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353/2009

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WIFO Working Papers, No. 353
December 2009

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2009/324/W/0

What Causes Gender Differences in the Participation and Intensity of Lifelong Learning?

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November 24, 2009

Abstract

We use recent advances in the statistical analysis of Oaxaca-Blinder decompositions for non-linear models to analyze the contribution of individual variables to total gender differences in participation and duration of training. Results suggest that effects stemming from the intra-household division of labour contribute significantly to gender differences, but that segregation of the labour market as well as differences in the access to training by tenure, age, occupation, profession and sectors are more important.

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JEL Codes: J16, J24
Keywords: gender differences, training

Acknowledgments: We are grateful to Rene Böheim, Christine Zulehner, Klaus Nowotny, Julia Bock-Schppelwein and the participants of the research seminar at the Economic and Social research Institute, Dublin for helpfull comments. The usual disclaimer applies.

1 Introduction

In the policy debate life long learning is often seen as a possibility to increase individuals' employability and to reduce their risk of job and associated earnings losses. In addition it is considered to have a positive impact on aggregate growth as well as reducing unemployment rates. Increasing the participation in life long learning has thus been a centrepiece of the European Employment Strategy and in May 2003 the Council of Ministers of the European Union committed to attaining a 12.5% participation rate in training of the 25 to 64 year olds by the year 2010.

This high policy interest is also reflected in a growing literature on the determinants of participation in life long learning in Europe (e.g. Brunello, 2001; Basanini and Brunello, 2008). This literature has occasionally also analysed gender differences: Arulampalam et al (2004) find that women are no less or even slightly more likely to enter training than men although their characteristics would imply higher aggregate training participation. They also show that - in contrast to men - women's training probability does not decline with age. Green (1993), Basanini et al (2007) and O'Halloran (2008) report similar results, but also find steeper education-training profiles and a stronger impact of family variables (i.e. marriage and children) on training participation of women. Royalty (1996) finds that a substantial part of gender differences in training can be explained by gender specific mobility patterns and Arulampalam and Booth (1997) suggest that the number of trainings received by women also depends more strongly on family variables.

These findings thus suggest that for gender differences in training a positive "characteristics" effect, which implies that given their characteristics women should have a higher training participation than men, is countered by a negative "parameters" effect, which reduces participation on account of lower "returns" to certain characteristics for women. This has been interpreted as indication of discrimination, and is associated with a different response of women to age, marriage, children, education and job-mobility. None of the papers cited above (and to the best of our knowledge also no other contribution) has, however, attempted to measure the relative contribution of these variables to total gender differences in training. This lack of results, while also a shortcoming from an analytical perspective, is particularly disturbing from the point of view of economic policy, since it leaves even the most well-meaning policy maker without guidance as to which of the possible causes for gender differences in training should be addressed with the highest priority to reduce these gender differences.

To fill this gap in the literature this paper uses recent advances in the statistical analysis of Oaxaca-Blinder decompositions for non-linear models (see: Yun, 2005a,c; Bauer and Sinning, 2008) to determine the relative contribution of individual variables to the differences in characteristics and parameter effects causing gender differences in training. Our particular focus is on the role of intra-household time allocation. We show that a two period household time allocation model predicts, that given gender wage differentials, single men and women have both an equal probability to participate in training and an equal duration of training, but that married women should have a lower participation probability in and a shorter duration of training than married men.

Estimating this model with data taken from the Austrian labour force survey we find that marriage and the presence of children in the household indeed have a different impact on both training participation and duration for men and women. We, however, also find that this difference can explain only about 0.3 percentage points of the total 1.2 percentage point difference in parameters effect for participation in training and about 0.4 hours of the total (3.9 hours) difference in parameters effect in training duration. Other determinants of gender differences such as tenure, education, employment sector and occupation are more important. Differences in parameters between genders with respect to these variables account for 1.2 percentage points of the difference in parameters effect in training participation, and for around 3.5 hours of the difference in parameters effect in training duration.

In the next section we present the theoretical model which guides our empirical analysis while section three describes data. In section four and five, we present the results of our estimations and decompositions, respectively and section 6 summarizes results and presents policy conclusions.

2 The Model

The starting point of our analysis is a standard intra-household decision making model (e.g. Chiappori, 1988, 1997; Apps and Rees, 1997; Albanesi and Olivetti, 2009), which considers a household composed of up to two people (indexed by $i \in \{M, F\}$) who both live for two periods ($t \in \{1, 2\}$). Household members receive utility from consumption (c_t^i) and (non-marketable) home production (h_t^i). Each household member is endowed with one unit of time, which has to be allocated between home production (h_t^i), working (ℓ_t^i) and training (τ_t^i). Per unit of time spent working in the first period a household member receives a wage of w_1^i, which is higher for males than females (i.e. $w_1^M > w_1^F$). In the second period wages depend on the time spent in training in period 1 according to $w_2^i = w_1^i \gamma(\tau_1^i)$, with $\gamma'(\tau_t^i) > 0$, $\gamma''(\tau_t^i) < 0$, $\gamma(0) = 1$, $\gamma'(0) = \alpha$ and $\gamma'(\tau_t^i)$, $\gamma''(\tau_t^i)$ the first and second derivatives of $\gamma(\tau_t^i)$. To save on notation we abstract from discounting and assume that training has no direct financial or utility costs. Furthermore, per unit of time spent in household production one unit of the household good is produced and household production is a public good to household members. Finally, household members have identical individual utility functions U such that:

$$U = \sum_{2}^{t=1} \beta ln(c_t^i) + (1-\beta) ln(h_t^i) \tag{1}$$

2.1 The Single Household

When single, each household maximizes (1) subject to the individual time constraints ($h_t^i + \tau_t^i + \ell_t^i = 1$) and the intertemporal budget constraint ($w_1^i \ell_1^i + w_1^i \gamma(\tau_1^i)\ell_1^i = c_1^i + c_2^i$). Maximizing with respect to consumption (taking time allocation as given) gives $c_1^i = c_2^i = [w_1^i \ell_1^i + w_1^i \gamma(\tau_1^i)\ell_1^i]/2$. Given this, optimising with respect to τ_1^i, ℓ_1^i and ℓ_2^i under the assumption of an interior solution for both ℓ_1^i and ℓ_2^i gives the following first order conditions.[1]

$$2\beta\gamma'(\tau_1^i)/[\ell_1^i + \gamma(\tau_1^i)\ell_2^i] - (1-\beta)/(1-\tau_1^i - \ell_1^i) \leq 0 \tag{2}$$

$$2\beta/[\ell_1^i + \gamma(\tau_1^i)\ell_2^i] - (1-\beta)/(1-\tau_1^i - \ell_1^i) = 0 \tag{3}$$

$$2\beta\gamma(\tau_1^i)/[\ell_1^i + \gamma(\tau_1^i)\ell_2^i] - (1-\beta)/(1-\ell_2^i) = 0 \tag{4}$$

