms' uncertainty about workers' future firm attachment) that firms take investment decisions under uncertainty. Thus for studying training decisions under uncertainty, human capital theory alone is clearly insufficient.

To analyse firms' training decisions in a situation of uncertainty about workers' future firm attachment we suggest adding theoretical considerations from statistical discrimination theory (Phelps, 1972; Aigner and Cain, 1977), which provides a framework for investigating investment decisions under uncertainty. Statistical discrimination theory has been used for analysing hiring decisions when firms have limited information about job applicants. The theory's main idea is that firms use observable characteristics of applicants as indicators for

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[2] We assume that neither benefits nor discount rates are group-specific (all else being equal), i.e. that they systematically differ between female and male workers, between part-time and full-time workers, or both.

workers' unobservable characteristics, e.g. future productivity. Uncertainty about workers' future productivity can work against groups with less reliable indicators. We extend the approach by adapting this model to firms' training decisions in which the important role of unobservable characteristics is similar to that in hiring decisions. While in the original model workers' productivity is the unobservable characteristic (relevant for hiring decisions), in our adaption workers' future firm attachment is the unobservable characteristic (relevant for training decisions).

2.1. The basic model of statistical discrimination theory and employer provided training

To take efficient training decisions, firms want to predict workers' future firm attachment as precisely as possible. In line with statistical discrimination theory, our model assumes that firms base their training decisions on workers' observable indicators for future firm attachment (e.g. part-time or full-time employment) and on previous statistical experience related to workers' group identity (e.g. gender). When firms take training decisions, they rely on the one hand on individual indicators (i) to make assumptions about a worker's future firm attachment (f). The relation between i and f is:[3]

$$i = f + u \tag{1}$$

where u is a normally distributed error term, with zero mean and constant variance; f is also assumed to be normally distributed with a mean equal to α. On the other hand, firms rely on previous statistical experience when predicting a group mean of future firm attachment (α). Therefore, the expected value of future firm attachment ($\hat{f}$), given the indicator variable and the group mean, is:

$$\hat{f_i} = \mathrm{E}\big(f_i \big| i_i\big) = \big[(1 - \gamma_i) \cdot \alpha + \gamma_i \cdot i_i\big] . \tag{2}$$

The factor γ_i is the weight of the individual effect (i_i). It also determines the weight of the group effect, which is $(1 - \gamma_i) \alpha$. The less reliable the individual indicator, the more the weight of the group effect increases. Thus when information on workers' characteristics is limited, firms cannot accurately predict future firm attachment for individual workers. Firms then turn to group identification as an indicator for future firm attachment.

Suppose that gender is observed along with potential indicators for firm attachment. Assuming that the reliability of the indicators (and thus the available information) differs for

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[3] To derive our theoretical model we closely follow Aigner and Cain (1977), where firms base their hiring decision on some indicators of productivity.

female (w) and male (m) workers, firms use different weights and different gender-specific measurement equations to predict workers' future firm attachment:

$$\hat{f}_w = \left[(1 - \gamma_w) \cdot \alpha_w + \gamma_w \cdot i_w\right] \tag{3}$$

$$\hat{f}_m = \left[(1 - \gamma_m) \cdot \alpha_m + \gamma_m \cdot i_m\right]_. \tag{4}$$

Following Aigner and Cain (1977), we suggest that firms, when deciding about training provision, look for indicators to accurately predict future firm attachment. Labour market status is an indicator available on the labour market and thus simply at firms' disposal. We thus particularly focus on labour market status,[4] i.e. part-time or full-time employment, as one potential observable indicator for future firm attachment.

2.2. Labour market status as a potential indicator for future firm attachment

We suggest that working part-time is an indicator that differs in the reliability for female and male workers to accurately predict future firm attachment.[5] The following two sections will show that while for male workers part-time employment serves as a reliable (negative) indicator for future firm attachment, for female workers the indicator is less reliable, adding no meaningful information in a situation with informational asymmetries as described above.

The high heterogeneity among the female workforce plays an important role when predicting women's firm attachment (Light and Ureta, 1992). This heterogeneity – ranging from women working full-time for their entire work lives over those working part-time for a period of time to women working full-time until they give birth to their first child and leave the labour market altogether[6] – may stem from women's still carrying the main responsibility for family work, from their being (traditionally) considered as secondary wage earners, or both. Women's labour market attachment is thus highly discontinuous. Therefore, we argue that for women future firm attachment does not differ systematically between female part-timers and full-timers. Predicting future firm attachment by labour market status results in a large measurement error for female workers for two reasons: first, the relationship between future and current labour market status does not vary systematically by current labour market status. Second, labour market status does not reliably predict how long a woman will remain with a

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[4] While firms might use additional indicators, e.g. level of education or being married, this paper solely focuses on the part-time indicator as the important predictor of future firm attachment and control for others.
[5] Our descriptive statistics show that while for male workers tenure varies systematically by labour market status, we do not observe a different pattern for female workers (cf. Table 1). We interpret this as first evidence that the reliability of the indicator is gender dependent.
[6] Whereas in some countries (e.g. Canada and Denmark) most couple families with children are dual-full-time-earner families, in other countries (e.g. UK and Switzerland) fathers in most of the families with children are full-timers, while many mothers are part-timers (OECD, 2007).

firm. Given the low reliability of part-time employment as an individual indicator for women's future firm attachment, our model predicts that firms give increasing weight to the group mean – and thus to women's average future firm attachment – to properly appraise their future firm attachment. Consequently, we derive our first hypothesis: firms provide similar training opportunities to women in part-time and full-time employment (all else being equal).

