SCHOOL OF ECONOMICS AND MANAGEMENT

ECONOMICS WORKING PAPER 2008-7

The Incidence and Intensity of Formal Lifelong Learning

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June 2008

Abstract

We exploit a rich high quality register-based employer-employee panel data set to investigate the incidence and intensity of government co-sponsored training for the Danish adult population. We focus specifically on training over the working life cycle and find that the levels of participation vary across genders. We consider both the incidence (take-up in a given year) and intensity (hours conditional on enrolment) of training. We find evidence of considerable lifelong learning with regards to enrolment in basic and vocational training regardless of gender, whereas post-secondary training enrolment usually takes place early in life with a smooth decline over the working life cycle. Once the enrolment decision is made, however, and once a comprehensive conditioning set is included there are no striking differences in hours in training with regards to gender. Neither hours in vocational nor hours in post-secondary training are strongly age dependent. Hours in basic training do decrease significantly with age but the effects are very small.

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Lars Skipper thanks the Danish Research Council for financial support. We would like to thank Jacob Nielsen Arendt, Claus H. Frederiksen, Torben P. Jensen, Nicolai Kristensen, Helena Skyt Nielsen, and in particular Jeff Smith for many valuable discussions and comments. Comments from participants at seminars at University of Copenhagen and University of Michigan are much appreciated.

1. Introduction

Life long learning is the continued learning over the working life cycle. This is considered by the OECD countries to be of the greatest importance for increasing levels of productivity since it presumably maintains as well as enhances skills for the individual worker and potentially generates spillover effects on less educated workers. In this paper we investigate the phenomenon of lifelong formal government co-sponsored learning in Denmark.

Although most governments within OECD support training either directly or indirectly, Denmark is very special in that it is the only country within the group actually providing and financing training of workers at off-the-job training sites with only token, if any, tuition fees[1]. Moreover, for training taking place during work hours, firms can get generous wage subsidies, typically 60 to 80 per cent of the wages of workers during the relevant periods. Should firms choose to organize formal training courses at the workplaces themselves, they will also be able to collect teacher subsidies. Since the early 1980s there has been a steady yearly increase in the participation rate in these training schemes such that Denmark, not surprisingly given the generosity of the training schemes, at the turn of the century was the country (along with Britain and Finland) overall investing most in training, see OECD (1999) and Arulampalam, Bryan & Booth (2004).

Our focus in this paper is the incidence and intensity of formal training among individuals from the entire Danish adult population. There exists a large literature on participation in and effects of training for groups with limited attachment to the labor market, yet, because of lack of data (see Carneiro & Heckman (2003)), there is comparatively little empirical research in training among employed individuals, neither on on- nor off-the-job training. See Arulampalam et al. (2004), Black, Noel & Wang (1992), Carneiro & Heckman (2003), Heckman, Roselius & Smith (1994), Krueger & Rouse (1998), Loewenstein & Spletzer (1998), and Lynch (1992). Despite the apparent policy interest, there is even less research on the existence of lifelong learning, see Arulampalam, Bryan & Booth (2004). Furthermore, much of the earlier literature suffers from having small – and often non-representative – samples (Krueger & Rouse (1998)) and from extremely imprecise measures of

[1] In this respect, financing of some of the training scheme in our study is similar to that in Krueger & Rouse (1998), who evaluate effects of workplace educational programs for low-skilled workers.

training incidences based on employee surveys.[2] A potential pitfall of such surveys is a high misclassification rate; Krueger and Rouse (1998) estimate the attenuation bias to be as high as 28% when comparing self-reported data to a manufacturing company's data.

In contrast, because the government co-sponsors much of the training in Denmark, precise information on training histories at the individual level is collected and recorded in representative central registers. With these data we consider participation over the working-life cycle in off-the-job and formal on-the-job training and characterize the participation processes for three main categories of training; basic education, vocational and technical training, and post-secondary training. This information is then merged onto a panel of employer-employee data, representative at the individual level. Using these data, we shed light on whether lifelong learning actually takes place. Empirically, we identify lifelong learning as training enrolment over the entire life-cycle. We consider both the incidence (take-up of training in a given year) and intensity (hours in training).

From a theoretical point of view, several factors beyond direct costs may impact the incidence and extent of training over the working-life cycle. According to standard human capital theory, Becker (1964), the incidence of training should decrease with age simply because older participants have less time over which to recoup the benefits from their investment compared to younger people. Still, as pointed out in Heckman (1976) and discussed in Arulampalam et al. (2004), rapid skill obsolescence may lead to a substantial take-up of training late in the working-life. Given recent assessments by the OECD on how work forces of member states are operating in an increasingly 'globalized' and 'computerized' world, see e.g. OECD (1999, 2003, and 2004), we may then expect a non-trivial amount of training taking place throughout the working-life cycle. In addition, variation over the life-cycle in indirect costs of participation may be of considerable importance for the take-up of training. For example, the presence of young children might affect investment in training by changing the shadow price of time. Following this line of reasoning, we will expect training at odd hours during years with dependent children to be especially costly. See also our companion paper, Simonsen and Skipper (2008), for further investigation of which factors induce and hinder participation, completion and passing.

[2] For example, prior to 1988 the NLSY excluded all training spells shorter than four weeks. In addition, training information is often gathered based on questions on participation during the last year (e.g. European Community Household Survey) or participation during the first three months of work (e.g. Small Business Administration Survey).

Our empirical results reveal distinct differences in the processes governing participation over the working life cycle across genders. We find that men are more likely to participate in vocational training, whereas women more often participate in basic or post-secondary training. Common to both genders is the existence of lifelong learning in basic and vocational training, whereas post-secondary training participation mainly takes place while individuals are young with a smooth decline over the working lifecycle and becomes negligible later in life. Once the enrolment decision is made, however, and once a comprehensive conditioning set is included there are no striking differences in hours in training with regards to gender. Neither hours in vocational nor hours in post-secondary training are strongly age dependent. Hours in basic training do decrease significantly with age but the effects are very small.

The rest of the paper is organized as follows. In section 2 the institutional framework is presented along with descriptive evidence of the incidence of lifelong learning for men and women, respectively. Section 3 offers a simple stylized theoretical model explaining the (differences in) patterns of training over the working-life cycle. Section 4 contains a description of our data and a discussion of the linkage between the model from Section 3 and our data. Section 5 presents our results and Section 6 concludes.

2. Institutional Framework and Training in the Danish Labor Market

The Danish labor force, which forms the basis of our analysis, is relatively highly educated. In fact, 81 percent of 25-64 year olds in Denmark have at least a high school education[3] and the average length of completed schooling is 13.6 years compared to OECD average of 12.0 and only surpassed by the US and Norway (both 13.8 years), OECD (2005). As is the case for the US, there are only small differences in length of education across cohorts, see Table A1 in the Appendix.

With the exception of individuals aged 55 or above,[4] labor market participation rates are also high for both genders, as documented in Table 1 below. On average, 84% of Danish men aged 15-66 are members of the labor force compared to 71% of women. The labor force operates in a labor market characterized by a low level of regulation similar to that of the US with small (if any) firing costs ('employment at will'), combined with the (continental) European system of high social protection,

[3] The corresponding number is 88 percent for the US.
[4] The official retirement age in 1996 is 67 yet early retirement makes the actual retirement age 62.

a so-called 'flexicurity' system, OECD (2004). Despite this deregulated and flexible labor market with high turnover rates, training incidence among the employed is high compared to other OECD countries, in effect an anomaly in the settings of Acemoglu & Pischke (1999).

TABLE 1

LABOR FORCE PARTICIPATION, 15-66 YEAR OLDS

Age	Men	Women
15-29	83.2	73.1
30-54	92.7	81.7
55-66	55.8	33.7
Total	83.7	70.9

Source: Statistics Denmark, www.statistikbanken.dk

An important and distinct feature of training in Denmark is as mentioned above, however, that it is heavily subsidized by the government in order to encourage the take-up of training. The more general types of training with standard curricula usually take place at off-site training facilities and are either organized jointly by local employers associations and labor unions or by the educational institutions themselves. Firm or industry specific training can take place either at the workplace directly, where the firm will be fully in charge of the curricula as well as potentially hiring outside teachers, or at off-site training facilities.

These publicly subsidized training courses will in this paper be grouped into three broad categories:

a) basic courses,
b) vocational and technical courses, and
c) post-secondary courses.[5]

For all three types of courses, employers or the employees directly will get a refund equivalent to that of the maximum unemployment insurance benefits should participation take place during working hours.[6]

Basic courses consist of courses on adult basic educational level (ranging from third to eight grade level) or adult secondary educational level (ninth and tenth grade level along with high school

[5] See Table A2 in the Appendix for details on the aggregation of training schemes used below.
[6] This is the case for more than 80 percent of the vocational training activity, whereas a little more than 10 percent of the activity in post secondary education is compensated and only five percent of basic training.

education). These education programs focus on literacy and basic skills training and are targeted towards adults with only little or obsolete education. Education will take place at either one of 75 adult educational centers spread out across the country or at community high schools and colleges.

Vocational and technical courses consist mainly of shorter courses with the overall purpose of maintaining and improving the qualifications of the working population as well as meeting more firm-specific needs. The types of courses range from purely firm-specific ("team-building", "team work at the plant", "management and cooperation at the assembly line") to more industry-specific with broad subcategories such as production, construction, agricultural, services, trade etc. Training takes place at either one of around 20 labor market training centers, at vocational and technical high schools, or it is adjourned to the work place.

Post-secondary training is typically on a higher and more specialized level such as either poly-technical and university college courses or MBA type courses, where working experience will be a prerequisite.

A full-time employed Danish male will, on average, spend ten hours per year undertaking vocational training, and between two and three hours in basic and post-secondary training, whereas an average full-time employed woman will spend eight hours engaging in basic and vocational training and four hours taking post-secondary training.[7] For both genders we see a clear tendency to engage in training over the working life cycle; see Figures 1 and 2. For men, however, training mainly takes place in their twenties and early thirties with a smooth decline over the working lifetime, whereas women engage slightly more in post-secondary training later in life compared to the child-bearing period. This latter difference between the two genders might stem from family responsibilities; women clearly engage the most in caring for children[8]. In addition, post-secondary education in particular is often scheduled to take place outside business hours with few lectures and more preparation. This will, in effect, raise the perceived opportunity costs from engaging in this type of training for mothers.

[7] Own calculations based on information from Statistics Denmark, www.dst.dk.
[8] Using time-use data on 6,624 adult Danes in 2001, Bonke (2002) finds that women with children below the age of seven spend close to six hours per day on home production. The corresponding number of hours for men is four. Single men or men in relationships without children or children older than seven years report spending between two and three hours per day. Women with children older than seven report spending 4½ hour per day whereas singles or women living in relationships without children report spending between two and four hours per day. Only for lone parents and singles below 45 are there no statistically differences between the hours spent on home production between the genders.