From equations (2) and (3) it follows that optimal training duration is zero if $\gamma'(0)\ell_2^i(0) = \alpha\beta < 1$ and otherwise impliticly given by:

$$\gamma'(\tau_1^i)\ell_2^i - 1 = 0 \tag{5}$$

Also, from equations (3) and (4) it is easy to see that both first and second period working hours (ℓ_2^i and ℓ_2^i) are independent of first period wages.[2] Thus unmarried males and females have equal probabilities of participating in training and equal training durations.

2.2 The Two Person Household

When, the household is a two person (i.e. married) household, members sign a binding contract at the beginning of period 1, which is the result of a Nash bargain (where to save on notation we assume that $\mu = 1/2$ is the bargaining power of males). Households thus seek to maximize utility function $U = \sum_{i=M,F}\sum_2^{t=1}[\beta ln(c_t^i) + (1-\beta)ln(h_t)]/2$ with $h_t = h_t^M + h_t^F$ subject to their intertemporal budget constraint ($\sum_{i=M,F}[w_1^i\ell_1^i + w_1^i\gamma(\tau_1^i)\ell_2^i] =$

$\sum_{i=M,F}[c_1^i + c_2^i]$) and the time constraints. Proceeding as for singles and optimising with respect to consumption implies that $c_1^M = c_2^M = c_1^F = c_2^F = \sum_{i=M,F}[w_1^i \ell_1^i + w_1^i \gamma(\tau_1^i)\ell_2^i]/4$.

Furthermore, if the desired total time spent in household production (h_t) in any period is smaller than one, then the partner with lower wages does all the household production and the partner with higher wages does none, since otherwise labour (or training) could reallocated from the low wage partner to the high wage partner, which would result in higher income (i.e. higher consumption), without reducing home production. If by contrast desired total time spent in household production is larger than unity ($h_t > 1$), by the same logic, the partner receiving higher wages will spend $h_t - 1$ hours in household production and the partner with lower wages will spend $h_t^i = 1$, and will thus not supply any labour.

We are interested in situations where both household members supply labour to the market in both periods. Thus we restrict attention to cases where $h_t < 1$ for $t = 1, 2$, which implies that $h_t^M = 0$ and $h_t = h_t^F$. Inserting consumption in the utility function and taking these constraints into account, the first order conditions to the time allocation problem are:

$$\gamma'(\tau_1^M) - 1 \leq 0 \tag{6}$$

$$2\beta\gamma'(\tau_1^F)/[\ell_1^F + \gamma(\tau_1^F)\ell_2^F] - (1-\beta)/(1-\tau_1^F - \ell_1^F) \leq 0 \tag{7}$$

$$2\beta/[\ell_1^F + \gamma(\tau_1^F)\ell_2^F] - 2(1-\beta)/(1-\tau_1^F - \ell_1^F) = 0 \tag{8}$$

$$2\beta\gamma(\tau_1^F)/[\ell_1^F + \gamma(\tau_1^F)\ell_2^F] - 2(1-\beta)/(1-\ell_2^F) = 0 \tag{9}$$

Married men will thus not participate in training if $\gamma'(0) = \alpha < 1$ and married women will not participate if $\gamma'(0)\ell_2^F(0) < 1$ and, conditional upon participation, training duration for men is implicitly given by $\gamma'(\tau_1^M) = 1$ and female training duration by $\gamma'(\tau_1^F)\ell_2^F(0) < 1$. Since $\ell_2^F = 1 - h_2^F < \ell_2^M = 1$, by equations (6) and (7) women have both a lower probability to participate in training and shorter duration of training than their male partners. In sum this model thus predicts an equal training participation and duration of unmarried men and women, but gender differences for married men and women.

3 Data

Given these predictions we estimate participation and duration equations for male and female workers, taking into account that both males and females are selected into training by applying the standard Heckman two step procedure. The data we use for this purpose stem from the Austrian Labour Force Survey from 2004 to 2007. In this representative survey each quarter around 20,000 Austrian households are asked whether they participated in job related training in the last 4 weeks and how much time they spent in training. In addition a large a number of household, personal and work related characteristics (see below) are collected. We focus on employed persons 25 or older and younger than 65 (i.e. those covered by the EU objective for life-long learning).[3] According to this data aggregate training participation rates for men and women are almost equal (table 1). When, however, splitting the sample by marital status - as predicted by our model - single women have a training participation rate that is slightly (by 0.6 percentage points) higher than that of single men. By contrast married women have a substantially (2 percentage point) lower participation rate than married males. Similar stylized facts apply to gender differences among households with children under the age of 6.

[Table 1: around here]

Training duration conditional on participation, by contrast, is lower for women than for men for all groups. Conditional on participation the average participant visits courses with a duration of around 17.3 hours in the last four weeks. Females on average spend 2.5 hours less in training than males. In contrast to participation data these gender differences are more pronounced for singles than for the married as well as for persons with no children than for persons with children.

In our analysis aside from marital status (measured by dummy variables for single or married persons) as our main variable of interest, we also include a dummy for the presence of children (under the age of six) in the household as explanatory variables, since this may lead parents to spend more time in household production. This would move training time and participation to the disadvantage of females. In addition we also include variables controlling for age and highest completed education (which may be compulsory, vocational, upper secondary or tertiary) and crude occupational status (self-employed, white collar, blue collar). Previous studies (Green, 1993; Brunello, 2001) find that younger, better educated and employees working in occupations with greater technological change are more likely to receive training. Also Green (1993) finds significant differences in the impact of these variables on training duration and participation of men and women. Furthermore, since Royalty (1996) finds that a substantial part of gender differences in training can be explained by different gender specific mobility patterns, we include tenure and two dummies that take on the value of one if the person under consideration changed sector or occupation of employment in the year preceding the interview, respectively.