By contrast, we argue that for men current labour market status reveals additional information on male workers' future firm attachment. First, we expect that firms anticipate male full-timers to remain more likely employed full-time than male part-timers to become employed full-time, resulting in a higher future firm attachment for full-time workers. As long as firms continue to perceive men in full-time employment as following traditional standards of behaviour (e.g. being the main earner, achieving professional success, and pursuing a career path) and consider long working hours and high flexibility as a prerequisite for men's professional success, a finding of sociological analysis (Webber and Williams, 2008), this expectation holds. Second, we assume a systematic relationship between labour market status and the expected time male workers will stay with the current firm. Men are more likely to be employed part-time when they are less attached to the labour market (e.g. Elias, 1994). Part-time male workers are more likely to bear a double burden in the form of a higher responsibility outside the employment relationship, limiting their mobility and thus making their labour supply less elastic than that of their full-time counterparts. Because male part-timers have higher priorities outside the employment relationship than their full-time counterparts, we suggest that part-time employment indicates that a male part-timer remains less long with the current firm than a male full-timer. Descriptive statistics (see section 3.2) underline our assumption and show that male part-timers have on average a significantly lower tenure than male full-timers. Given that our assumptions hold, part-time employment is a highly reliable individual indicator for men's future firm attachment. We derive our second hypothesis: firms provide male full-timers more training because male full-timers have a higher future firm attachment than male part-timers.

These arguments show that firms weight the part-time indicator more heavily for male than for female workers in predicting their future firm attachment. Factor γ is thus higher in eq. (3) predicting the future firm attachment for male than in eq. (4) for female workers:

$$\gamma_w < \gamma_m \tag{5}$$

Whereas the part-time effect has only a minor weight in determining women's future firm attachment, the effect is negatively associated for male workers. We predict a positive

interaction term between female largely and part-time employment, i.e. reducing the negative part-time effect on employer-provided training for female workers. The interaction term indicates that part-time employment is not as disadvantageous for female workers as for male workers in firms' training decisions.

However, differences not only in the reliability of the individual indicator (part-time/full-time) but also in group means can lead to differences in the probability of receiving employer-provided training. Because of the lower reliability of women's indicators, firms increase the weight towards women's group effect – women's average future firm attachment. Because of women's high discontinuity in their labour market attachment (as argued previously), we expect a lower average firm attachment for women than men (in line with the empirical evidence, e.g. Royalty, 1996; Sicherman, 1996; Light and Ureta, 1992). If previous statistical experience shows a lower average future firm attachment for women, then firms perceive women's average future firm attachment to be lower than men's average future firm attachment:[7]

$$\left[\alpha_w < \alpha_m \right] \tag{6}$$

A lower α for female workers leads firms to offer women less training opportunities when women's indicators are not reliable enough. To summarize, for female workers we expect a lower training probability than for male workers, a probability that nonetheless does not vary by labour market status (part-time vs. full-time employment), as human capital theory would suggest.

3. Data, descriptive statistics, and method

Analysing the training probabilities of women and men in part-time and full-time employment requires data containing rich information on specific training facets, including information on whether work-related training is employer-provided. Moreover, the analysis requires information on the number of contracted working hours. Ideally, workers should report a number of firm and job characteristics, together with details on a variety of features describing their personal situation and household structure. We use the Swiss Labour Force Survey (SLFS), a nationally representative data set of private households in Switzerland.

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[7] This assumption corresponds to Phelps' (1972) argument of different productivities between groups. Aigner and Cain (1977) question this assumption. In our study, we neither assume nor claim productivities to be different, but we argue based on empirical evidence that women's and men's average future firm attachment differ.

The SLFS provides information on the structure of the labour force and employment behaviour patterns. The data allow us to predict training probabilities, controlling for the usual variables in studies on training participation (e.g. Bassanini *et al.*, 2007). As the SLFS adheres to international definitions, it makes Swiss data comparable with OECD and EU data. The survey collects detailed information on training every three to four years, with the survey on training enhanced since 2006.[8] To investigate our hypotheses, we use data from the 2009 wave and test our results for consistency with data from the 2006 wave, see Appendix Table A1 and A2.