On the cost side, the government spends some €800 million on operating expenses and another €300 million on worker subsidies per year, in total around 0.5 percent of GDP or equivalent to its spending on the ordinary post-secondary educational system. The cost of operating these courses vary dramatically between the three different types: whereas supplying a year of full-time studies of vocational or technical training on average costs €21,700, the cost is €5,500 for basic courses and €5,000 on average for courses on the post-secondary level. This reflects the fact that vocational training is much more teacher intensive, with typically 35 to 40 hours of classroom training per week with limited number of participants, and often involves technical equipment. In contrast, basic and post-secondary education will be less teacher-intensive with a low number of lectures per week and more students per class. Most of the worker subsidies (77 pct of total subsidies) are spent in connection with vocational and technical training, whereas the basic (5 pct) and post-secondary courses (18 pct) are much more likely to take place outside working hours where the government provides no wage compensation. Should a course take place at training facilities more than 7.5 miles from the residence of the participant, he is eligible to a refund covering traveling expenses. Finally, participants (or participating firms) pay an additional €80 million in token tuition fees.[9]

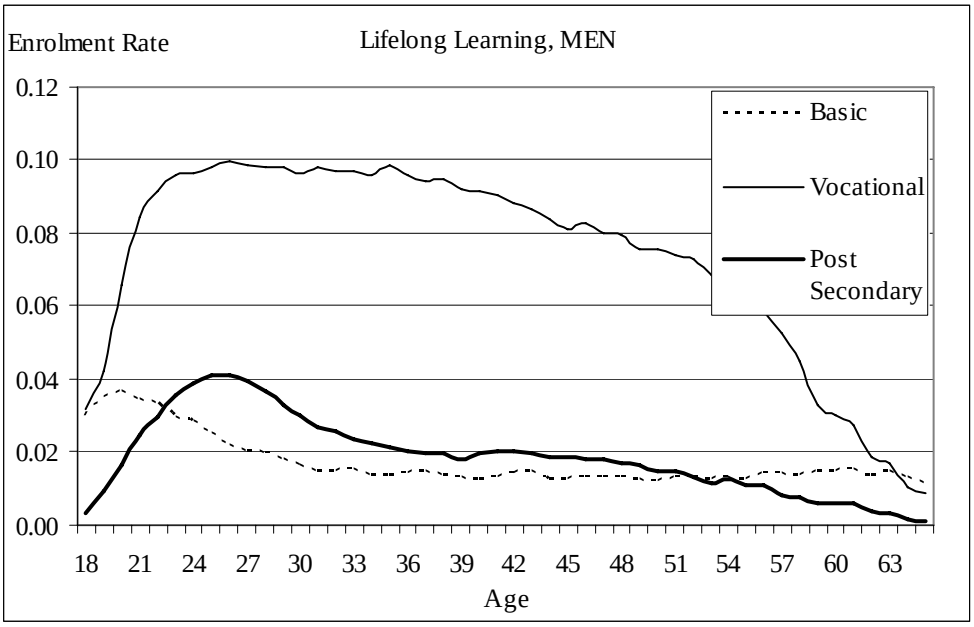

Fig. 1: Training enrolment rates, Danish men, 1990-2002.

[9] Preparatory courses are typically free of charge, a course on the high school level costs €25, vocational courses cost €25 per employee per week of full time training, and the fee for a post-secondary course is as much as €800. Unfortunately, we do not have information on whether the participant or the employing firm pays these fees as the course suppliers in charge of collecting the fees do not record this.

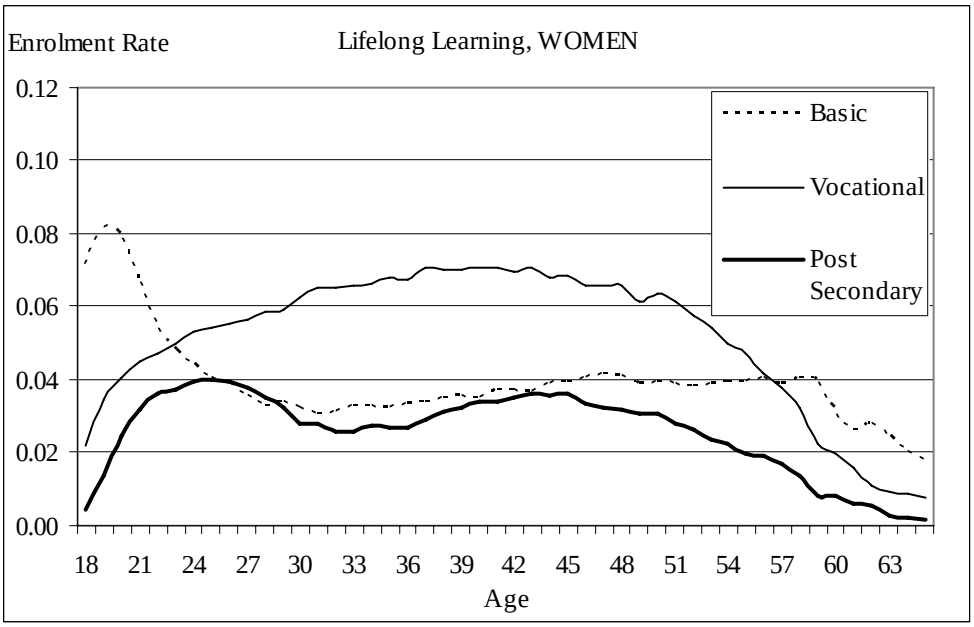

Fig. 2: Training enrolment rates, Danish women, 1990-2002.

3. Lifelong Learning

To guide our empirical analysis, we present here a simple stylized model of the decision to participate in training over the working life cycle. The model can easily be generalized to describe intensity of training within a given year as well but for simplicity we only describe the decision to enroll. We assume a wealth maximizing agent, who retires at age $\bar{a}$. Let *D(a)* = 1 if an individual participates in training at age $a \leq \bar{a}$ and *D(a) = 0* otherwise. Also, let *W(a)* represent the expected future net gains from training, *C(a)* the direct pecuniary costs of training, and *N(a)* the indirect costs of training. An employee will then choose to participate in training if the net benefit

$$D^*(a) = W(a) - C(a) - N(a)$$

is positive

$$D = I(D^*(a) \geq 0).$$

Within the framework of this stylized model several factors may impact the incidence and extent of training over the working life. Becker (1964) argues that training participation should decrease with

age as $W(a)$ is expected to decline over the working life as a approaches $\bar{a}$. I.e. holding $C(a)$ and $N(a)$ constant, we may expect

$$\frac{\partial \Pr(D=1)}{\partial a} \leq 0.$$

Despite this, Heckman (1976) points out that "if the depreciation rate is sufficiently high, hours of time spent investing may "wiggle" up but must eventually decline". Thus, rapid skill obsolescence may lead to lifelong learning.

The system under evaluation here leaves no room for varying the direct price of participation with age, i.e. $C(a) = C$. Furthermore, and quite obviously[10], increasing direct tuition costs, everything else being equal, will lead to a declining probability of training participation, i.e.

$$\frac{\partial \Pr(D=1)}{\partial C} \leq 0.$$

So direct government subsidies to training will likely increase the level of participation irrespective of age and thus enhance life-long learning. See footnote 8 above on size of these costs in the Danish context.

In addition to direct costs, indirect costs of participation may be of considerable importance. First of all, from the viewpoint of the participant, there is the issue of foregone earnings while participating, should participation take place during regular office hours, or the shadow price of time, should the training take place outside. Concerning the former, the employer may decide to compensate the employee fully in terms of wages leaving only differences in costs of effort between participating in training and normal work effort. Unfortunately, our data do not hold information on the extent to which employers compensate their participating employees beyond the government sponsored level of compensation – typically 60 to 80 percent of earnings – but a tentative indication may be that 95 percent of the government compensation in connection with vocational and technical courses gets passed on directly to the employer whereas this was only the case for 36 percent of the

[10] We will refrain from any discussions of general equilibrium effects of training tuitions here and throughout the rest of the paper and instead refer the reader to Heckman, Lochner & Taber (1998) on these issues.

compensation paid to those participating in basic education and 45 percent of those participating in post secondary education, see Trepartsudvalget (2006).

For the employer, the costs of sending a member of the workforce on training are directly related to the difference between the marginal product of the worker undertaking training and the level of the potential government subsidy. In this respect, the employer is only willing to let the employee engage in training during working hours if the expected future productivity gains from this training engagement accruing to the firm exceed the cost. Productivity measures such as hourly and relative wage (see Lynch (1992) and Barron, Berger & Black (1999)), level of education (see Bishop (1997)) and prior training are therefore expected to influence the participation decision. Furthermore, firm characteristics such as industry, sector (see Arulampalam, Bryan & Booth (2004)), size (see Black, Noel & Wang (1999)), employee composition, wage rates, and training histories among workers may explain indirect costs of training as well.

Given that employment status is likely correlated with net gains of training, it is maybe not surprising, that labor force dynamics have been shown to be pivotal in predicting training participation, Heckman & Smith (1999). More specifically it has been found that training is often used as a stepping stone among non-participants in the labor market to remedy a lack of (or at this point depreciated) existing human capital. Entering the state of unemployment from employment is also found to predict training participation as this greatly lowers the opportunity cost of participating.

As already touched upon in the previous section, a potential source of variation in the incidence and intensity of training across the working life cycle and across genders is the family structure in general and the presence of dependent children in particular. These will influence the participation decision by changing the cost of time.

Finally, there may be a consumption motive (or non-market benefits) of human capital in play as well in determining the indirect cost of participation, see Heckman (1976). It is often found that education begets education; see for instance Carneiro & Heckman (2003) and Cunha & Heckman (2007). This may to some extent indicate heterogeneity in terms of taste for education and not just differences in returns. Moreover, with the potential presence of initial search costs (it may be costly

time-wise to familiarize oneself with the supply of these courses and the governmental compensation schemes for the first time) we may observe that previous contact with these training courses leads to an increased likelihood of future participation beyond what is to be expected from complementarities between past and potential present training. That is, *awareness* of possible programs, which may also come via union membership (see Acemoglu & Pischke (1999)) may play an important role. See also Heckman & Smith (1999) for a discussion of this pattern in the case of social program participation.

The next section will present our data set in more detail along with variables instrumental in relating the theoretical model to our empirical analysis.

4. Data

We employ a register-based panel data set maintained by Statistics Denmark from 1990-2002. The register data set contains information on a representative sample of 10% of all Danish individuals in the 15-74 age bracket. The data consist of two main parts. Firstly, they include a long list of socio-economic variables measured on a yearly basis in addition to merged employer information extracted from the integrated database for labor market research and the income registers in Statistics Denmark. Secondly, we know the history of training including exact timing and duration. See Table A3 for a description of the variables used in the conditioning set below. All information in the conditioning set is measured prior to participation. We distinguish between three sets of variables: personal characteristics (e.g age, family status, and type of education), career related characteristics (e.g labor market experience and previous labor market training), and firm characteristics (e.g. number of employees, industry, and labor market training behavior at the workplace) in our estimations below.

Table 2 shows descriptive statistics for a series of our variables along with information on the different training programs. For participants enrolling in more than one course of a given type during a calendar year we use only the course with the earliest starting date. By far the largest group consists of those engaging in vocational and technical training, with basic and post secondary training of more equal size. Furthermore, as already indicated by Figures 1 and 2, women tend to

participate more in basic training, whereas it is not surprisingly the more educated and those in managerial positions who participate in post-secondary training.