Arulampalam et al (2004) also find that in some EU-countries part-time work as well as fixed term contracts have a negative impact on training probabilities. In addition there are substantial gender differences in part-time work in Austria, which may contaminate our findings with respect to other variables. We thus include variables which measure whether the interviewed held a second job at the time of interview, the (usual weekly) working time (in hours) and a dummy variable for fixed term contracts. In addition we include crude sectoral controls (for employment in agriculture, manufacturing, construction, market or non market services) to account for potential impacts on gender differences arising from sectoral gender segregation as well as a dummy for foreign and native born and identify the selection equation by a set of NUTS2 level dummies for region of residence.

[Table 2: Around Here]

Summary statistics for these variables (see table 2) suggest that women have substantially lower tenure and shorter working time than males. They are also more likely to have only completed compulsory education and to work in (market and non-market) services and white collar jobs and less likely to have a vocational education as well as to work as self-employed, blue collar jobs or jobs in construction or manufacturing.[4]

4 Estimation Results

Table 3 presents estimation results of the selection and duration equations for males and females. This table differs from standard regression output only in that coefficients of the dummy variables are reparametrised to measure effects relative to the mean.[5] According to these results household structure is indeed an important determinant of participation in training. Men's participation rates in training are positively influenced by marriage while womens' participation rates are not significantly affected by marriage. In addition, the presence of children under the age of six in the household does not significantly affect men's participation in training, while it significantly reduces women's participation.

Aside from household structure, however, age, tenure, educational attainment, occupational status (i.e. blue vs. white collar workers), sectoral differences and nation of birth are important variables determining participation in training. In accordance with previous literature older persons and persons born abroad have lower, and persons with a higher completed education have higher participation rates in training. This is also the case for employed in the non-market services. Also with respect to these variables there are important gender differences that accord with the literature. Women have flatter age-training, but steeper education-training profiles, and with respect to occupational status, the white collar premium for participation in training is higher for women than for men. Foreign born women also face a smaller penalty for participation in training than foreign born men and employment in market services is associated with a premium only for men. Furthermore training participation significantly increases with tenure only for men.

[Table 3: Around Here]

Variables that measure the nature of the employment relationship (working hours, temporary employment and secondary jobs) and even more strongly variables indicating a change of job (either with respect to occupation or with respect to sector) in the last year, are more important determinants of training participation for men than for women. While both men as well as women with a second job are significantly less likely to obtain training than persons that hold only one job, holding a temporary job and a change of occupation or sector in the last year increases the training probability significantly only for men. Working hours, by contrast, have an insignificant impact on the training probability of both men and women.[6]

Concerning the duration of training we find much fewer significant variables. In particular in contrast to results for training participation the presence of children under the age of six has an insignificant impact on training duration of both men and women. Marriage - in accordance with our model - however, reduces the average training duration of women significantly by (0.6 hours) while it has no significant impact on the training duration of men.

The most important variables governing the duration of training both for men and women, however, are age and tenure. Both for males and females the duration of training falls with increasing age and tenure, but effects are larger for men with respect to age, while they are larger for women with respect to tenure. Most other variables that attain significance, by contrast, do so only for men or women. For men training duration is significantly higher for white collar workers, persons with completed secondary education and significantly lower for employed in agriculture. For women training duration increases significantly with working hours, while women, who have changed sector of employment in the last year or work in manufacturing, have significantly lower training duration.

Interestingly also the selection term in the duration equation (i.e. the inverse mills ratio of the first stage probit regression labeled by λ in table 3) is insignificant both for men and women. This suggests that the correction for selectivity of training participation has only minor impacts on regression results and thus reconfirms results found in earlier work by Green (1993).

5 A decomposition

Our results so far thus suggest a number of differences between men and women both with respect to determinants of the duration as well as the participation in training. This opens the question how much different variables contribute to total gender differences. In linear models this issue can be addressed by Oaxaca-Blinder decompositions. Recently this method has been generalised to non-linear models (including probit models) by Yun (2005a) and Bauer and Sinning (2008). Defining $\widehat{\gamma}^M$ and $\widehat{\gamma}^F$ as the parameter estimates of the participation equation for males and females, gender differences in participation in training can be decomposed into a difference in characteristics and a difference in parameters effect by noticing that (see also Fairlie, 2005):

$$P(\tau_j^M) - P(\tau_j^F) = [\bar{\Phi}(Z_j^M \widehat{\gamma^M}) - \bar{\Phi}(Z_j^F \widehat{\gamma^M})] + [\bar{\Phi}(Z_j^F \widehat{\gamma^M}) - \bar{\Phi}(Z_j^M \widehat{\gamma^M})] \quad (10)$$

with Φ the cumulative normal, a bar over variables indicating sample means, Z_j^M and Z_j^F the characteristics of males and females, and the first term in square brackets the difference in characteristics and the second the difference in parameters effect. In addition Yun (2005a) shows that the contribution of each individual parameter $(\widehat{\gamma}_k^i)$ to the difference in characteristics effect can be calculated by $\frac{(\bar{Z}_k^M - \bar{Z}_k^F)\widehat{\gamma_k^M}}{(\bar{Z}^M - \bar{Z}^F)\widehat{\gamma^M}}[\bar{\Phi}(Z_j^M \widehat{\gamma^M}) - \bar{\Phi}(Z_j^F \widehat{\gamma^M})]$ and the contribution of this variable to the difference in parameters effect is given by $\frac{\bar{Z}_k^F(\widehat{\gamma_k^M} - \widehat{\gamma_k^F})}{\bar{Z}^F(\widehat{\gamma^M} - \widehat{\gamma^F})}[\bar{\Phi}(Z_j^F \widehat{\gamma^M}) - \bar{\Phi}(Z_j^M \widehat{\gamma^M})]$. He also derives the asymptotic standard errors for each of these components.