We focus our estimation on individuals aged 25 to 64,[9] in full-time and part-time employment, who reported valid information on all variables of interest. We restrict our sample to workers who work one day or more per week, as we assume that those working less are a very specific, unrepresentative group of workers not receiving much training, if any. We further exclude self-employed individuals and workers in public administration and education, as their access to training is differently organized. The sample selection results in a data set with 17,120 observations.

3.1 Measurement of employer-provided training and explanatory variables

The survey defines 'training', our dependent variable of interest, as an educational programme or learning activity that does not end in an educational degree and is thus not part of the institutionalised educational system.[10] Respondents report whether they participated in training in the previous 12 months. Affirmative answers are followed by the question of whether they participated for private or work-related reasons. Further, we have information on whether training is employer-provided, defined as including training that employers (partly) finance, that (partly) occurs during working hours, or both.

Moreover, the data set allows us to distinguish two types of training: formal and informal training. Formal training includes courses, seminars, congresses, lectures, conferences, and private lessons. Informal training comprises all learning activities outside the teacher-student relationship. For our purpose – to analyse training crucial for workers' labour market success – we analyse formal training. Specifically, we focus on participation in employer-provided, work-related formal training, thus defining our dependent variable as follows: training takes

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[8] According to the Swiss Federal Office data on training in waves 2006 and 2009 are thus not comparable to the surveys from the other years (BFS, Swiss Labour Force Survey (SLFS), 2009).
[9] As a considerable share of workers are still enrolled in (higher) education at the beginning of their twenties, we include only workers older than 25. Because early retirement is not common in Switzerland, we do not restrict the sample in older cohorts.
[10] Therefore, training does not include formal education such as apprenticeship training or university degrees. Training for personal interests and hobbies are also excluded.

the value 1 if a worker received any employer-provided work-related formal training in the previous year and 0 otherwise.

Being female and part-time employed are our two main explanatory variables. For part-time status we rely on the SLFS definition, the common definition of part-time employment in Switzerland: less than 37 contracted hours (corresponding to a four-and-a-half-day working week or less). Obviously, this definition differs from the more common definition of 30 working hours or less (e.g. Mumford and Smith, 2009). Nevertheless, our results remain robust for either definition. To test for the sensitivity of the choice of cut-off points, we run regressions using the official 30-hours-per-week definition. The significance of the results remains, suggesting that the results are not sensitive to the 37-hour cut-off.[11]

3.2 Descriptive statistics

Our sample includes 12,537 full-time and 4,583 part-time workers, i.e. every fourth employee in our sample works part-time. Whereas in our sample more than 50% of the female labour force works part-time, only 6% of male workers are part-time employed. In contrast, among OECD countries, on average 25% of the female and 10% of the male labour force is part-time employed. However, countries such as Australia, Germany, and the United Kingdom have substantially higher part-time shares – shares comparable to that of Switzerland and also mostly dominated by female workers (OECD, 2010).

Table 1 presents means and differences in means for formal training and selected individual characteristics broken down by gender and part-time/full-time status. Column 1 in Table 1 indicates that men in full-time employment participate the most in formal work-related training (42%), followed by women in full-time employment (39%). Female and male part-timers have equally low training participation rates of 33%, but with a considerable part-time/full-time training difference for men (10%) and women (7%). Both differences in means are highly statistically significant.

We further analyse by gender whether part-timers and full-timers differ in other characteristics that determine training participation rates. Our data suggests that women are more likely to work part-time when married or raising children,[12] while the opposite holds for men (table 1, row 2 and 3). Table 1 also shows for female and male part-time workers, that the older (aged 55 to 64) are under-represented. Moreover, the share of highly educated male

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[11] Results are available from the authors upon request.
[12] The main reasons for young women in OECD countries to work part-time are caring responsibilities (OECD 2007), e.g. UK women are much more likely than men to work part-time after they have children (Paull, 2006).

part-timers does not differ from that of highly educated male full-timers, whereas female part-timers are significantly less educated than female full-timers (table1, row 7).

Table 1 Descriptive statistics for women and men in part-time and full-time employment

| | Male workers | | | | | Female workers | | | | |
| | full-time N = 8,819 | | part-time N = 603 | | Equality of means | full-time N = 3,718 | | part-time N = 3'980 | | Equality means |
	Mean	Std. Dev.	Mean	Std. Dev.	t-test	Mean	Std. Dev.	Mean	Std. Dev.	t-test
(1) training	**0.42**	**0.49**	**0.33**	**0.47**	**4.87*****	**0.39**	**0.49**	**0.33**	**0.47**	**6.28*****
(2) married	0.67	0.47	0.55	0.50	5.85***	0.39	0.49	0.67	0.47	-25.56***
(3) children	0.51	0.50	0.38	0.49	6.02***	0.31	0.46	0.63	0.48	-29.63***
(4) age 25-39	0.40	0.49	0.33	0.47	3.67***	0.47	0.50	0.36	0.48	10.22***
(5) age 40-54	0.45	0.50	0.43	0.50	0.64	0.40	0.49	0.48	0.50	-6.57***
(6) age 55-64	0.15	0.35	0.23	0.42	-4.89***	0.13	0.33	0.17	0.37	-4.96***
(7) highly educated	0.40	0.49	0.42	0.49	-1.04	0.35	0.48	0.27	0.44	7.93***
(8) tenure	9.87	9.56	8.52	9.62	3.35***	8.33	8.60	8.21	7.82	0.65