TABLE 2

NUMBER OF OBSERVATIONS AND SELECTED CHARACTERISTICS, 1992-2002

	Basic Courses	Vocational and Technical Courses	Post Secondary Courses	Non-Participants
Observations	95.782	246.571	92.010	2.925.452
Share of women (in %)	68	41	56	48
Education (mean)	2,28	2,47	3,7	2,63
Outside Labor Force (in %)…	19	5	4	11
and in Formal Education (in %)	3	1	1	3
Unemployed (in %)	21	9	4	8
Self-Employed (in %)	3	3	1	8
Employed (in %)…	56	83	90	74
in Higher Management (in %)	8	9	45	16
in Lower Management (in %)	14	15	23	16
as Skilled Worker (in %)	18	40	14	23
as Unskilled Worker (in %)	10	15	3	12
Other (in %)	6	4	5	7
Duration of training (mean calendar days)	227	25	206	•
ECTS (mean credit points)	6	2	6	•

Note: Education is measured as basic(1), high school(2), vocational(3), 1-3 years of college(4), 3-4 years of college(5), and 4 or more years of college(6), job position is measured as uskilled(1), skilled(2), lower management(3), and higher management(4). ECTS is *The European Credit Transfer and Accumulation System* with one credit corresponding to 25 to 30 working hours and with 60 ECTS assumed equivalent to a workload of a full-time student during one academic year.

The average intended or planned duration of the vocational courses is only 25 days. The intensity is high, however, with average workloads of 50 to 60 working hours. In contrast, the basic and post-secondary courses typically stretch over eight months or more, with a resulting lower workload per time unit.

Table 3 documents that there is considerable persistence in training over time.[11] This is most pronounced for post-secondary training: 57 percent of those who participated in post secondary training in a given year also participated in the year immediately prior to this compared to "only" 27 and 25 for basic and vocational, respectively. The shares decrease slightly when we backtrack an additional year.

[11] Persistence in training is also observed in Bassanini, Booth, Brunello, de Paola & Leuven (2006).

TABLE 3

TRANSITION MATRIX

	Choice	T={1992,…,2002) Non-Participation	Basic Training	Vocational Training	Post Secondary	Total
T-1={1991,…,2001}	Nonparticipation	2.673.898	53.491	174.351	43.842	2.945.582
	Row Percentage	[91]	[2]	[6]	[1]	[100]
	Column Percentage	(91)	(56)	(71)	(48)	(84)
	Basic Training	54.811	35.278	8.266	2.809	101.164
	Row Percentage	[54]	[35]	[8]	[3]	[100]
	Column Percentage	(2)	(37)	(3)	(3)	(2)
	Vocational Training	163.705	8.329	61.191	7.214	240.439
	Row Percentage	[68]	[3]	[25]	[3]	[100]
	Column Percentage	(6)	(9)	(25)	(8)	(10)
	Post Secondary Training	41.157	2.199	7.129	42.692	93.177
	Row Percentage	[44]	[2]	[8]	[46]	[100]
	Column Percentage	(1)	(2)	(3)	(46)	(5)
T-2={1990,…2000}	Nonparticipation	2.651.985	69.196	189.717	56.809	2.967.707
	Row Percentage	[89]	[2]	[6]	[2]	[100]
	Column Percentage	(91)	(72)	(77)	(62)	(85)
	Basic Training	69.050	19.043	8.238	3.008	99.339
	Row Percentage	[70]	[19]	[8]	[3]	[100]
	Column Percentage	(2)	(20)	(3)	(3)	(2)
	Vocational Training	166.938	7.420	45.187	6.282	225.827
	Row Percentage	[74]	[3]	[20]	[3]	[100]
	Column Percentage	(6)	(8)	(18)	(7)	(9)
	Post Secondary Training	47.908	2.030	6.604	28.857	85.399
	Row Percentage	[56]	[2]	[8]	[34]	[100]
	Column Percentage	(2)	(2)	(3)	(31)	(4)

Note: The 'non-participation' categories contain those who did not participate in any training during the year. Participants may appear more than once in each column but only once in each cell.

5. Results

The following two subsections present the results from our econometric analysis. First, we investigate the extramarginal decision; the propensity to enroll. We next analyse the intramarginal decision; the intensity of training conditional on enrolment. We investigate these decisions separately for each gender and each of the three types of training discussed above.

5.1 Results: the Propensity to Enroll in Formal Government Co-sponsored Training

This subsection presents the first part of our empirical analysis. We model the probability of enrolment during 1992-2002 for the Danish population. That is, our outcome of interest is a dummy taking the value one if the individual enrolled in at least one course in a given year and is zero otherwise. We estimate gender- and training type specific logit models.

TABLE 4

MEAN OF INCREMENTAL EFFECTS AND STANDARD ERRORS FROM PARTICIPATION LOGITS BASIC TRAINING[a]

	Women							
	Marginal Effect	Std. Error	Marginal Effect	Std. Error	Marginal Effect	Std. Error	Marginal Effect	Std. Error
Age 19 or below	**4.29**	0.13	**2.06**	0.12	**2.73**	0.13	**2.78**	0.13
Age 20 to 24	**2.23**	0.08	**1.98**	0.09	**1.14**	0.06	**1.15**	0.07
Age 30 to 34	**-0.47**	0.06	**-0.55**	0.06	**-0.27**	0.05	**-0.28**	0.05
Age 35 to 39	**-0.26**	0.06	**-0.61**	0.07	**-0.25**	0.05	**-0.25**	0.05
Age 40 to 44	0.08	0.07	**-0.39**	0.07	-0.06	0.06	-0.07	0.06
Age 45 to 49	**0.45**	0.07	0.04	0.08	**0.17**	0.06	**0.16**	0.06
Age 50 to 54	**0.31**	0.07	0.00	0.08	**0.19**	0.06	**0.17**	0.06
Age 55 to 59	**0.41**	0.08	**0.04**	0.09	**0.15**	0.07	0.10	0.07
Age 60 or above	**-1.13**	0.08	**-1.47**	0.08	**-0.54**	0.07	**-0.57**	0.07
Controls for								
personal characteristics and year	NO		YES		YES		YES	
career related characteristics	NO		NO		YES		YES	
firm characteristics	NO		NO		NO		YES	
Share of correct predictions								
participants	0.251		0.585		0.573		0.575	
non-participants	0.842		0.588		0.859		0.860	

[a]Estimated incremental effects are multiplied by 100. Thus mean incremental effects should be interpreted as the per cent difference in the propensity to participate in training relative to the excluded group
Bold effects are significant at the 5% level and italic at the 10% level. Effects calculated using Jonah B. Gelbach's margfx.ado, version 4.3

Tables 4-9 show the mean incremental effects of age on the enrolment in basic, vocational, and post-secondary training for men and women in the overall population.[12,13] Incremental effects are multiplied by 100; thus the interpretation is percentage change in the propensity to participate in a given type of training relative to the excluded group (25-30 year olds). It should be kept in mind that that we are merely investigating conditional means, *not* attempting to inform on causality.

[12] See Appendix B for discussion of results incorporating fixed effects.
[13] We realise that there may be cohort differences in the take-up of training that differ from age and time effects. See Appendix D for descriptive evidence following Deaton (1997).

TABLE 5

MEAN OF INCREMENTAL EFFECTS AND STANDARD ERRORS FROM PARTICIPATION LOGITS BASIC TRAINING[a]

	Men							
	Marginal Effect	Std. Error	Marginal Effect	Std. Error	Marginal Effect	Std. Error	Marginal Effect	Std. Error
Age 19 or below	**0.96**	0.06	**0.25**	0.06	**0.59**	0.06	**0.61**	0.06
Age 20 to 24	**0.89**	0.05	**0.61**	0.05	**0.40**	0.03	**0.40**	0.03
Age 30 to 34	**-0.50**	0.03	**-0.35**	0.04	**-0.17**	0.03	**-0.17**	0.03
Age 35 to 39	**-0.61**	0.03	**-0.48**	0.04	**-0.20**	0.03	**-0.21**	0.03
Age 40 to 44	**-0.65**	0.03	**-0.59**	0.04	**-0.24**	0.03	**-0.25**	0.03
Age 45 to 49	**-0.70**	0.03	**-0.68**	0.04	**-0.28**	0.03	**-0.29**	0.03
Age 50 to 54	**-0.71**	0.03	**-0.71**	0.04	**-0.26**	0.03	**-0.28**	0.03
Age 55 to 59	**-0.61**	0.03	**-0.61**	0.04	**-0.21**	0.03	**-0.24**	0.03
Age 60 or above	**-0.56**	0.04	**-0.57**	0.05	**-0.12**	0.04	**-0.15**	0.04
Controls for								
personal characteristics and year	NO		YES		YES		YES	
career related characteristics	NO		NO		YES		YES	
firm characteristics	NO		NO		NO		YES	
Share of correct predictions								
participants	0.442		0.552		0.608		0.619	
non-participants	0.712		0.652		0.828		0.829	

[a]Estimated incremental effects are multiplied by 100. Thus mean incremental effects should be interpreted as the per cent difference in the propensity to participate in training relative to the excluded group
Bold effects are significant at the 5% level and italic at the 10% level. Effects calculated using Jonah B. Gelbach's margfx.ado, version 4.3

Tables 4 and 5 depict participation patterns for basic training over the life-cycle. The excluded age category is 25-29 year olds. We first consider women. Here, the participation pattern clearly varies with age: women aged 24 or younger are significantly more likely to participate compared to 25-29 year olds, whereas women in the child bearing age (30-44) are less likely to enroll in basic training. Once the women turn 45, participation levels increase again only to decrease around age 60. This pattern is robust to the inclusion of family and educational information, career related information, and firm related information, though mean incremental effects do change somewhat with the conditioning set. Adding family and educational information to the conditioning set, in particular, reduces the probability that women aged 40-54 enroll in basic training. Thus, high participation rates for this group seem to be driven by the facts that women in these age groups are not as likely to have young children and may have a type of education that needs updating or is obsolete. For men, we find a clear downward trend in basic training participation over the working lifecycle, as was also evident in Figure 1. Again, the results are robust to changes in the conditioning set.