For the duration equation standard Oaxaca-Blinder decompositions augmented by the selectivity term can be used (see Yun (2005c), Madden (2000) for recent applications and Jann (2005) for standard errors). Here defining $\widehat{\beta}^M$, $\widehat{\beta}^F$ as the coefficients for the duration equation, gender differences are decomposed into three effects: a difference in characteristics effect $(\overline{X}^M \widehat{\beta}^M - \overline{X}^F \widehat{\beta}^M)$, a difference in coefficients effect $(\overline{X}^F \widehat{\beta}^M - \overline{X}^F \widehat{\beta}^F)$ and a selection effect $(\widehat{\theta}^M \overline{\lambda}^M - \widehat{\theta}^F \overline{\lambda}^F)$ where $\overline{X}^M$ and $\overline{X}^F$ the characteristics of males and females and λ^i and θ^i are the mills ratio and its coefficient. The contributions of individual variables to the difference in parameter and parameters effect are measured as $\overline{X}_k^M \widehat{\beta}_k^M - \overline{X}_k^M \widehat{\beta}_k^F$ and $\overline{X}_k^M \widehat{\beta}_k^F - \overline{X}_k^F \widehat{\beta}_k^F$ respectively.

5.1 Aggregate Decompositions

Table 4 shows the results of these decompositions when using males as the base category.[7] Focusing first on aggregate decompositions (at the top of table 4) we find that if women had the same parameters as men, their participation in training would be significantly (by 1.2 to 1.3 percentage points) higher than that of males. This, however, is countered by a significant difference in parameters effect, which reduces the participation probability of women by between 1.0 to 1.2 percentage points. Thus, as also found by much of the literature, females should have significantly higher participation and duration in training than males, if their training participation rates were governed by the same parameters as those of men. The reason why females have about equal participation rates is that their "returns" on certain characteristics governing participation are lower.

[Table 4: Around Here]

When considering the duration of training, we find that if women had the same parameters as men, their training duration would be insignificantly (by 1.6 hours) longer than that of men while, their training duration is significantly (by 3.9 hours) lower due to the difference in parameters effect and that selection into training contributes only marginally (0.05 hours) and statistically insignificantly to these differences. The shorter duration of training for females is thus also solely due to the difference in parameters effect.

5.2 Detailed Decompositions

Furthermore, when looking at detailed decompositions of gender differences in training participation, the differences in characteristics effect is closely linked to gender segregation in terms of education, occupational status (white vs. blue collar) as well as employment sector. If the training participation decision of women were governed by the same parameters as that of males (i.e. males are considered the reference group), women's participation rates would be by around 0.5 percentage points lower than mens' on account of their lower average educational attainment. By contrast the higher share of women working in white collar jobs as well as their lower share in blue collar jobs and their higher share in services would lead to an increase in participation in training by 0.8 percentage points each.[8] Aside from this, differences in age, nature of the employment relationship (temporary contract, second jobs) and indicators of job change in the last year contribute significantly to the differences in characteristics effect. In economic terms their contribution is, however, small (mostly contributing less than 0.1 percentage points) and (at least for temporary contracts and mobility) not robust to changes in reference groups.

Considering the difference in parameters effect for participation in training, suggests that the differences in "returns" to being single for men and women contribute to increasing female participation rates by 0.1 percentage points, while differences in parameters for being married contribute to reducing female participation rates by 0.2 percentage points. Similarly, the different parameter for women without a child contributes 0.7 percentage points to the total difference in parameters effect and differences for women with a child account for 0.2 percentage points higher participation rates. Thus the differential impact of marriage and the presence of children on men and women contribute significantly to the difference in parameter effect in training participation.

The most important significant contribution, however, stems from the parameter differences with respect to age, tenure, educational attainment, employment sector and occupational status. Differences in parameters with respect to occupation, employment sector and tenure between men and women contribute around 1.2 percentage points to the total difference in parameters effect, while the difference in parameters for age contributes to increasing female participation rates by 2.8 percentage points.[9] Thus these variables are more important in explaining the difference in parameters effect in participation than differences in response to marital status and children.

For the detailed decompositions of the duration of training, by contrast, only differences in age, tenure and employment sector and occupational status contribute significantly to the difference in characteristics effect both when considering males as well as females as a reference group.[10] In total these robustly significant differences contribute to explaining 1.5 hours of the total difference in characteristics effect.

When considering the difference in parameters effect for training duration, as originally hypothesised, marriage contributes significantly to the total difference in parameters effect and reduces average female training duration by around 0.4 hours. Once more, however, differences in the impact of age, tenure, educational attainment, employment sector and occupational status are more important. In particular the large difference age parameters implies that female training duration would be by 1.5 hours shorter, while the lower white collar and non-market services premium to training duration as well as the differential reaction to tenure and education variables contribute to reducing female training duration by around 3.5 hours in total, and thus explain the majority of the total difference in parameters effect.

6 Conclusions

In this paper we analyze gender differences in training. We argue that one of the reasons for such differences may be a different impact of marriage (and children) on participation in and duration of training for men and women. Using data from the Austrian labour force survey we find some evidence for this hypothesis. Other factors such as the segregation of the labour market and different age-training as well as education-training profiles and differences in the impact of certain occupations are more important, however. In total differences in the reaction to marriage and children can explain about 0.3 percentage points of the total 1.2 percentage point difference in parameters effect on gender differences in training participation and 0.4 hours of the total 3.9 hour difference in parameters effect in training duration. By contrast, the different impact of educational attainment, occupational status, employment sector and tenure on the probability of training between genders contribute 1.2 percentage points to the difference in parameter effect, while flatter age-training profiles contribute to reducing female participation rates (relative to those of men) by 2.8 percentage points. Similarly, with respect to the duration of training, the lower white collar and non-market services premium to training duration as well as the differential reaction to tenure and education variables reduce female training duration by around 3.5 hours in total, and thus explain the majority of the total difference in parameters effect.

From a policy perspective this suggests that both segregation of the labour market as well as discrimination in the access to training by occupation, profession and sectors are more important factors contributing to the inequality in participation and duration of life long learning by genders, than effects stemming from the intra-household division of labour. Policies that focus on these variables could thus significantly contribute to reducing gender discrimination in training participation and duration.

7 Appendix

In this appendix we derive the necessary conditions for the single households optimisation problem to have an interior solution for both ℓ_1^i and ℓ_2^i. First notice that by the assumptions on the functional form of the utility function $\ell_1^i + \ell_2^i > 0$. Thus possible corner solutions can either be $\ell_1^i = 0$ and $\ell_2^i > 0$ or $\ell_2^i = 0$ and $\ell_1^i > 0$. Starting with the case $\ell_2^i = 0$ and $\ell_1^i > 0$ rewriting equations (3) and (4) to allow for such corner solutions, and noting that if $\ell_2^i = 0$ also $\tau_1^i = 0$ we get

$$2\beta/[\ell_1^i] - (1-\beta)/(1-\ell_1^i) = 0 \tag{11}$$

$$2\beta/[\ell_1^i] - (1-\beta)/ < 0 \tag{12}$$

we get from (11) that $2\beta < (1-\beta)\ell_1^i$ and from (12) that $2\beta = (1+\beta)\ell_1^i$. Thus this requires $(1+\beta) < (1-\beta)$ which is impossible for positive β.