Data Source: SLFS 2009 (restricted sample). Own calculations. *Note:* Statistically significant differences in means are marked with * whereas 1% significance level: ***, 5% significance level: **, 10% significance level: *

In the theory section, we suggest that the part-time indicator is reliable for men but not for women in predicting individual future firm attachment. One reason is that for men, working part-time or full-time correlates with the length of the return period (i.e. tenure), whereas for women there is no systematic relationship. Descriptive statistics confirm this suggestion: female workers do not differ in their average tenure whether working part-time or full-time (table1, row 8). Men, in contrast, have been staying on average of 1.4 years longer with a firm when working full-time. Working part-time thus correlates with a lower average future firm attachment – derived from a lower average tenure – only for men but not for women. Booth and Wood (2008) find similar results for Australia. While our raw figures clearly show a different relationship of part-time employment and future firm attachment (table1, row 8), we expect a different relationship of part-time employment and training participation for women and men. Therefore, we now turn to a multivariate analysis to control for an interaction term of working part-time and being female.

3.3 Estimation model

We estimate a probit model to identify the joint effect of being female and part-time employed on the probability of participating in employer-provided training. Workers receive training if firms expect training benefits (B) to be higher than training costs (C), i.e. if net benefits (NB) are positive:

$$NB > 0 \text{ (or } B > C). \tag{7}$$

Net benefits are unobservable. However, we can observe whether workers participate in employer-provided training or not. The underlying latent variable model of training is as follows:

$$NB_i^* = X'_i \beta + u_i, y = I\left[NB^* > 0\right] \tag{8}$$

where NB* refers to the net benefits that are unobserved for the researcher. X'_i is a vector of variables potentially determining net benefits of training. The indicator function (I) takes the value 1 if NB*>0. Thus:

y = 1 if NB*>0

y = 0 if NB* ≤ 0 (9)

If net benefits are positive, workers receive employer-provided training, whereas if net benefits are negative (or zero), they do not. As our dependent variable (y) is a binary variable and we assume *u* to have a standard normal distribution, we use a probit model to estimate training probabilities. The equations that are estimated are versions of:

$$P(y_i = 1) = \Phi(\beta_1 x_1 + \beta_2 x_2 + \beta_P(x_1 * x_2) + \sum_{i=3,...,k}^{k} \beta_i Z_i) \tag{10}$$

with Φ being a standard normal density function. $P(y_i = 1)$ measures the individuals' (i) probability of participating in employer-provided training. Workers either participate in employer-provided work-related training (y_i=1) or not (y_i=0). The independent variables on which we focus are binary and indicate part-time employment (x_1) and being female (x_2). We include an interaction term ($x_1 * x_2$) to investigate whether working part-time interacts with being female in influencing the probability of receiving work-related training. Z stands for the constant term and a set of control variables.

To investigate the sensitivity of our results, we gradually include four groups of control variables. These groups and the corresponding variables are similar to those used in classic studies of training, e.g. by Bassanini *et al.,* (2007, chap. 10.5) or Oosterbeek (1998). The first group relates to personal characteristics (marital status, children dummy, regional dummies, urban dummy, and age dummies); the second describes human capital variables (educational dummies, tenure, and tenure squared), and the third relates to firm attributes (flexible working time, fixed-term work contract, firm size dummies, and industry dummies). The fourth group covers job attributes (occupational dummies and different leadership positions). Calculations in the following section will evaluate the sensitivity of our results.

4. Empirical results

4.1 The impact of the interaction term between working part-time and being female on training

Table 2 presents the estimation results for the probit model given by eq. (10). We estimate five different model specifications. For specification 1 we include our main independent variables (working part-time, being female, and the interaction term); for specification 2 to specification 5 we gradually include control variables according to the 4 groups (personal characteristics, human capital variables, firm attributes and job attributes) as described in section 3.3. Overall, we find that working part-time and being female have a negative effect on the training probability, whereas the interaction term has a positive effect.