TABLE 6

MEAN OF INCREMENTAL EFFECTS AND STANDARD ERRORS FROM PARTICIPATION LOGITS VOCATIONAL TRAINING[a]

	Women							
	Marginal Effect	Std. Error	Marginal Effect	Std. Error	Marginal Effect	Std. Error	Marginal Effect	Std. Error
Age 19 or below	**-3.11**	0.07	**-3.05**	0.08	**1.18**	0.15	**1.06**	0.14
Age 20 to 24	**-0.85**	0.07	**-0.56**	0.08	**0.50**	0.07	**0.38**	0.07
Age 30 to 34	**0.73**	0.08	**0.35**	0.08	0.01	0.06	0.05	0.06
Age 35 to 39	**1.15**	0.08	**0.60**	0.09	0.11	0.07	**0.22**	0.06
Age 40 to 44	**1.25**	0.08	**0.73**	0.10	**0.17**	0.07	**0.35**	0.07
Age 45 to 49	**0.78**	0.08	**0.47**	0.10	0.04	0.07	**0.28**	0.07
Age 50 to 54	-0.12	0.08	**-0.43**	0.09	**-0.43**	0.07	-0.10	0.07
Age 55 to 59	**-2.36**	0.07	**-2.48**	0.08	**-1.64**	0.06	**-1.20**	0.06
Age 60 or above	**-4.90**	0.06	**-4.88**	0.06	**-2.93**	0.06	**-2.48**	0.06
Controls for								
personal characteristics and year	NO		YES		YES		YES	
career related characteristics	NO		NO		YES		YES	
firm characteristics	NO		NO		NO		YES	
Share of correct predictions								
participants	0.713		0.676		0.697		0.708	
non-participants	0.382		0.591		0.669		0.683	

[a]Estimated incremental effects are multiplied by 100. Thus mean incremental effects should be interpreted as the per cent difference in the propensity to participate in training relative to the excluded group
Bold effects are significant at the 5% level and italic at the 10% level. Effects calculated using Jonah B. Gelbach's margfx.ado, version 4.3

Tables 6 and 7 show the results for vocational training. The conclusions vary somewhat with the conditioning set; in models with only controls for age as well as family and educational information it seems that women aged 30-49 participate more than do both younger and older women. Adding controls for career related and firm characteristics changes this slightly such that only women aged 55 or above are less likely to participate compared to the excluded group of 25-29 year olds. For men, we see the exact same pattern as for basic training.

TABLE 7

MEAN OF INCREMENTAL EFFECTS AND STANDARD ERRORS FROM PARTICIPATION LOGITS VOCATIONAL TRAINING[a]

	Men							
	Marginal Effect	Std. Error	Marginal Effect	Std. Error	Marginal Effect	Std. Error	Marginal Effect	Std. Error
Age 19 or below	**-5.46**	0.07	**-5.28**	0.08	**-1.42**	0.11	**-1.07**	0.11
Age 20 to 24	**-0.91**	0.07	-0.12	0.09	**0.63**	0.08	**0.57**	0.07
Age 30 to 34	**-0.25**	0.07	**-0.73**	0.08	**-0.43**	0.06	**-0.41**	0.06
Age 35 to 39	**-0.45**	0.07	**-1.04**	0.09	**-0.55**	0.07	**-0.49**	0.07
Age 40 to 44	**-1.05**	0.07	**-1.42**	0.09	**-0.76**	0.08	**-0.66**	0.07
Age 45 to 49	**-1.80**	0.07	**-1.82**	0.09	**-0.97**	0.08	**-0.83**	0.07
Age 50 to 54	**-2.57**	0.07	**-2.52**	0.09	**-1.39**	0.07	**-1.24**	0.07
Age 55 to 59	**-4.40**	0.06	**-4.30**	0.08	**-2.65**	0.07	**-2.44**	0.06
Age 60 or above	**-6.98**	0.05	**-6.80**	0.06	**-4.16**	0.07	**-3.86**	0.06
Controls for								
personal characteristics and year	NO		YES		YES		YES	
career related characteristics	NO		NO		YES		YES	
firm characteristics	NO		NO		NO		YES	
Share of correct predictions								
participants	0.709		0.694		0.699		0.715	
non-participants	0.400		0.563		0.676		0.680	

[a]Estimated incremental effects are multiplied by 100. Thus mean incremental effects should be interpreted as the per cent difference in the propensity to participate in training relative to the excluded group
Bold effects are significant at the 5% level and italic at the 10% level. Effects calculated using Jonah B. Gelbach's margfx.ado, version 4.3

Finally, Tables 8 and 9 shed light on participation in post-secondary training. Here, there are no differences across genders: both participate the most around ages 25-29 and a higher age is correlated with a lower propensity to take up post-secondary training. This is true no matter the conditioning set.

TABLE 8

MEAN OF INCREMENTAL EFFECTS AND STANDARD ERRORS FROM PARTICIPATION LOGITS POST-SECONDARY TRAINING[a]

	Women							
	Marginal Effect	Std. Error	Marginal Effect	Std. Error	Marginal Effect	Std. Error	Marginal Effect	Std. Error
Age 19 or below	**-2.45**	0.04	**-0.79**	0.09	**0.26**	0.06	**0.24**	0.05
Age 20 to 24	**-0.16**	0.05	**0.61**	0.06	**0.38**	0.03	**0.34**	0.03
Age 30 to 34	**-0.88**	0.04	**-1.12**	0.04	**-0.35**	0.02	**-0.27**	0.02
Age 35 to 39	**-0.69**	0.04	**-1.51**	0.04	**-0.44**	0.02	**-0.34**	0.02
Age 40 to 44	**-0.23**	0.05	**-1.74**	0.04	**-0.56**	0.02	**-0.44**	0.02
Age 45 to 49	**-0.43**	0.05	**-1.78**	0.04	**-0.67**	0.02	**-0.55**	0.01
Age 50 to 54	**-1.02**	0.04	**-1.74**	0.04	**-0.73**	0.02	**-0.60**	0.01
Age 55 to 59	**-1.95**	0.04	**-2.09**	0.04	**-0.85**	0.02	**-0.69**	0.01
Age 60 or above	**-2.84**	0.03	**-2.86**	0.03	**-1.01**	0.01	**-0.82**	0.01
Controls for								
personal characteristics and year	NO		YES		YES		YES	
career related characteristics	NO		NO		YES		YES	
firm characteristics	NO		NO		NO		YES	
Share of correct predictions								
participants	0.721		0.716		0.774		0.788	
non-participants	0.392		0.769		0.858		0.866	

[a]Estimated incremental effects are multiplied by 100. Thus mean incremental effects should be interpreted as the per cent difference in the propensity to participate in training relative to the excluded group
Bold effects are significant at the 5% level and italic at the 10% level. Effects calculated using Jonah B. Gelbach's margfx.ado, version 4.3

Arulampalam et al. (2004) interpret the case with no significant (or, with large samples, only small) differences in participation with age as evidence of lifelong learning. In this light, conditioning on our rich set of explanatory variables implies that post-secondary training shows no signs of lifelong learning no matter the gender.

TABLE 9

MEAN OF INCREMENTAL EFFECTS AND STANDARD ERRORS FROM PARTICIPATION LOGITS POST-SECONDARY TRAINING[a]

	Men							
	Marginal Effect	Std. Error	Marginal Effect	Std. Error	Marginal Effect	Std. Error	Marginal Effect	Std. Error
Age 19 or below	**-2.08**	0.02	**-1.18**	0.06	**-0.29**	0.03	**-0.20**	0.03
Age 20 to 24	**-0.53**	0.03	**-0.17**	0.04	**0.05**	0.02	**0.04**	0.02
Age 30 to 34	**-0.84**	0.03	**-0.92**	0.03	**-0.23**	0.01	**-0.18**	0.01
Age 35 to 39	**-1.28**	0.03	**-1.57**	0.03	**-0.40**	0.01	**-0.32**	0.01
Age 40 to 44	**-1.28**	0.03	**-1.92**	0.03	**-0.51**	0.01	**-0.42**	0.01
Age 45 to 49	**-1.45**	0.03	**-2.13**	0.03	**-0.60**	0.01	**-0.49**	0.01
Age 50 to 54	**-1.77**	0.02	**-2.20**	0.02	**-0.68**	0.01	**-0.55**	0.01
Age 55 to 59	**-2.04**	0.02	**-2.24**	0.02	**-0.74**	0.01	**-0.59**	0.01
Age 60 or above	**-2.26**	0.02	**-2.39**	0.02	**-0.79**	0.01	**-0.63**	0.01
Controls for								
personal characteristics and year	NO		YES		YES		YES	
career related characteristics	NO		NO		YES		YES	
firm characteristics	NO		NO		NO		YES	
Share of correct predictions								
participants	0.560		0.741		0.774		0.788	
non-participants	0.632		0.765		0.866		0.870	

[a]Estimated incremental effects are multiplied by 100. Thus mean incremental effects should be interpreted as the per cent difference in the propensity to participate in training relative to the excluded group
Bold effects are significant at the 5% level and italic at the 10% level. Effects calculated using Jonah B. Gelbach's margfx.ado, version 4.3

Even if the probability of participating in training is decreasing in age, however, the level of training may still be high for older cohorts indicating lifelong learning. Similarly, the level of participation may be very low for all age groups, in which case there would seem to be lifelong learning when in reality there is none. An alternative way to look for signs of lifelong learning, therefore, is to consider the size of the age effects relative to the level of enrolment.

In our sample, 1.8% of the male population enrolls in basic training, 8.1% in vocational training, and 2.1% in post secondary training. To conclude that there is no evidence of lifelong learning in vocational training seems, therefore, to be misleading: Though the probability of participating in vocational training *is* reduced by around 3 percentage points (around 40% lower enrolment than the mean) for men aged 55-59 and around 4 percentage points for men aged 60 or older (around 50% lower enrolment than the mean) this means that we will still predict a significant share of older men to receive training, *ceteris paribus*. For post-secondary training, however, the story is quite different. Here, the share of men receiving training becomes very small after the age of 45.

For women, 4.1% enroll in basic training, 5.7% in vocational training, and 2.9% in post-secondary training. Again, though the probability that women aged 55-59 receive basic training is reduced by around 1 percentage points (around 25% lower enrolment than the mean) compared to 25-29 year olds, the share receiving this type of training is still substantial, *ceteris paribus*. Similarly, the probability that women aged 60 or above receive vocational training is about 2.5 percentage points lower compared to the excluded group (around 40% lower enrolment than the mean). Thus it is still fair to say that significant enrolment in vocational training takes place over the lifecycle. Post-secondary training participation levels are low for women aged 35 and above.

To sum up, we find evidence of considerable lifelong enrolment with regards to basic and vocational training regardless of gender, whereas post-secondary training usually takes place early in life.

5.2 Results: the Intensity of Training

The second part of our empirical analysis is an analysis of the intensity of training. In particular, we model intensity of training in a given year conditional on enrolling in training for the period 1992-2002. The outcome variable is continuous and lies between 0 and 120, where 60 is equivalent to a full year of training using the European Credit Transfer and Accumulation System (ECTS), see note to Table 2. We estimate gender- and training type specific OLS models. Results are shown in Tables 11-15.[14]

Conditional of enrolment, a member of the male population will on average participate in basic training with a workload equivalent to 12.5 ECTS. For vocational and post-secondary training the average yearly workloads correspond to 4.1 and 10.0 ECTS, respectively. For women, the numbers hardly differ from those of men: 13.2 ECTS for basic training, 4.0 ECTS for vocational training, and 8.3 ECTS for post-secondary training. I.e. most of the differences in training participation between the genders stem from enrolment, not intensity. Comparing the numbers with those in the bottom row in Table 2, we see that conditional on enrolment in a given year, an average participant

[14] See Appendix C for discussion of results incorporating fixed effects.

will be participating in two basic courses and two vocational courses, but only one and half course of the post-secondary type.

Tables 10 and 11 show the results for basic training for women and men. The patterns are the same for both genders: The models suggest that young individuals participate more intensely in training conditional on enrolling, yet if we compare coefficient estimates to average levels of course loads (see above), there is still considerable training taking place at older ages. The addition of covariates renders the coefficients largely unchanged.