This leaves potential corner solutions where $\ell_1^i = 0$ and $\ell_2^i > 0$. Proceeding as above the first order conditions here would imply that,

$$2\beta/[\gamma(\tau_t^i)\ell_2^i] - (1-\beta)/(1-\tau_1^i) < 0 \tag{13}$$

$$2\beta/[\ell_2^i] - (1-\beta)/(1-\ell_2^i) = 0 \tag{14}$$

this leads to $2\beta = (1+\beta)\ell_2^i$ and $2\beta < (1-\beta)\ell_1^i\gamma(\tau_t^i)$ this will be the case if $(1+\beta)/(1-\beta) < \gamma(\tau_t^i)$. Which leads to the conclusion that for an interior solution of both variables $(1+\beta)/(1-\beta) > \gamma(\tau_t^i) > 1$ has to apply, where the second inequality follows from the assumptions on $\gamma(\tau_t^i)$.

Notes

[1]There is no incentive for training in the second period thus $\tau_2^i = 0$ and by the assumptions on the utility function $\ell_1^i + \ell_2^i > 0$. In the appendix we show that $\ell_2^i > 0$ always applies, while for $\ell_1^i > 0$ we have to assume that $\gamma(\tau_1^i) \leq (1+\beta)/(1-\beta)$.

[2]By (3) and (4) $\ell_1^i = 1 - \tau_1^i - \gamma(\tau_1^i)(1 - \ell_2^i)$. Inserting this into (4) gives $\ell_2^i = [(1+\beta)\gamma(\tau_t^i) - (1-\tau_1^i)(1-\beta)]/2\gamma(\tau_1^i)$.

[3]In earlier versions of this paper we also considered the population at large. This leads to few differences in results. Thus we report only results on the employed here.

[4]This accords with previous analyses of the Austrian labour market which find substantial gender segmentation (see Leitner, 2001) that also contribute to gender wage differences (Grünberger and Zulehner, 2009; Böheim et al, 2007).

[5]We do this because Oaxaca and Ransom (1999) show that detailed decompositions are sensitive to the choice of base categories of dummy variables. Yun (2005b) suggests to reparametrise estimates so that coefficients can be interpreted as relative to the mean to avoid this.

[6]Controls for regional dummy variables at the NUTS2 level are also significant in a number of cases. Results suggest higher training probabilities in Upper Austria and Vorarlberg but lower training rates in Vienna and the Burgenland. These results may in part be traced to differences in regional policy (see Lutz et al, 2003)

[7]Since results of decompositions may be sensitive to the choice of reference groups (which could be males, females or a combination of these two groups), we report results when considering females as reference group in the appendix.

[8]These results are robust to changes in reference group. If females are taken as the reference group training participation should be by almost 0.6 percentage points lower due to differences in educational attainment and by around 1.7 percentage points higher due to employment segregation by branch and occupational status.

[9]Again these effects are robust to changes in reference group, while other variables are insignificant or not robust.

[10]In addition when considering males as a reference group also educational attainment plays a significant role, while when females are considered the reference group the same applies to job changes

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Table 1: Average Participation and duration of training for professional reasons by gender

	Participation			Duration		
	Male	Female	Total	Male	Female	Total
Total	7.9%	8.0%	8.0%	18.4	15.9	17.3
Single	7.7%	8.3%	7.9%	18.0	15.8	16.9
Married	8.8%	6.8%	8.0%	19.9	17.0	18.9
No Children	7.6%	8.9%	8.2%	20.0	17.2	18.6
Children	8.0%	7.5%	7.8%	17.6	15.1	16.5

S: Austrian Labour Force Survey (pooled sample 2004-2007) employed 25 to 65 years old

Table 2: Descriptive Statistics of dependent variables

	Total		Males		Females	
	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
Age	41.79	9.20	42.11	9.39	41.40	8.97
Tenure	137.59	118.96	151.77	124.39	120.73	109.81
No children under 6	0.82	0.38	0.81	0.39	0.84	0.37
Children under 6	0.18	0.38	0.19	0.39	0.16	0.37
Single	0.36	0.48	0.35	0.48	0.37	0.48
Married	0.64	0.48	0.65	0.48	0.63	0.48
Compulsory Education	0.17	0.37	0.13	0.33	0.22	0.41
Vocational Education	0.54	0.50	0.57	0.50	0.49	0.50
Secondary Education	0.10	0.30	0.08	0.28	0.12	0.32
Tertiary Education	0.20	0.40	0.22	0.41	0.17	0.38
Austrian Born	0.88	0.33	0.88	0.33	0.87	0.33
Foreign Born	0.12	0.33	0.12	0.33	0.13	0.33
Second Job	0.95	0.21	0.95	0.23	0.96	0.19
No Second Job	0.05	0.21	0.05	0.23	0.04	0.19
Normal Working hours	52.43	111.64	58.25	113.00	45.52	109.60
No temporary Contract	0.96	0.19	0.97	0.17	0.96	0.20
Temporary Contract	0.04	0.19	0.03	0.17	0.04	0.20
No Change of Profession	0.60	0.49	0.63	0.48	0.56	0.50
Change of Proffession	0.40	0.49	0.37	0.48	0.44	0.50
Change of sector	0.60	0.49	0.63	0.48	0.56	0.50
No Change of Sector	0.40	0.49	0.37	0.48	0.44	0.50
Blue Collar	0.52	0.50	0.46	0.50	0.59	0.49
White collar	0.27	0.44	0.32	0.47	0.20	0.40
Self employed	0.21	0.41	0.21	0.41	0.21	0.40
Aggriculture	0.06	0.24	0.06	0.23	0.06	0.24
Manufacturing	0.19	0.40	0.26	0.44	0.11	0.32
Construction	0.08	0.27	0.13	0.33	0.02	0.15
Market Services	0.39	0.49	0.36	0.48	0.43	0.49
Non-market Services	0.28	0.45	0.19	0.40	0.38	0.48
2004	0.24	0.43	0.24	0.43	0.24	0.42
2005	0.25	0.43	0.25	0.43	0.25	0.43
2006	0.25	0.43	0.25	0.43	0.25	0.43
2007	0.26	0.44	0.26	0.44	0.26	0.44
Burgenland	0.08	0.28	0.08	0.28	0.08	0.27
Lower Austria	0.12	0.33	0.12	0.33	0.12	0.33
Vienna	0.11	0.31	0.11	0.31	0.12	0.32
Carinthia	0.10	0.31	0.10	0.31	0.10	0.30
Styria	0.12	0.32	0.12	0.32	0.12	0.32
Upper Austria	0.12	0.32	0.12	0.32	0.12	0.32
Salzburg	0.11	0.32	0.11	0.31	0.12	0.32
Tirol	0.11	0.32	0.11	0.32	0.11	0.31
Vorarlberg	0.12	0.32	0.12	0.32	0.11	0.32
Number of obsevations	319199		173317		145882	