Table 2 Employer-provided training equations (Probit)

Training	Specification 1 Coef. [Std. Err.]	Specification 2 Coef. [Std. Err.]	Specification 3 Coef. [Std. Err.]	Specification 4 Coef. [Std. Err.]	Specification 5 Coef. [Std. Err.]
part-time	-0.256*** [0.0546]	-0.282*** [0.0552]	-0.302*** [0.0573]	-0.363*** [0.0592]	-0.266*** [0.0605]
female	-0.0740*** [0.0248]	-0.113*** [0.0257]	-0.0212 [0.0270]	-0.142*** [0.0287]	-0.112*** [0.0299]
part-time * female	0.0717 [0.0620]	0.158** [0.0634]	0.156** [0.0659]	0.193*** [0.0676]	0.161** [0.0687]
personal characteristics		yes	yes	yes	yes
human capital			yes	yes	yes
firm attributes & industry dummies				yes	yes
occupation & leadership					yes
LR chi^2	121.74***	358.00***	2302.01***	3432.15***	4054.74***
Observations	17,120	17,120	17,120	17,120	17,120

Data Source: SLFS 2009 (restricted sample). Own calculations.
Notes: (i) The dependent variable is employer-provided work-related formal training; (ii) 1% significance level: ***, 5% significance level: **, 1% significance level: *

The coefficient of greatest interest – the interaction term of working part-time and being female – positively determines the probability of participating in formal training (table 2). The interaction term is statistically significant for all specifications except the first, i.e. when we control only for the raw training difference without considering any explanatory variables other than labour market status and gender. We thus find the part-time/full-time training difference to significantly vary by gender. While male workers face a considerably lower

training probability associated with part-time employment, for female workers the impact of part-time employment is minor. These results are in line with the theoretical predictions we derived from statistical discrimination theory, i.e. that firms weight the part-time indicator differently for male and female workers. While for male workers part-time employment is a reliable indicator for (lower) future firm attachment, for female workers the indicator is not as predictive. Our results show only a minor part-time/full-time training difference for women, because – according to statistical discrimination theory – a woman's current labour market status is not systematically related to her future labour market status or her expected firm tenure.

The second row of Table 2 shows that being female significantly negatively determines the probability of participating in work-related training. However, with the introduction of human capital attributes (tenure and dummies for different educational levels) in specification 3, the significant female effect disappears. We explain this result with the (on average) lower educational level of the female labour force and the considerably high impact of education on training participation.[13] Nevertheless, with the inclusion of firm attributes and industry dummies in specification 4 and the occupational and leadership dummies in specification 5, the female coefficient is again highly statistically significant. The female workforce thus appears disadvantaged in access to employer-provided formal training even if it has a comparable level of human capital and works in similar firms, industries, and occupations. This finding is also in line with studies from other countries, finding negative effects for women on the probability of receiving employer-provided training (e.g. Lynch, 1992 for U.S. workers; Bassanini *et al.*, 2007 for young female workers across European countries).

The negative effect for female workers supports the theoretical prediction we draw from statistical discrimination theory: as the female workforce is highly heterogeneous, firms gain no additional information on women's future firm attachment from the part-time indicator. Therefore, firms more likely rely on previous statistical experience regarding women's future firm attachment, which is on average lower than men's. When (economically efficient) firms base their investment decisions on average future firm attachment and thus on reasonable, gender-specific stereotypes, women collectively receive less employer-provided training than men. As long as individual women conform to this stereotype (i.e. having a lower average future firm attachment), they are not disadvantaged in access to training relative to men. By

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[13] Whereas the gender education gap is diminishing in OECD countries, Switzerland still has a large gap for tertiary education in favour of men (OECD, 2002). Among the OECD countries Switzerland has an average rate of training participation that nonetheless largely favours workers with tertiary education.

contrast, women who do not conform to this stereotype (i.e. women who intend to pursue a career, women who participate in the paid labour force for their entire working lives, or both), are individually discriminated against, because they receive less employer-provided training than similarly situated men.[14] Given that women's indicators for future firm attachment are less reliable, this uncertainty thus works against women.

The significance and signs of the coefficients of the control variables support the theoretical predictions and confirm the findings of previous studies (for an overview see Blundell *et al.*, 1996). Moreover, the different model specifications support the robustness of our results. The estimates also appear stable and consistent across SLFS wave 2006, suggesting that the interaction term plays a significant role in determining access to employer-provided training. We report the estimation results for wave 2006 in Appendix Table A1 and A2.

To determine the magnitude of the effects, we calculate predicted probabilities of training participation for female and male part-timers and full-timers. We base the calculation of the average predicted probabilities on specification 5 in Table 2. The average predicted probabilities depend on the actual values of the covariates for which we control.

Table 3 Average predicted probabilities of employer-provided training

	Male workers			Female workers			Difference
	full-time (1)	part-time (2)	Difference (1) - (2)	full-time (3)	part-time (4)	Difference (3) - (4)	((1) - (2)) - ((3) - (4))
Training	42%	33%	8%***	38%	35%	3%***	5%***

Note: Average predicted probabilities are calculated based on specification 5 in table 2.
Data Source: SLFS 2009 (restricted sample). Own calculations.