TABLE 10

COEFFICIENT ESTIMATES AND STANDARD ERRORS FROM INTENSITY (ECTS) OLS WOMEN IN BASIC TRAINING[a]

	Coef. Estimate	Std. Error	Coef. Estimate	Std. Error	Coef. Estimate	Std. Error	Coef. Estimate	Std. Error
Age 19 or below	**5.64**	0.24	**5.93**	0.24	**4.44**	0.26	**4.43**	0.27
Age 20 to 24	**2.70**	0.18	**2.82**	0.19	**2.27**	0.20	**2.26**	0.20
Age 30 to 34	**-0.96**	0.18	**-0.92**	0.20	**-0.66**	0.20	**-0.66**	0.20
Age 35 to 39	**-2.04**	0.18	**-1.87**	0.21	**-1.29**	0.22	**-1.27**	0.22
Age 40 to 44	**-3.36**	0.18	**-2.97**	0.22	**-1.80**	0.23	**-1.78**	0.23
Age 45 to 49	**-3.90**	0.18	**-3.31**	0.21	**-2.03**	0.23	**-2.00**	0.23
Age 50 to 54	**-4.26**	0.18	**-3.56**	0.22	**-2.28**	0.24	**-2.27**	0.24
Age 55 to 59	**-3.60**	0.24	**-2.88**	0.24	**-2.31**	0.26	**-2.29**	0.27
Age 60 or above	**-5.82**	0.36	**-5.06**	0.37	**-3.82**	0.38	**-3.81**	0.38
Controls for								
personal characteristics and year	NO		YES		YES		YES	
career related characteristics	NO		NO		YES		YES	
firm characteristics	NO		NO		NO		YES	
R^2	0.055		0.062		0.173		0.174	

[a]Bold coefficients are significant at the 5% level and italic at the 10% level. ECTS is *European Credit Transfer and Accumulation System* with one credit corresponding to 25 to 30 working hours and with 60 ECTS assumed equivalent to a workload of a full time student during one academic year

TABLE 11

COEFFICIENT ESTIMATES AND STANDARD ERRORS FROM INTENSITY (ECTS) OLS MEN IN BASIC TRAINING[a]

	Coef. Estimate	Std. Error	Coef. Estimate	Std. Error	Coef. Estimate	Std. Error	Coef. Estimate	Std. Error
Age 19 or below	**2.95**	0.32	**2.40**	0.32	**1.80**	0.37	**1.87**	0.37
Age 20 to 24	**2.04**	0.23	**1.73**	0.24	**1.77**	0.25	**1.69**	0.25
Age 30 to 34	**-1.91**	0.27	**-1.50**	0.27	**-1.34**	0.28	**-1.32**	0.28
Age 35 to 39	**-3.13**	0.29	**-2.39**	0.29	**-1.91**	0.32	**-1.95**	0.32
Age 40 to 44	**-4.06**	0.29	**-2.96**	0.31	**-2.09**	0.34	**-2.15**	0.34
Age 45 to 49	**-5.03**	0.29	**-3.79**	0.31	**-2.53**	0.34	**-2.64**	0.34
Age 50 to 54	**-5.01**	0.31	**-3.62**	0.32	**-2.26**	0.36	**-2.41**	0.36
Age 55 to 59	**-4.60**	0.33	**-3.22**	0.35	**-2.39**	0.39	**-2.55**	0.39
Age 60 or above	**-5.43**	0.43	**-3.87**	0.45	**-2.87**	0.49	**-3.00**	0.49
Controls for								
personal characteristics and year	NO		YES		YES		YES	
career related characteristics	NO		NO		YES		YES	
firm characteristics	NO		NO		NO		YES	
R^2	0.047		0.061		0.170		0.174	

[a]Bold coefficients are significant at the 5% level and italic at the 10% level. ECTS is *European Credit Transfer and Accumulation System* with one credit corresponding to 25 to 30 working hours and with 60 ECTS assumed equivalent to a workload of a full time student during one academic year

We consider next vocational training. The model for women displays no strong age profile. For men age significantly reduces the number of hours spent in training and this conclusion is robust no matter the set of covariates. The coefficient estimates are very small, however.

TABLE 12

COEFFICIENT ESTIMATES AND STANDARD ERRORS FROM INTENSITY (ECTS) OLS
WOMEN IN VOCATIONAL TRAINING[a]

	Coef. Estimate	Std. Error	Coef. Estimate	Std. Error	Coef. Estimate	Std. Error	Coef. Estimate	Std. Error
Age 19 or below	**0.42**	0.12	**0.43**	0.12	**0.49**	0.13	**0.35**	0.13
Age 20 to 24	0.00	0.06	0.02	0.07	**0.14**	0.07	*0.13*	0.07
Age 30 to 34	**0.12**	0.06	0.09	0.06	**0.26**	0.06	**0.24**	0.06
Age 35 to 39	**-0.18**	0.06	-0.09	0.06	**0.19**	0.07	**0.19**	0.07
Age 40 to 44	**-0.18**	0.06	-0.04	0.07	**0.23**	0.08	**0.22**	0.08
Age 45 to 49	**-0.24**	0.06	*-0.13*	0.07	**0.22**	0.08	**0.18**	0.08
Age 50 to 54	**-0.36**	0.06	**-0.26**	0.07	*0.14*	0.08	0.09	0.08
Age 55 to 59	**-0.54**	0.06	**-0.43**	0.09	-0.06	0.10	-0.10	0.10
Age 60 or above	**-1.02**	0.18	**-0.94**	0.19	**-0.63**	0.19	**-0.67**	0.19
Controls for								
personal characteristics and year	NO		YES		YES		YES	
career related characteristics	NO		NO		YES		YES	
firm characteristics	NO		NO		NO		YES	
R^2	0.001		0.024		0.077		0.090	

[a]Bold coefficients are significant at the 5% level and italic at the 10% level. ECTS is *European Credit Transfer and Accumulation System* with one credit corresponding to 25 to 30 working hours and with 60 ECTS assumed equivalent to a workload of a full time student during one academic year

TABLE 13

COEFFICIENT ESTIMATES AND STANDARD ERRORS FROM INTENSITY (ECTS) OLS
MEN IN VOCATIONAL TRAINING[a]

	Coef. Estimate	Std. Error	Coef. Estimate	Std. Error	Coef. Estimate	Std. Error	Coef. Estimate	Std. Error
Age 19 or below	**0.70**	0.09	**0.43**	0.09	**0.57**	0.10	**0.47**	0.10
Age 20 to 24	**0.23**	0.04	**0.10**	0.04	**0.22**	0.05	**0.22**	0.05
Age 30 to 34	**-0.17**	0.04	**-0.09**	0.04	**-0.11**	0.05	**-0.13**	0.05
Age 35 to 39	**-0.30**	0.04	**-0.15**	0.04	**-0.14**	0.05	**-0.17**	0.05
Age 40 to 44	**-0.38**	0.04	**-0.22**	0.05	**-0.15**	0.06	**-0.19**	0.06
Age 45 to 49	**-0.41**	0.05	**-0.24**	0.05	-0.10	0.06	**-0.15**	0.06
Age 50 to 54	**-0.52**	0.05	**-0.36**	0.05	**-0.16**	0.06	**-0.23**	0.06
Age 55 to 59	**-0.64**	0.06	**-0.46**	0.06	**-0.28**	0.07	**-0.34**	0.07
Age 60 or above	**-1.05**	0.12	**-0.86**	0.12	**-0.57**	0.12	**-0.63**	0.12
Controls for								
personal characteristics and year	NO		YES		YES		YES	
career related characteristics	NO		NO		YES		YES	
firm characteristics	NO		NO		NO		YES	
R^2	0.004		0.020		0.078		0.088	

[a]Bold coefficients are significant at the 5% level and italic at the 10% level. ECTS is *European Credit Transfer and Accumulation System* with one credit corresponding to 25 to 30 working hours and with 60 ECTS assumed equivalent to a workload of a full time student during one academic year

Finally, we consider post secondary training. The pattern is the same across genders: without conditioning variables there is a considerable age gradient. This becomes much weaker, though, once career and firm characteristics are accounted for, demonstrating significant evidence of life-long learning.

TABLE 14

COEFFICIENT ESTIMATES AND STANDARD ERRORS FROM INTENSITY (ECTS) OLS WOMEN IN POST SECONDARY TRAINING[a]

	Coef. Estimate	Std. Error	Coef. Estimate	Std. Error	Coef. Estimate	Std. Error	Coef. Estimate	Std. Error
Age 19 or below	**-0.24**	0.30	-0.25	0.33	0.47	0.33	0.59	0.33
Age 20 to 24	**1.38**	0.12	**1.22**	0.13	**0.51**	0.14	**0.54**	0.14
Age 30 to 34	**-0.96**	0.12	**-0.37**	0.14	0.21	0.14	0.26	0.14
Age 35 to 39	**-1.92**	0.12	**-1.03**	0.15	0.20	0.16	0.30	0.16
Age 40 to 44	**-2.76**	0.12	**-1.92**	0.15	**0.37**	0.17	**0.53**	0.17
Age 45 to 49	**-3.48**	0.12	**-2.99**	0.15	0.28	0.17	**0.56**	0.17
Age 50 to 54	**-5.10**	0.12	**-4.91**	0.16	**-0.81**	0.18	**-0.43**	0.18
Age 55 to 59	**-6.36**	0.18	**-6.42**	0.21	**-1.71**	0.22	**-1.32**	0.23
Age 60 or above	**-7.56**	0.54	**-7.77**	0.51	**-2.75**	0.47	**-2.36**	0.47
Controls for								
personal characteristics and year	NO		YES		YES		YES	
career related characteristics	NO		NO		YES		YES	
firm characteristics	NO		NO		NO		YES	
R^2	0.057		0.071		0.251		0.260	

[a]Bold coefficients are significant at the 5% level and italic at the 10% level. ECTS is *European Credit Transfer and Accumulation System* with one credit corresponding to 25 to 30 working hours and with 60 ECTS assumed equivalent to a workload of a full time student during one academic year

TABLE 15

COEFFICIENT ESTIMATES AND STANDARD ERRORS FROM INTENSITY (ECTS) OLS MEN IN POST SECONDARY TRAINING[a]

	Coef. Estimate	Std. Error	Coef. Estimate	Std. Error	Coef. Estimate	Std. Error	Coef. Estimate	Std. Error
Age 19 or below	**0.33**	0.38	0.43	0.38	0.46	0.36	0.63	0.36
Age 20 to 24	**1.33**	0.13	**1.22**	0.13	**0.41**	0.13	**0.47**	0.13
Age 30 to 34	**-1.40**	0.14	**-0.94**	0.14	-0.08	0.13	-0.01	0.13
Age 35 to 39	**-2.71**	0.15	**-1.78**	0.16	0.11	0.16	0.18	0.16
Age 40 to 44	**-4.00**	0.15	**-2.73**	0.17	0.24	0.18	**0.38**	0.18
Age 45 to 49	**-5.27**	0.16	**-4.14**	0.18	-0.34	0.19	-0.09	0.19
Age 50 to 54	**-6.06**	0.19	**-5.36**	0.19	**-0.64**	0.21	-0.33	0.21
Age 55 to 59	**-6.54**	0.25	**-6.14**	0.25	**-0.86**	0.25	**-0.55**	0.26
Age 60 or above	**-8.35**	0.49	**-8.19**	0.49	**-2.09**	0.45	**-1.68**	0.45
Controls for								
personal characteristics and year	NO		YES		YES		YES	
career related characteristics	NO		NO		YES		YES	
firm characteristics	NO		NO		NO		YES	
R^2	0.086		0.096		0.321		0.331	

[a]Bold coefficients are significant at the 5% level and italic at the 10% level. ECTS is *European Credit Transfer and Accumulation System* with one credit corresponding to 25 to 30 working hours and with 60 ECTS assumed equivalent to a workload of a full time student during one academic year

6. Conclusion

In this paper we use a large administrative data set from Denmark covering the period 1990-2002 to examine the take-up of formal training over the working lifecycle for the entire population, thereby adding to a small empirical literature. Some influential players in the political arena (e.g. the OECD and the European Union) argue that formal training is necessary to offset skill obsolescence and enables employees to stay in the labor market over the entire lifecycle. It is therefore important to establish whether and to what extent lifelong formal learning actually exists. If it does not, and it is in fact true that formal training participation is crucial for maintaining and enhancing skills, it may be necessary to consider the institutional framework providing workers (and firms) with incentives to engage in training.