Notes: Std.Dev=Standard deviation, S: Austrian labour Force Survey (pooled sample 2004 - 2007) employed 25 to 65 years old

Table 3: Regression Results

	Participation				Duration			
	Males		Females		Males		Females	
	Coeff	S.E	Coeff	S.E	Coeff	S.E	Coeff	S.E
Age	-0.0134 ***	0.0007	-0.0056 ***	0.0007	-0.2541 ***	0.0401	-0.1127 ***	0.0282
Tenure	0.0004 ***	0.0000	0.0000	0.0001	-0.0092 ***	0.0020	-0.0138 ***	0.0019
No children under 6	-0.0013	0.0063	0.1007 ***	0.0078	-0.1330	0.2314	0.4843	0.3426
Children under 6	0.0013	0.0063	-0.1007 ***	0.0078	0.1330	0.2314	-0.4843	0.3426
Single	-0.0458 ***	0.0055	-0.0088	0.0055	-0.0677	0.2375	0.6376 **	0.1805
Married	0.0458 ***	0.0055	0.0088	0.0055	0.0677	0.2375	-0.6376 **	0.1805
Compulsory Education	-0.2227 ***	0.0136	-0.3752 ***	0.0132	-0.3364	0.7169	0.2388	0.8488
Vocational Education	-0.0640 ***	0.0077	-0.1259 ***	0.0082	0.8759 **	0.3509	-0.7246	0.4562
Secondary Education	0.0559 ***	0.0120	0.1211 ***	0.0110	-0.2212	0.4518	-0.3218	0.3919
Tertiary Education	0.2309 ***	0.0087	0.3800 ***	0.0093	-0.3182	0.6209	0.8076	0.9240
Austrian Born	0.0974 ***	0.0089	0.0745 ***	0.0091	-0.1302	0.4198	0.6211 *	0.3576
Foreign Born	-0.0974 ***	0.0089	-0.0745 ***	0.0091	0.1302	0.4198	-0.6211 *	0.3576
Second Job	-0.0864 ***	0.0090	-0.0952 ***	0.0118	0.1767	0.3868	-0.5633	0.4317
No Second Job	0.0864 ***	0.0090	0.0952 ***	0.0118	-0.1767	0.3868	0.5633	0.4317
Normal Working hours	0.0000	0.0000	0.0001 *	0.0000	0.0007	0.0017	0.0041 **	0.0016
No temporary Contract	-0.0324 **	0.0131	-0.0146	0.0120	-0.8968 *	0.4800	-0.6716 *	0.3732
Temporary Contract	0.0324 **	0.0131	0.0146	0.0120	0.8968 *	0.4800	0.6716 *	0.3732
No Change of Profession	-0.0501 **	0.0222	-0.0042	0.0253	0.5544	0.7918	1.3176 *	0.7228
Change of Proffession	0.0501 **	0.0222	0.0042	0.0253	-0.5544	0.7918	-1.3176 *	0.7228
Change of sector	0.0463 **	0.0223	0.0246	0.0252	-1.3154 *	0.7966	-1.9897 ***	0.7242
No Change of Sector	-0.0463 **	0.0223	-0.0246	0.0252	1.3154 *	0.7966	1.9897 **	0.7242
Blue Collar	0.2312 ***	0.0068	0.1698 ***	0.0085	1.3467 **	0.5106	-0.0879	0.3966
White collar	-0.2598 ***	0.0094	-0.3031 ***	0.0136	-0.8969	0.5580	-0.3847	0.6663
Self employed	0.0287 ***	0.0088	0.1332 ***	0.0104	-0.4498	0.3577	0.4726	0.3957
Aggriculture	-0.0656 ***	0.0190	-0.2130 ***	0.0252	-2.6588 ***	0.7732	0.2986	1.0283
Manufacturing	-0.0475 ***	0.0102	-0.0306 *	0.0178	-0.1981	0.4307	-1.3335 **	0.6765
Construction	-0.1548 ***	0.0142	-0.1023 ***	0.0321	-0.2074	0.6758	0.6454	1.2348
Market Services	0.0314 ***	0.0087	-0.0115	0.0127	-0.1945	0.3427	0.0108	0.4866
Non-market Services	0.2365 ***	0.0096	0.3575 ***	0.0121	3.2589 ***	0.6599	0.3787	0.8319
2004	-0.0482 ***	0.0086	-0.0306 ***	0.0094	-0.3031	0.3399	0.8400 ***	0.3176
2005	0.0164 *	0.0098	0.0409 ***	0.0101	-1.1028 ***	0.3801	-1.5113 ***	0.3497
2006	0.0245 **	0.0090	-0.0022	0.0095	0.5083	0.3415	-0.0562	0.3143
2007	0.0073	0.0089	-0.0082	0.0095	0.8976 ***	0.3394	0.7275 **	0.3127
Burgenland	-0.0097	0.0149	-0.0541 ***	0.0171				
Lower Austria	0.0165	0.0122	0.0155	0.0136				
Vienna	-0.1188 ***	0.0142	-0.0636 ***	0.0141				
Carinthia	-0.0338 **	0.0137	0.0230	0.0146				
Styria	-0.0015	0.0129	-0.0079	0.0142				
Upper Austria	0.0768 ***	0.0124	0.0276 *	0.0142				
Salzburg	-0.0351 ***	0.0131	-0.0069	0.0141				
Tirol	0.0378 ***	0.0127	-0.0037	0.0147				
Vorarlberg	0.0679 ***	0.0123	0.0699 ***	0.0143				
Constant	-1.0281 ***	0.0297	-1.4644 ***	0.0327	31.7998 **	2.6066	24.7259 ***	1.8206
Mills Ratio					-10.8725	7.8742	-9.5622	7.2222

Note: Table presents coeffecients of a logit analysis of training participation (columns 2-5) and regression results for training duration (Columns 6-9). Source: Austrian Labour Force Survey (pooled sample 2004-2007) employed 25 to 65 years old, Coeff=Coefficient Estimate, Std.Err. = Standard error of the estimate. ***significant at 1%, significant at 5%, * significant at 10% level.