Table 3 summarizes the predicted probabilities for employer-provided training. Men in full-time employment participate in training with a probability of 42%, whereas this probability significantly and sharply decreases (by 8%) for men in part-time employment. In contrast, women in full-time employment participate with a probability of 38% in training, a probability considerably lower than that for their male counterparts. However, women's part-time/full-time training difference in the average predicted probabilities of 3% is low compared to the 8% difference for men. We thus find that men have a considerably higher reduction in training probabilities when working part-time than comparably situated women. All these differences are highly statistically significant.

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[14] Our results refer to individual discrimination whereas in Aigner and Cain's (1977) model the result clearly points to group discrimination (i.e. unequal pay to groups for equal productivity).

To summarize, our results show that the interaction term (being female and working part-time) has a significant positive effect on the probability of receiving employer-provided training. The positive interaction term between part-time employment and being female indicates that the training disadvantage for female part-timers is not as large as for male part-timers. Mumford and Smith (2009) and Hirsch (2005) find similar results for wag gaps: whereas the residual part-time earnings gap is negative for males, it is basically zero for females.

4.2 Further discussion and robustness checks

To assess the robustness of our results, in this section we run estimations for different groups of individuals that might differ in their labour market attachment and thus in their training probabilities. Table 4 shows the effects of working part-time, being female and the interaction effect (part-time * female) on the probability of participating in employer-provided training. Table 5 presents predicted training probabilities. For the different sub-samples we observe – where expected – an overall similar pattern of coefficients to the main results in Table 2.

First, we examine whether the results differ between part-timers working 20-49% and part-timers working 50-90% of full-time working hours. According to the human capital theory, we expect part-timers working 20-49% to have systematically lower training probabilities than part-timers working 50-90% (all else being equal). Table 5 (column 1 and 2) shows, compared to their full-time counterparts, that those female and male part-timers working 20-49% have a much higher reduction in the training probability than those working 50-90%. Moreover, we find that the results for the interaction term remain consistent for both group s of part-time workers (table 4, estimations 1 and 2). This result shows that firms take the current labour market status in account when investing in workers' human capital.

Second, we expect systematic differences between workers under the age of 40 and those above. As for the prime childbearing age group, women's labour market status shows a high discontinuity between full-time, part-time and non-employment, we expect the gender difference in the part-time/full-time training gap to be more pronounced for workers without children in this age group. Therefore, we run estimations distinguishing between the group of young child-rearing workers (aged 25 to 40) and the group of young workers without children.[15] We argue that rearing a child is a valid indicator for a higher firm attachment for both women and men in part-time and full-time employment. However, unobservable heterogeneity becomes considerably important among young female workers without

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[15] We focus on children at pre-school age.

Table 4 Employer-provided training equations (Probit) for different sub-samples

Training	(1)	(2)	(3)	(4)	(5)	(6)
Sub-Samples	**part-time 20%-49%**	**part-time 50%-90%**	**aged 25-40 no children**	**aged 25-40 children**	**aged 41-65 non-married**	**aged 41-65 married**
	Coef. [Std. Err.]	Coef. [Std. Err.]	Coef. [Std. Err.]	Coef. [Std. Err.]		Coef. [Std. Err.]
part-time	-0.403***	-0.222***	-0.309***	-0.107	-0.266**	-0.255***
	[0.110]	[0.0641]	[0.120]	[0.184]	[0.125]	[0.0987]
female	-0.102***	-0.106***	-0.0892*	-0.331***	-0.00611	-0.189***
	[0.0309]	[0.0300]	[0.0478]	[0.0975]	[0.0624]	[0.0637]
part-time * female	0.230**	0.175**	0.191	-0.15	0.224	0.314***
	[0.117]	[0.0730]	[0.137]	[0.208]	[0.139]	[0.118]
LR chi^2	3577.24***	3741.11***	1128.28***	717.41***	836.17***	1590.19***
Observations	14'588	15'843	4'863	2'669	3'475	6'111

Training	(7)	(8)	(9)	(10)	(11)
Sub-Samples	**ten > = 3 years**	**higher education**	**lower education**	**part-time occupations**	**non-part-time occupations**
	Coef. [Std. Err.]	Coef. [Std. Err.]	Coef. [Std. Err.]	Coef. [Std. Err.]	Coef. [Std. Err.]
part-time	-0.283***	-0.239***	-0.312***	-0.262**	-0.271***
	[0.0748]	[0.0865]	[0.0858]	[0.105]	[0.0744]
female	-0.128***	-0.0436	-0.162***	-0.102**	-0.129***
	[0.0374]	[0.0463]	[0.0398]	[0.0475]	[0.0392]
part-time * female	0.219***	0.0407	0.254***	0.137	0.168*
	[0.0848]	[0.102]	[0.0951]	[0.115]	[0.0874]
LR chi^2	2812.77***	661.09***	2101.92***	1241.9***	2872.93***
Observations	11'662	6'146	10'974	6'029	11'091

Data Source: SLFS 2009 (restricted sample). Own calculations.