Our results show that men and women have different enrolment patterns: men are more likely to enroll in vocational courses, whereas women most often enrol in basic or post-secondary training courses. Additionally, our results demonstrate that once personal and career related characteristics

have been accounted for, firm characteristics seem of smaller importance for predicting course participation. This is, maybe not surprisingly, especially true for basic and post-secondary course enrolment, whereas firm characteristics do influence the take-up of vocational training beyond what can be explained by personal and career related characteristics.

Significant lifelong learning takes place in basic and vocational training. Post-secondary training, on the other hand, most often takes place while individuals are young. This is true for both genders. Thus, even when training participation is highly subsidized, as is the case in Denmark, it seems that for the older group of workers, the costs of participating in this latter type of courses are too high compared to the gains, monetary or otherwise. Potential reasons are that post-secondary courses are characterized by a heavier workload and may be more intellectually demanding vis-à-vis basic and vocational training. Finally, once the enrolment decision is made and once a comprehensive conditioning set is included there are no striking differences in hours in training with regards to gender. Neither hours in vocational nor hours in post-secondary training are strongly age dependent. Hours in basic training do decrease significantly with age but the effects are very small. We conclude that any important differences in training accumulation across genders and age groups stem from differences at the *extensive* rather than the *intensive* margin.

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Appendix A

TABLE A1

AVERAGE YEARS OF FORMAL SCHOOLING

	US		Denmark		OECD, mean	
Age	Men	Women	Men	Women	Men	Women
25-34	13.7	14.0	13.7	14.0	12.7	12.9
35-44	13.8	14.0	13.7	13.9	12.4	12.3
45-54	14.0	13.9	13.6	13.9	11.9	11.5
55-64	13.8	13.5	13.5	13.0	11.3	10.6

Source: OECD (2005).

TABLE A2

AGGREGATION OF TRAINING SCHEMES

Type	Men	Women
Basic Courses:	**30.311**	**65.471**
Primary and lower Secondary Schooling		
Low Level	3.883 (13)	7.069 (11)
Medium Level	7.867 (26)	17.013 (26)
High Level	6.598 (22)	15.279 (23)
High School Equivalents	11.963 (39)	26.110 (40)
Vocational and Technical Courses:	**145.854**	**100.717**
Educational	287 (0)	2.693 (3)
Commercial & Clerical	27.672 (19)	43.334 (43)
Construction	9.935 (7)	953 (1)
Industrial	51.075 (35)	15.180 (15)
Graphical	1.038 (1)	478 (0)
Clothing & Textile	6.721 (5)	6.685 (7)
Service	3.855 (3)	6.456 (6)
Food & Beverages	4.193 (3)	5.002 (5)
Agricultural	5.146 (4)	1.011 (1)
Transportation	25.517 (17)	2.927 (3)
Health	248 (0)	2.915 (3)
Security	121 (0)	8 (0)
Other	10.046 (7)	13.075 (13)
Post Secondary Courses:	**40.719**	**51.291**
Associate's degree, Business	18.811 (46)	21.791 (42)
Associate's degree, Technical Studies	1.981 (5)	851 (2)
Associate's degree, Language	49 (0)	738 (1)
Continuing Education for Teachers	11.608 (29)	24.002 (47)
MBA	8.270 (20)	3.909 (8)

Note: Numbers in parentheses denote percentage of subgroup totals (in bold).

TABLE A3

DEFINITION OF VARIABLES

Variable Name	Description
Gender "woman"	Indicator variable taking the value 1 if woman.
Age "age 18 to 24", "age 25 to 29", "age 30 to 39", "age 40 to 49", "age above 50"	Indicator variables for the relevant agebracket of the individual. "age 40 to 49" used as reference category.
Cohabitation Status currently single	Indicator variabel for cohabitation status.
Children "children 0-2", "children 3-6", "children 7-9", "children 10-14", "children 15-17"	Indicator variables for presence of children in relevant agebracket in household.
Country of Origin "OECD", "non-OECD"	Indicator variables for country of origin. Reference category is native Danes.
County	16 indicator variables for residential county.
Education "basic school", "high school", "vocational training", "1-3 years of college", "3-4 years of college", "4 or more years of college"	Indicator variable for the educational attainment in ordinary educational system. Reference category is "vocational training".
Time since Completion of Education "less than 1 year", "between 1 and 2 years", "between 2 and 5 years", "between 5 and 10 years", "more than 10 years"	Indicator variables for time since completion of ordinary education. Reference category is "between 1 and 2 years".
Type of Education "general", "educational", "humanities", "music and arts", "physical sciences", "social sciences", "construction", "metal", "graphics", "neddle work", "technical", "service","food and beverage", "agricultural", "transport", "health", "security".	Indicator variables for type of ordinary education. Reference category is "construction" for men and "health" for women.
Job Position "higher management", "lower management", "skilled", "unskilled".	Job position function. Reference category is "lower management".
Tenure "less than 1 quarter", "between 1 and 2 q.", "between 2 and 3 q.", "between 3 and 4 q., "between 1 and 2 years", "between 2 and 3 y.", "between 3 and 4 y.", "between 4 and 5 y.", "between 5 and 10 y.", "more than 10 years".	Indicator variables for the relevant tenure. "between 1 and 2 years" used as reference.
Experience	Labour market experience minus tenure in current job.
Labour market earnings, 1994 and 1995	
Unemployment "unempQ1_94", "unempQ2_94", "unempQ3_94", "unempQ4_94", "unempQ1_95", "unempQ2_95", "unempQ3_95".	Fraction of time spend unemployed in quarters leading up to training. Sample is selected such that everybody is fulltime employed in last quarter of 1995.
Union Status	Indicator taking the value 1 if member of labor union.
Distance to work	Distance between residence and work place, kilometers.
Hourly wage rate	Measured in 1995. Constructed from annual earnings and number of working hours.

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(Table A3 continued from previous page)

Relative hourly wage rate "ratio_higher", "ratio_lower", "ratio_skilled", "ratio_unskilled".	Hourly wage rate divided by average hourly wage rate within same position in firm
Sector	Indicator variable taking the value 1 if employed in public sector.
Industry "agriculture/fishery/mining/energy/water", "food/ alcohol/tobacco", "textiles", "metals", "other manufacturing", "construction", "trade/hotel/ restaurants", "transport/postal/communication", "banking/insurance", "consulting/real estate", "public services", "education", "health care", "social institutions", "other services".	Industry sector indicators of employment. "metal" is reference category.
Previous training by the individual "ibasic94", "ivoc94", "ipost94", "ibasic95", "ivoc95", "ipost95", "jbasic94", "jvoc94", "jpost94", "jbasic95" "jvoc95", "jpost95","nbasic94", "nvoc94", "npost94", "nbasic95","nvoc95","npost95","vbasic94","vvoc94", "vpost94", "vbasic95", "vvoc95", "vpost95", "wbasic94", "wvoc94", "wpost94", "wbasic95", "wvoc95", "wpost95".	Whether or not the individual started (i), wherther or not the individual completed (j), number (n) of and extent (v) to which the individual engaged in and completed (w) training in years leading up to 1996. Extent (v and w) is measured as a fraction between and 1 where 1 is equivalent to a year of full time study. v measures the fraction of time spent in training that did not result in completion and passing.
Number of employees relative to previous year "relative size"	Variable between 0 and 10, where 1 is unchanged number of employees at workplace.
Fraction of workforce departed	Fraction of workforce as of november 1994, who are no longer present in november 1995 at the workplace.
Total number of employees	Total number of (distinct) employees at the firm in 1995
Fraction of stayers	Fraction of workers employed 1994 among those employed in 1995
Composition of workforce "fraction unskilled", "fraction skilled", "fraction lower management", "fraction higher management". "fraction women among unskilled", "fraction women among skilled", "fraction women among lower management", "fraction women among higher management"	Variables between 0 and 1 (dummies included if exactly 0).
Average degree of unemployment	Average degree of unemployment in 1995 among employees experiencing at least one spell of unemployment in 1995.
Average number of unemployment spells	Average number of unemployment spells in 1995 among employees experiencing at least one spell of unemployment.
Hourly wage rate of workforce "average wage", "average wage, uskilled", "average wage, skilled", "average wage, lower management", "average wage, higher management".	Hourly average wage rate at workplace as of November 1995.
Training participation among co-workers. "w_part", "w_basic", "w_voc", "w_post", "f_part", "f_basic", "f_voc", "f_post".	Whether or not any co-worker participated in training (also partitioned into sub-groups of training type), and the fraction of the co-workers who participated in training. Both sets of variables are measured in 1995.

Appendix B

This appendix shows results from estimating fixed effects logit models of the incidence of training. The results are shown for completeness but are not included in the main part of the paper because estimating partial effects on the response probabilities requires an arbitrary assumption about the value of the unobserved component. In the following analyses, the unobserved component is assumed to be zero. Tables B1-B2 show the results.

TABLE B1

MEAN OF INCREMENTAL EFFECTS AND STANDARD ERRORS FROM PARTICIPATION LOGITS[a]

	Women					
	Basic		Vocational		Post-Secondary	
	Marginal Effect	Std. Error	Marginal Effect	Std. Error	Marginal Effect	Std. Error
Age 19 or below	**4.89**	1.03	**5.45**	1.05	**-7.46**	2.12
Age 20 to 24	**5.41**	0.77	**3.44**	0.57	**1.23**	0.49
Age 30 to 34	**-2.16**	0.68	0.09	0.46	**-3.49**	1.02
Age 35 to 39	**-1.65**	1.01	**2.03**	0.69	**-2.37**	0.92
Age 40 to 44	-0.08	1.31	**4.61**	0.94	-0.89	0.85
Age 45 to 49	1.03	1.60	**7.15**	1.18	-0.24	0.99
Age 50 to 54	2.75	1.88	**8.85**	1.41	0.03	1.17
Age 55 to 59	**9.66**	2.05	**7.86**	1.59	-0.94	1.54
Age 60 or above	**16.02**	2.45	1.07	2.22	**-10.54**	4.04
Controls for						
personal characteristics and year	YES		YES		YES	
career related characteristics	YES		YES		YES	
firm characteristics	YES		YES		YES	
individual fixed effects	YES		YES		YES	
Share of correct predictions						
participants	0.241		0.150		0.111	
non-participants	0.927		0.936		0.964	

[a]Estimated incremental effects are multiplied by 100. Thus mean incremental effects should be interpreted as the per cent difference in the propensity to participate in training relative to the excluded group
Bold effects are significant at the 5% level and italic at the 10% level. Effects calculated using Jonah B. Gelbach's margfx.ado, version 4.3

We see that adding individual fixed effects to the model for women in basic training renders, qualitatively, the results unaffected. The only exception occurs for the group of women aged 55 or above. Here, it seems that women are much more likely to participate when incorporating individual level fixed effects. That is, women aged 55 or above have unobserved characteristics or skills that decrease participation in basic courses.