Table 4: Decomposition Results (reference=male)

	Participation				Duration			
	Difference in Characteristics		Differences in Parameter		Difference in Characteristics		Difference in Parameters	
	Contr	S.E.	Contr	S.E.	Contr	S.E.	Contr	S.E.
	Aggregate Decomposition							
Total	-0.0131 ***	0.0005	0.0115 ***	0.0011	-1.5712	1.9280	3.9436 **	1.9425
Selection					0.0546	1.3240		
	Detailed Decompostion							
Age	-0.0013 **	0.00054	-0.0280 **	0.014	-0.1337 ***	0.0350	-1.7481 ***	0.7922
Tenure	0.0016	0.02378	0.0039 ***	0.0009	-0.2708 **	0.0614	0.5827 *	0.3507
No children under 6	0.0000	0.00003	-0.0074 ***	0.0012	0.0101	0.0176	-0.1323	0.3566
Children under 6	0.0000	0.00003	0.0014 ***	0.0002	0.0101	0.0176	0.0850	0.0570
Single	0.0001 ***	0.00002	-0.0012 ***	0.0003	0.0046	0.0163	-0.2858 **	0.1209
Married	0.0001 ***	0.00002	0.0020 ***	0.0005	0.0046	0.0163	0.4195 **	0.1774
Compulsory Education	0.0028 ***	0.00019	0.0029 ***	0.0003	0.0036	0.0081	-0.0399	0.0771
Vocational Education	-0.0007 ***	0.00009	0.0026 ***	0.0005	0.0878 **	0.0357	0.5736 ***	0.2064
Secondary Education	-0.0003 ***	0.00005	-0.0007 ***	0.0002	0.0131	0.0269	0.0173	0.1031
Tertiary Education	0.0015 ***	0.00006	-0.0022 ***	0.0002	0.0096	0.0193	-0.1502	0.4452
Austrian Born	0.0001 ***	0.00001	0.0017 *	0.001	-0.0020	0.0068	-0.1911	0.5073
Foreign Born	0.0001 ***	0.00001	-0.0003 *	0.0001	-0.0020	0.0068	0.0601	0.0442
Second Job	0.0002 ***	0.00002	0.0007	0.0012	-0.0045	0.0099	0.6951	0.5445
No Second Job	0.0002 ***	0.00003	0.0000	5E-05	-0.0045	0.0099	-0.0448	0.0352
Normal Working hours	0.0000	0.00974	-0.0003	0.0002	0.0072	0.0183	-0.1628	0.1083
No temporary Contract	-0.0001 **	0.00002	-0.0015	0.0015	-0.0190	0.0105	-0.2120	0.5723
Temporary Contract	-0.0001 **	0.00002	0.0001	7E-05	-0.0190	0.0105	0.0132	0.0357
No Change of Profession	-0.0004 **	0.00019	-0.0022	0.0018	0.0224	0.0325	-0.1501	0.6323
Change of Proffession	-0.0004 **	0.00021	0.0017	0.0012	0.0224	0.0325	0.3131	0.4399
Change of sector	0.0004 **	0.00020	0.0011	0.0016	-0.0571	0.0358	0.3977	0.6349
No Change of Sector	0.0004 **	0.00019	-0.0008	0.0013	-0.0571	0.0358	-0.2767	0.4417
Blue Collar	-0.0041 ***	0.00021	0.0032 ***	0.0006	-0.0647 **	0.0259	1.0387 **	0.4681
White collar	-0.0044 ***	0.00017	0.0007 ***	0.0003	-0.0661	0.0413	-0.0235	0.0400
Self employed	0.0000 **	0.00001	-0.0019 ***	0.0003	0.0116	0.0097	-0.2122 *	0.1228
Aggriculture	0.0001 ***	0.00002	0.0008 ***	0.0002	-0.0453 ***	0.0145	-0.0668 **	0.0294
Manufacturing	-0.0010 ***	0.00026	-0.0002	0.0002	-0.0280	0.0608	0.0693	0.0490
Construction	-0.0022 ***	0.00022	-0.0001	7E-05	-0.0108	0.0351	-0.0108	0.0180
Market Services	-0.0003 ***	0.00009	0.0016 ***	0.0005	-0.0175	0.0309	-0.0556	0.1613
Non-market Services	-0.0058 ***	0.00031	-0.0039 ***	0.0008	-0.9772 ***	0.1989	1.8223 ***	0.6720
2004	0.0000 *	0.00000	-0.0004	0.0003	-0.0014	0.0028	-0.1520	0.1027
2005	0.0000	0.00000	-0.0005 *	0.0003	0.0038	0.0066	0.1083	0.1369
2006	0.0000 **	0.00000	0.0006 **	0.0003	0.0010	0.0034	0.1449	0.1192
2007	0.0000	0.00000	0.0003	0.0003	-0.0027	0.0054	0.0438	0.1189
Burgenland	0.0000	0.00001	0.0003 **	0.0002				
Lower Austria	0.0000	0.00000	0.0000	0.0002				
Vienna	0.0002 ***	0.00002	-0.0006 ***	0.0002				
Carinthia	0.0000 **	0.00000	-0.0005 ***	0.0002				
Styria	0.0000	0.00000	0.0001	0.0002				
Upper Austria	0.0000 **	0.00001	0.0005 **	0.0002				
Salzburg	0.0000 **	0.00001	-0.0003	0.0002				
Tirol	0.0000 ***	0.00001	0.0004 **	0.0002				
Vorarlberg	0.0001 ***	0.00001	0.0000	0.0002				
Constant	0.0000	0.00000	0.0377 **	0.0186			1.4739	3.1794

Note: Table presents results of an Oaxaca Blinder Decomposition of training participation (columns 2-5) and training duration (Columns 6-9), based on coefficient estimates from table 3, with males as a base group . Source: Austrian Labour Force Survey (pooled sample 2004-2007) employed 25 to 65 years old, Contr=Contribution to total Gender differences, S.E. = Standard error of the estimate. ***significant at 1%, significant at 5%, * significant at 10% level.