Notes: (i) The dependent variable is employer-provided work-related formal training; (ii) Estimations based on specification 5 in Table 2; (iii) 1% significance level: ***, 5% significance level: **, 1% significance level: *.

children. We therefore expect the interaction term to be statistically significant especially for this sub-sample. We find that, for the sub-sample of young workers (aged 25 to 40) without children, the results remain fairly consistent (the interaction term is scarcely insignificant (P=0.191), table 4, estimation 3).

In Table 5, predicted training probabilities for workers without children show that the training disadvantage is much higher for male part-timers (10%) than for female part-timers (4%), as compared to their full-time counterparts. In contrast, for the younger workers with children, female part-timers have a comparably much higher training disadvantage than male part-timers. Having children thus seems to be a highly negatively associated indicator for future firm attachment not only for part-time working women but for women in general.

For the older workers (aged 40 to 65) we again expect systematic differences due to unobservable heterogeneity among married women, who are likely secondary wage earners. As those women are not dependent on their income they are more likely to switch their labour market status (here part-time, full-time, and non-employment). We therefore compare estimation results for the following two sub-samples: Married older workers and non-married older workers. We find that results remain consistent for older, married workers (part-time employment is not a negative indicator for women but for men), whereas for older non-married workers part-time employment is a particular disadvantage for accessing employer-provided training for both women and men (see table 4, estimation 5). Table 5 shows that gender difference in the part-time/full-time training gap is high (10%) for older married workers, suggesting that male part-time workers in this sub-sample suffer a high training disadvantage.

Third, as we confine the focus to women and men with significant labour market attachments, we restrict the sample to those with a minimum of three years with one firm. Within this sub-sample we can exclude training with the sole function of introductory job training. We find that the results remain consistent for this sub-sample of workers with more than three years tenure (see table 4, estimation 7). The part-time/full-time training gap remains significantly different for women and men (7%, see table 5, row 7)

Fourth, as better-educated workers are more likely to receive employer-provided training (e.g. Arulampalam *et al.*, 2004), we further analyse whether the interaction term remains significant for workers with different educational backgrounds. We run separate regressions for highly educated workers (including higher vocational education and university degree) and non-highly educated workers. Whereas our results remain robust for non-highly educated

workers, women and men with a higher education have comparable training probabilities independent of their labour market status. The female effect on the training probability is not statistically significant, nor is the interaction effect (see table 4, estimations 8 and 9). Moreover, Table 5 (row 8) shows that highly educated women and men have the highest training probability in full-time employment – at least compared to the other presented specifications – at 58% and 60%, respectively. Both highly educated female and male part-timers suffer from a substantial drawback, as their training probability decreases by 7% and 9%, respectively, when working part-time. We explain this result by high education, which might work as an indicator for a more persistent future firm attachment than either labour market status or gender does. Firms thus appear to assess highly educated workers differently.

The last robustness check deals with the finding of wage-related studies, that the part-time/full-time pay gap is a result of occupational downgrading (e.g. Connolly and Gregory, 2009). We analyse whether the results for occupations favoured by part-time workers (part-time occupations) differ from the results for occupations less favoured by part-time workers (non-part-time occupations). Table 4 (estimations 10 and 11) shows that the results remain consistent for non-part-time occupations. In contrast, the interaction effect is not statistically significant for part-time occupations. We suggest that female and male part-timers are equally more likely to remain part-time employed in part-time occupations, as working part-time in part-time occupations (where part-timers are less in competition with full-time workers) constitutes less of a disadvantage.

Although the interaction term is not consistently statistically significant across the samples (table 4), Table 5 shows that training differences between male part-timers and full-timers are statistically significant and high in size for nearly all sub-samples (ranging from 7% to 12%). In contrast, the training differences between female part-timers and full-timers are only for some samples statistically significant and rather small (ranging from 3% to 7%). In sum, we find that the part-time/full-time training gap is different for female and male workers ranging from significant 5% to 10%. Independent of the particular group to which an individual belongs, part-time employment is much less attractive for male than for female workers, at least for the probability of participating in employer-provided training.

Table 5 Average predicted probabilities of employer-provided training for different sub-samples

		Male workers			Female workers			
		full-time (1)	part-time (2)	Difference (1) - (2)	full-time (3)	part-time (4)	Difference (3) - (4)	Difference ((1) - (2)) - ((3) - (4))
(1)	part-time 20%-49%	41%	29%	12%***	38%	32%	5%***	7%**
(2)	part-time 50%-90%	42%	35%	7%***	39%	37%	1%	5%**
(3)	aged 25-40 no children	44%	34%	10%***	41%	37%	4%*	6%
(4)	aged 25-40 children	43%	39%	4%	33%	26%	7%**	-3%
(5)	aged 41-65 non-married	40%	32%	8%**	40%	38%	2%	6%
(6)	aged 41-65 married	40%	32%	8%***	34%	36%	-2%	10%***
(7)	ten > = 3 years	42%	33%	9%***	38%	36%	2%	7%***
(8)	highly educated	60%	51%	9%***	58%	51%	7%***	1%
(9)	lower educated	32%	23%	9%***	27%	25%	2%	7%***
(10)	part-time occupations	46%	38%	9%**	43%	39%	4%**	5%
(11)	non-part-time occupations	39%	31%	8%***	35%	32%	3%**	5%**

Note: Average predicted probabilities are calculated based on specification 5 in Table 2.
Data Source: SLFS 2009 (restricted sample). Own calculations.