TABLE B2

MEAN OF INCREMENTAL EFFECTS AND STANDARD ERRORS FROM PARTICIPATION LOGITS[a]

	Men					
	Basic		Vocational		Post-Secondary	
	Marginal Effect	Std. Error	Marginal Effect	Std. Error	Marginal Effect	Std. Error
Age 19 or below	-0.08	1.54	**-8.15**	0.98	**-24.08**	1.97
Age 20 to 24	**6.44**	0.93	0.43	0.40	**-4.50**	0.92
Age 30 to 34	**-6.42**	0.99	-0.52	0.38	**-6.35**	0.90
Age 35 to 39	**-9.26**	1.57	0.87	0.58	**-9.13**	1.47
Age 40 to 44	**-10.82**	2.14	**1.87**	0.78	**-9.15**	2.04
Age 45 to 49	**-11.37**	2.69	**3.29**	0.96	**-7.27**	2.61
Age 50 to 54	**-9.36**	3.29	**4.51**	1.15	**-8.12**	3.21
Age 55 to 59	-1.23	3.94	**3.15**	1.40	**-8.94**	3.87
Age 60 or above	**15.64**	4.03	-3.52	1.99	**-16.03**	4.69
Controls for						
personal characteristics and year	YES		YES		YES	
career related characteristics	YES		YES		YES	
firm characteristics	YES		YES		YES	
individual fixed effects	YES		YES		YES	
Share of correct predictions						
participants	0.268		0.061		0.163	
non-participants	0.907		0.975		0.957	

[a]Estimated incremental effects are multiplied by 100. Thus mean incremental effects should be interpreted as the per cent difference in the propensity to participate in training relative to the excluded group
Bold effects are significant at the 5% level and italic at the 10% level. Effects calculated using Jonah B. Gelbach's margfx.ado, version 4.3

Presumably our maintained conclusions when adding individual level fixed effects regarding most of the age profile reflects that we account for a rich set of variables including prior training participation. The size of the incremental effects and standard deviations, however, becomes much larger with the inclusion of fixed effects. This is probably due to the fact that identification in the latter case is based on individuals who switch status. Thus enrolment rates for this new population are different (in fact they are much higher, see below. This is due to the fact that the share of individuals that never enrols is much larger than the share that always enrols) and we have less variation to identify our parameters off of. The observations on size of parameter estimates and standard deviations hold true for both genders and all three types of training.

As was the case for women, adding individual level fixed effects to the model of men in basic training does not change the conclusions regarding the age profile *except* for the group of men aged 60 or above. This group seems now much more likely to participate in basic training.

Considering vocational training, the inclusion of fixed effects in the model only changes the conclusions for women aged 50 or above. Again, this group now seems much more likely to participate. For men, the results are much more sensitive to the fixed effects controls: Only men aged 19 or below are significantly less likely to participate in vocational training compared to the group of 25-29 year olds. Men aged 20-24 and 30-39 are as likely to participate and men aged 40-59 are significantly more likely to participate compared to the excluded group.

Finally, the conclusions regarding post-secondary training probabilities are completely unaffected by the inclusion of fixed effects.

Applying the Arulampalam et al. (2004) interpretation of the model results, in the fixed effects estimations, there does seem to be signs of lifelong participation in the cases of basic and vocational training. Of course, in addition to the arbitrary assumption about the value of individual level unobservables, one may worry that these are not even constant over time (or life), in which case the set of estimations controlling for fixed effects would be misleading and we would conclude that only for basic training – and only for the group of women – do we observe that lifelong learning is taking place.

However, considering estimated incremental effects relative to mean enrolment rates, we merely enforce the results from the analyses without fixed effects. (For the male population used to identify our fixed effects models, enrolment rates are, respectively, 16.8%, 19.1% and 21.1% in basic, vocational, and post-secondary training, whereas the corresponding numbers for women are 18.7%, 16.4%, and 22.9%).

Appendix C

This appendix shows results from estimating fixed effects OLS models of the intensity (ECTS) of training. Clearly, OLS does not require us to make any arbitrary assumptions about the value of the

unobserved component. For consistency reasons, however, these results are not presented in the main part of the paper either. Tables C1-C2 show the results. We see that adding fixed effects swipes away all important differences across ages, also in the case of basic training.

TABLE C1

COEFFICIENT ESTIMATES AND STANDARD ERRORS FROM INTENSITY (ECTS) OLS[a]

	Women					
	Basic		Vocational		Post-Secondary	
	Marginal Effect	Std. Error	Marginal Effect	Std. Error	Marginal Effect	Std. Error
Age 19 or below	0.01	0.60	**1.91**	0.29	**-1.34**	0.47
Age 20 to 24	-0.11	0.40	**0.40**	0.13	-0.39	0.21
Age 30 to 34	0.71	0.41	0.16	0.12	**1.08**	0.22
Age 35 to 39	**1.41**	0.62	0.05	0.18	**1.78**	0.34
Age 40 to 44	0.46	0.80	0.09	0.24	**2.37**	0.44
Age 45 to 49	-0.39	0.96	0.02	0.30	**2.35**	0.54
Age 50 to 54	-0.54	1.13	0.00	0.37	1.09	0.64
Age 55 to 59	0.15	1.30	0.01	0.44	-0.31	0.75
Age 60 or above	-0.92	1.57	-0.39	0.62	-1.55	1.03
Controls for						
personal characteristics and year	YES		YES		YES	
career related characteristics	YES		YES		YES	
firm characteristics	YES		YES		YES	
individual fixed effects	YES		YES		YES	

[a]Bold coefficients are significant at the 5% level and italic at the 10% level. ECTS is *European Credit Transfer and Accumulation System* with one credit corresponding to 25 to 30 working hours and with 60 ECTS assumed equivalent to a workload of a full time student during one academic year

TABLE C2

COEFFICIENT ESTIMATES AND STANDARD ERRORS FROM INTENSITY (ECTS) OLS[a]

	Men					
	Basic		Vocational		Post-Secondary	
	Marginal Effect	Std. Error	Marginal Effect	Std. Error	Marginal Effect	Std. Error
Age 19 or below	1.01	0.89	**0.43**	0.20	**-1.58**	0.52
Age 20 to 24	**1.40**	0.54	0.12	0.09	-0.32	0.20
Age 30 to 34	-0.02	0.60	-0.10	0.08	**0.70**	0.21
Age 35 to 39	-1.68	0.96	-0.06	0.12	**0.81**	0.36
Age 40 to 44	-2.13	1.29	0.01	0.17	0.92	0.49
Age 45 to 49	-1.86	1.59	0.17	0.22	0.07	0.62
Age 50 to 54	-0.43	1.88	0.31	0.27	-0.61	0.74
Age 55 to 59	-0.05	2.18	0.53	0.32	-1.56	0.89
Age 60 or above	1.05	2.54	-0.06	0.43	**-2.85**	1.17
Controls for						
personal characteristics and year	YES		YES		YES	
career related characteristics	YES		YES		YES	
firm characteristics	YES		YES		YES	
individual fixed effects	YES		YES		YES	

[a]Bold coefficients are significant at the 5% level and italic at the 10% level. ECTS is *European Credit Transfer and Accumulation System* with one credit corresponding to 25 to 30 working hours and with 60 ECTS assumed equivalent to a workload of a full time student during one academic year

Appendix D

This appendix shows enrolment levels by cohort and decompositions by age, cohort, and year. Following Deaton (1997), we regress the enrolment dummy on a full set of age, cohort, and year dummies using OLS.[15] For identification reasons, we restrict the year dummies to sum to zero and to be orthogonal to a time trend. This corresponds to attributing growth to age and cohort effects, and to use the year effects to capture cyclical fluctuations or business cycle effects that average to zero over the long run. This procedure relies on observing a cohort over several periods; otherwise the age profile will be confounded with cohort effects and trends cannot be separated from transitory shocks. To avoid small cells, we trim our original dataset slightly: the cohorts aged above 60 in 1992 are excluded (they only contribute for a maximum of five years) as are cohorts younger than 25 in 2002 (they only contribute for a maximum of seven years).

[15] Since we estimate a fully saturated model, the linear probability model is well-specified.

Figure D1 shows the results for basic training for the male population. The lefthandmost graph presents age profiles in enrolment by cohorts in five year age intervals (cohort age in 1992). From the left, we show the enrolment profile for individuals aged 20 in 1992; individuals aged 25 in 1992 and so forth. We see that younger cohorts participate more when young but this tendency disappears after a few years. The middle and righthandmost show the decompositions into age and cohort.[16] Enrolment decreases with age and is increasing at a decreasing rate in cohort age in 1992. Figure D2 shows the results for women in basic training. The age and cohort effect profile mirror those of men, though the levels are different. Figures D3-D4 show the results for vocational training, and Figures D5-D6 the results for post-secondary training. For vocational training we see an increasing age profile but a decreasing cohort profile. Finally, both men and women are more likely to enrol in post-secondary training in the mid-twenties after which enrolment rates decrease with age. The post-secondary cohort profile is concave with a maximum around cohort age 46 in 1992.

Importantly, the results accounting for cohort effects in addition to age and time effects cast some doubt on the existence of lifelong learning in basic training. The results on vocational and post-secondary training are, however, consistent with the results of the main section: vocational training takes place over the working life cycle (in fact, enrolment is increasing in age once cohort effects are accounted for), whereas post-secondary training largely takes place early in life.

[16] Figures showing time effects are available on request.