Table A1: Decomposition Results (reference=female)

	Participation				Duration			
	Difference in Characteristics		Differences in Parameter		Difference in Characteristics		Difference in Parameters	
	Contr	S.E.	Contr	S.E.	Contr	S.E.	Contr	S.E.
	Aggregate Decomposition							
Total	-0.01236 ***	0.00054	0.01069 ***	0.00115	-0.92115	1.92796	3.37179 **	1.6425
Selection Effect					0.05462	1.324		
	Detailed Decompsition							
Age	-0.00050	0.00083	-0.0261 **	0.0121	-0.0593 ***	0.0195	-1.8225 ***	0.8180
Tenure	0.00001	0.03634	0.0044 ***	0.0013	-0.4056 ***	0.0584	0.7175 *	0.4318
No children under 6	-0.00035 ***	0.00004	-0.0065 ***	0.0010	-0.0367	0.0261	-0.0855	0.3252
Children under 6	-0.00035 ***	0.00004	0.0015 ***	0.0002	-0.0367	0.0261	0.1318	0.0883
Single	0.00002	0.00002	-0.0010 ***	0.0002	-0.0043	0.0129	-0.2378 **	0.1006
Married	0.00002	0.00002	0.0019 ***	0.0004	-0.0043	0.0129	0.4676 **	0.1978
Compulsory Education	0.00430 ***	0.00016	0.0015 ***	0.0002	-0.0026	0.0095	-0.0337	0.0652
Vocational Education	-0.00120 ***	0.00014	0.0028 ***	0.0006	-0.0727	0.0461	0.7341 ***	0.2641
Secondary Education	-0.00050 ***	0.00006	-0.0004 ***	0.0001	0.0191	0.0233	0.0114	0.0677
Tertiary Education	0.00232 ***	0.00009	-0.0026 ***	0.0003	-0.0245	0.0290	-0.1161	0.4115
Austrian Born	0.00004 ***	0.00001	0.0016 **	0.0009	0.0098	0.0061	-0.2029	0.5160
Foreign Born	0.00004 ***	0.00001	-0.0002 **	0.0001	0.0098	0.0061	0.0483	0.0355
Second Job	0.00022 ***	0.00004	0.0007	0.0011	0.0142	0.0111	0.6764	0.5299
No Second Job	0.00022 ***	0.00004	0.0000	0.0001	0.0142	0.0111	-0.0635	0.0498
Normal Working hours	0.00013	0.01490	-0.0004	0.0003	0.0450 **	0.0183	-0.2006	0.1334
No temporary Contract	-0.00002	0.00002	-0.0014	0.0014	-0.0142 *	0.0082	-0.2168	0.5851
Temporary Contract	-0.00002	0.00002	0.0000	0.0000	-0.0142 *	0.0082	0.0085	0.0229
No Change of Profession	-0.00003	0.00021	-0.0023	0.0017	0.0532 *	0.0306	-0.1809	0.6756
Change of Proffession	-0.00003	0.00021	0.0014	0.0010	0.0532 *	0.0306	0.2823	0.3966
Change of sector	0.00020	0.00021	0.0011	0.0017	-0.0863 **	0.0340	0.4269	0.6816
No Change of Sector	0.00020	0.00022	-0.0006	0.0010	-0.0863 **	0.0340	-0.2474	0.3950
Blue Collar	-0.00277 ***	0.00015	0.0023 ***	0.0004	0.0042 ***	0.0192	0.9698 **	0.4371
White collar	-0.00478 ***	0.00029	0.0011 ***	0.0005	-0.0284 ***	0.0492	-0.0613	0.1040
Self employed	0.00007 ***	0.00001	-0.0018 ***	0.0003	-0.0122 ***	0.0107	-0.1884 *	0.1090
Aggriculture	0.00018 ***	0.00002	0.0007 ***	0.0001	0.0051	0.0177	-0.1172 **	0.0513
Manufacturing	-0.00058 *	0.00037	-0.0004	0.0004	-0.1882 **	0.0957	0.2295	0.1622
Construction	-0.00132 ***	0.00039	-0.0005 *	0.0003	0.0335	0.0642	-0.0551	0.0910
Market Services	0.00010	0.00015	0.0012 ***	0.0005	0.0010	0.0438	-0.0741	0.2147
Non-market Services	-0.00810 ***	0.00021	-0.0019 ***	0.0004	-0.1136	0.2495	0.9586 ***	0.3536
2004	-0.00001 **	0.00001	-0.0003	0.0002	0.0038	0.0049	-0.1572	0.1048
2005	0.00000 ***	0.00000	-0.0005 *	0.0003	0.0053	0.0087	0.1068	0.1351
2006	0.00000	0.00000	0.0005 **	0.0003	-0.0001	0.0019	0.1461	0.1201
2007	0.00000	0.00000	0.0003	0.0003	-0.0022	0.0045	0.0433	0.1175
Burgenland	-0.00002 ***	0.00001	0.0003 **	0.0002				
Lower Austria	0.00000	0.00000	0.0000	0.0002				
Vienna	0.00010 ***	0.00003	-0.0005 ***	0.0002				
Carinthia	0.00000	0.00000	-0.0005 ***	0.0002				
Styria	0.00000	0.00000	0.0001	0.0002				
Upper Austria	0.00001 *	0.00001	0.0005 **	0.0002				
Salzburg	0.00001	0.00002	-0.0002	0.0002				
Tirol	0.00000	0.00001	0.0004 **	0.0002				
Vorarlberg	0.00006 ***	0.00001	0.0000	0.0002				
Constant	0.00000	0.00000	0.0346	0.0219			1.4739	3.1794

Note: Table presents results of an Oaxaca Blinder Decomposition of training participation (columns 2-5) and training duration (Columns 6-9), based on coefficient estimates from table 3, with females as a base group . Source: Austrian Labour Force Survey (pooled sample 2004-2007) employed 25 to 65 years old, Contr=Contribution to total Gender differences, S.E. = Standard error of the estimate. ***significant at 1%, significant at 5%, * significant at 10% level.

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