5. Conclusion

This study investigates whether the part-time/full-time difference in employer-provided training differs by gender. We test hypotheses from human capital and statistical discrimination theory. Using data from the Swiss Labour Force Survey, we estimate a probit model to examine training probabilities.

In line with the results of previous studies (see, e.g. Blundell *et al.*, 1996), we find two negative effects: one for working part-time and one for being female. Previous studies have shown that working part-time significantly reduces the probability of participating in employer-provided training. However, none of these studies show the magnitude of the difference of the part-time effect for women and men.

We show that the part-time/full-time training difference is gender-dependent. We find a significant positive interaction effect of working part-time and being female on the probability of receiving employer-provided training. Our results show that working part-time is not as disadvantageous for women as for men for their access to training. Men in part-time employment receive much less training compared to men in full-time employment. For women, however, working part-time or full-time makes a minor difference in accessing employer-provided training.

These results are consistent with our theoretical predictions from human capital and statistical discrimination theory. As outlined in the theoretical section, we assume that firms use part-time employment as an observable indicator to predict worker's future firm attachment, which is an unobservable characteristic relevant in firms' training decisions. Our results suggest that firms weight the part-time indicator differently by gender. While for men part-time employment is a reliable indicator for a lower future firm attachment, for women the part-time indicator adds no reliable information. For women firms rely on previous statistical experience and thus on women's *average* firm attachment, which is markedly lower than men's. Therefore, women on average have a lower probability of training participation than men.

This finding indicates that economically efficient firms base their training decision for women on the comparably lower average firm attachment, and thus on gender stereotypes. However, inequality arises for individual female workers (Blau and Jusenius, 1976) who do not fit this stereotype. Such women are particularly disadvantaged in access to employer-provided training as the low reliability of women's indicators leads to women's being judged on the

basis of their group characteristics. Given this result, the challenge for policymakers is to find a way of ensuring that firms do not restrict training access for women in general. One potential policy instrument to foster women's equality in the labour market might be to promote women's access to higher education, as we only find minor differences among women and men in the sub-group of highly educated workers.

From a welfare perspective, the finding that the part-time/full-time training difference is large for male workers is problematic because part-time employment places men at a disadvantage relative to their full-time counterparts. Designing a policy for improving the attractiveness of part-time employment might be effective. As training is important for workers' professional advancement, lower training probabilities might make part-time employment unattractive for men. There might even be feedback effects where male part-timers respond by behaving in an unstable manner, as employers expect (Arrow, 1973). Therefore, reducing the part-time/full-time training difference might increase the attractiveness of part-time employment for the male labour force and increase men's possibility of combining working and family life.

Acknowledgements

Funding

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Appendix

Table A1 Employer-provided training equations (Probit)

Training	Specification 1 Coef. [Std. Err.]	Specification 2 Coef. [Std. Err.]	Specification 3 Coef. [Std. Err.]	Specification 4 Coef. [Std. Err.]	Specification 5 Coef. [Std. Err.]
part-time	-0.260*** [0.0569]	-0.284*** [0.0574]	-0.345*** [0.0600]	-0.458*** [0.0624]	-0.364*** [0.0638]
female	-0.101*** [0.0254]	-0.158*** [0.0266]	-0.0613** [0.0281]	-0.194*** [0.0299]	-0.185*** [0.0312]
part-time * female	0.115* [0.0645]	0.223*** [0.0660]	0.265*** [0.0690]	0.335*** [0.0711]	0.291*** [0.0723]
personal characteristics		yes	yes	yes	yes
human capital			yes	yes	yes
firm attributes & industry dummies				yes	yes
occupation & leadership					yes
LR chi^2	106.57***	432.71***	2368.54***	3562.45***	4225.37***
Observations	16,704	16,704	16,704	16,704	16,704

Data Source: **SLFS 2006** (restricted sample). Own calculations.
Notes: (i) The dependent variable is employer-provided work-related formal training;
(ii) 1% significance level: ***, 5% significance level: **, 1% significance level: *

Table A2 Average predicted probabilities of employer-provided training

	Male workers			Female workers			Difference
	full-time (1)	part-time (2)	Difference (1) - (2)	full-time (3)	part-time (4)	Difference (3) - (4)	((1) - (2)) - ((3) - (4))
Training	39%	29%	11%***	34%	32%	2%	9%***

Note: Average predicted probabilities are calculated based on specification 5 in table A2.
Data Source: **SLFS 2006** (restricted sample). Own calculations.