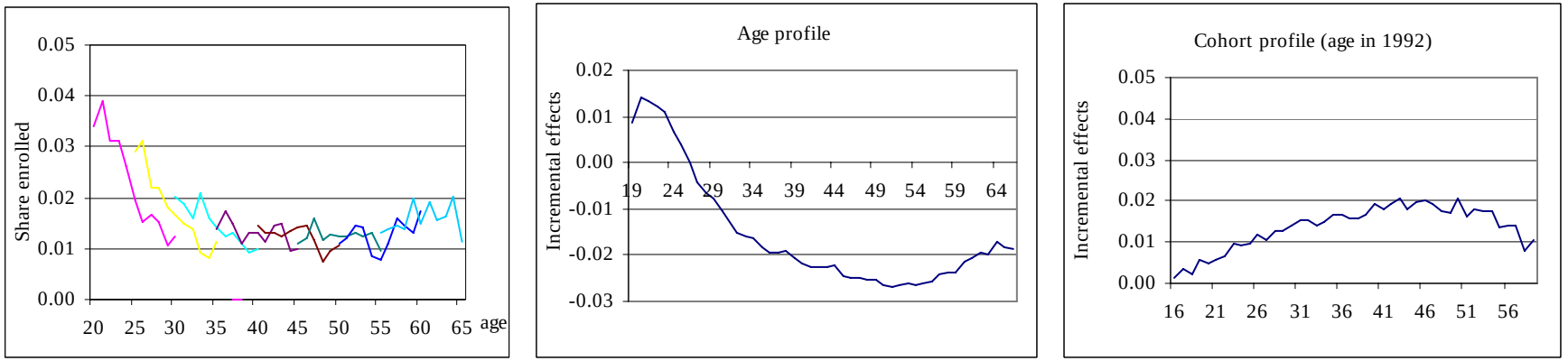

Fig. D1: Training enrolment rates by cohort, age effects, and cohort effects; basic training, Danish men, 1992-2002.

Note: average enrolment rate for men in basic training 1.8 per cent.

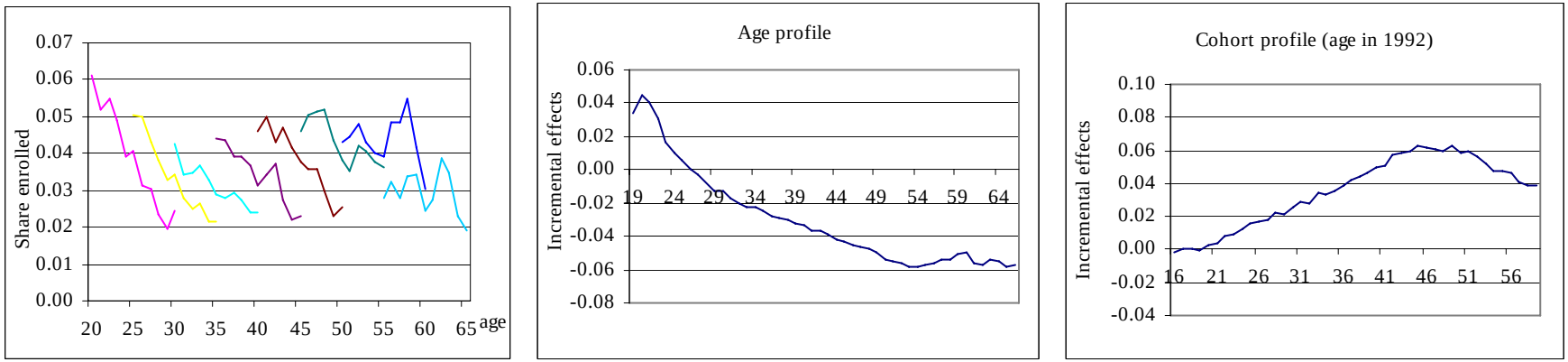

Fig. D2: Training enrolment rates by cohort, age effects, and cohort effects; basic training, Danish women, 1992-2002.

Note: average enrolment rate for women in basic training 4.1 per cent.

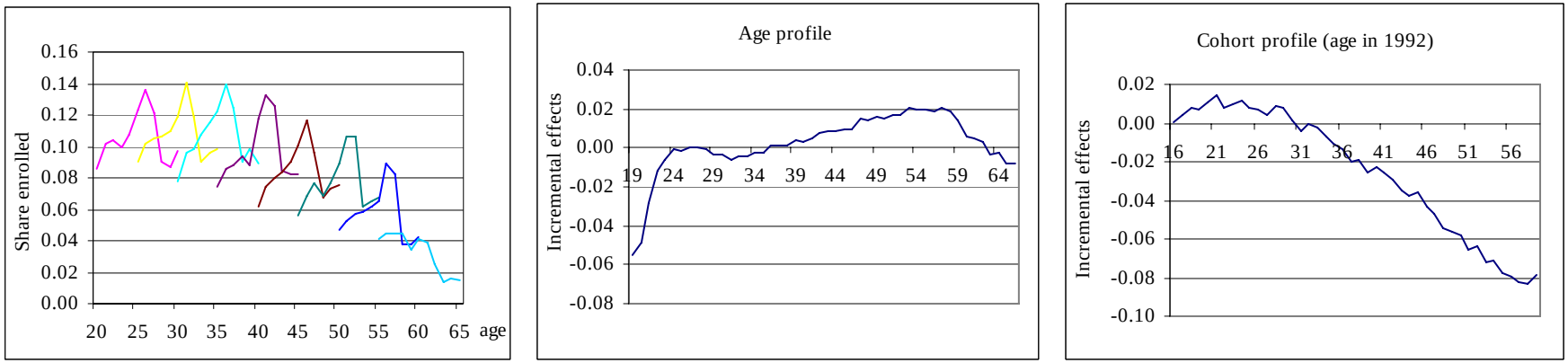

Fig. D3: Training enrolment rates by cohort, age effects, and cohort effects; vocational training, Danish men, 1992-2002.

Note: average enrolment rate for men in vocational training 8.1 per cent.

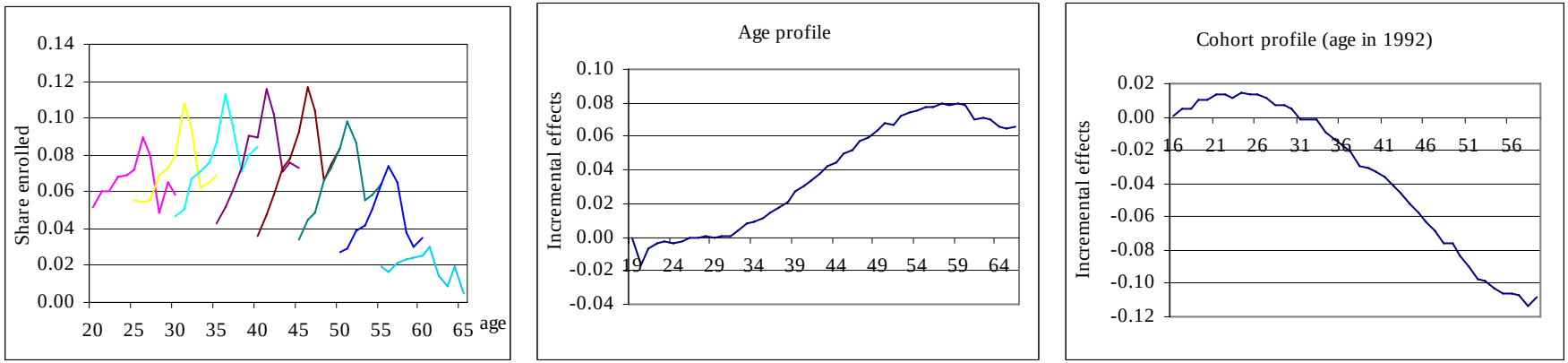

Fig. D4: Training enrolment rates by cohort, age effects, and cohort effects; vocational training, Danish women, 1992-2002.

Note: average enrolment rate for women in vocational training 5.7 per cent.

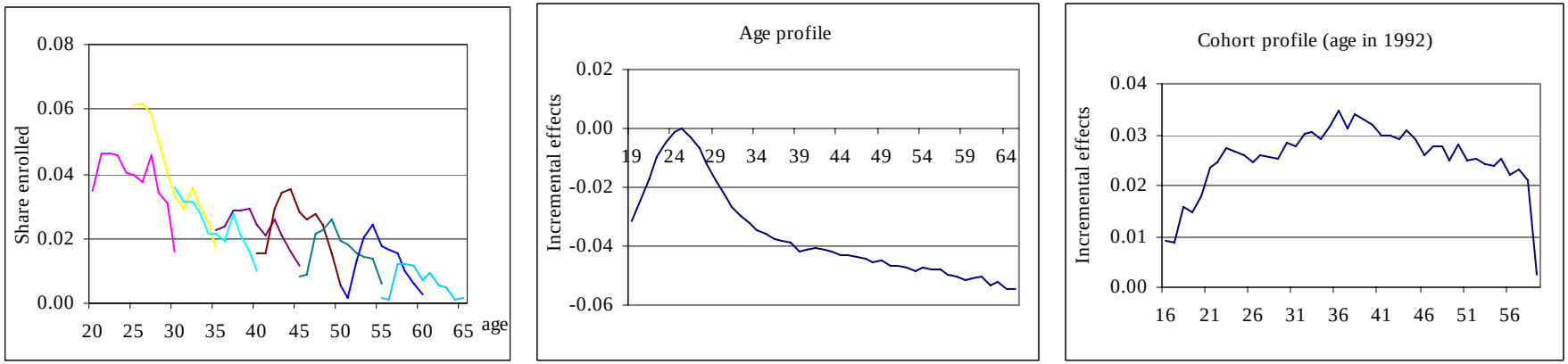

Fig. D5: Training enrolment rates by cohort, age effects, and cohort effects; post-secondary training, Danish men, 1992-2002.

Note: average enrolment rate for men in post-secondary training 2.1 per cent.

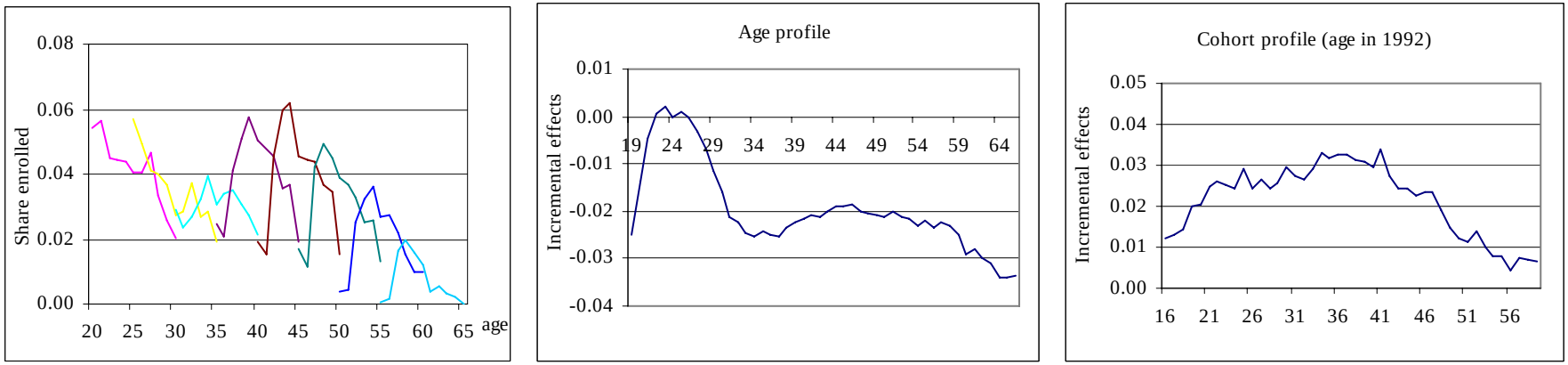

Fig. D6: Training enrolment rates by cohort, age effects, and cohort effects; post-secondary training, Danish women, 1992-2002.

Note: average enrolment rate for women in post-secondary training 2.9 per cent.

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