

From Childbirth to Paid Work: A Structural Analysis of the Effects of Adult Education on Labor Market Outcomes of Prime-Aged Mothers

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Abstract

Women without work after childbirth may participate in adult education programs. We estimate a structural job search model to analyze the effect of program participation on the duration to work and on labor income, using Swedish matched longitudinal administrative data sets covering the full population. The Swedish adult education program is unprecedented in its size and scope. We focus on low-skilled women who have recently given birth. We take account of program accessibility, selection issues, course heterogeneity, the income received during adult education, parental leave, and child care fees.

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1 Introduction

During the past decade, a substantial amount of research has been conducted on the effect of labor market policies on the individual employment prospects (for overviews see e.g. Fay, 1996; Heckman, LaLonde and Smith, 1999; Martin and Grubb, 2001; and Calmfors, Forslund and Hemström, 2001). Nevertheless, our knowledge of which type of policy works for whom is still quite limited. This also applies to low educated women with children, although they constitute a particularly weak labor market group. For example, the OECD average employment rate of mothers with less than secondary education in 2000 was only 48% (OECD, 2002). In order to help these women to (re-)integrate in the labor market and to raise their productivity, it is helpful to obtain insights into the effectiveness of active labor market programs and education programs for this group.¹ This is even more so since large budgets are allocated towards these programs.

In this paper we examine the effect of participation in adult education programs on the duration to work and the labor income of low-skilled women who have recently given birth. Empirical studies of unemployed women who return to the labor market after a spell of child-raising activity provide some optimism on the effects of training program participation on labor market outcomes (Heckman, Lalonde and Smith, 1999; King, 2004). At the same time, training participants with a low initial level of education typically benefit very little from educational training (Heckman, LaLonde and Smith, 1999). In our analysis we focus on the Swedish adult education program (Komvux). Sweden has a long tradition of training adult workers (see e.g. Ministry of Education, 1998; Friberg, 2000; and Ministry of Industry, 2001). In 1997 the program was modernized, and, in the period 1997–2002, the program was dramatically expanded in order to raise the skill level of low-skilled workers to a medium skill level, accordingly focusing on workers without work and with a low level of education. The size of the program is unprecedented: for example, over the period 1997–2000, the number of participants exceeded 10% of the labor force. Clearly, the program reflects a great deal of optimism about the extent to which an adult’s human capital can be im-

¹Recently, life-long learning, adult education, and employability have become focal points in the labor market policies of many advanced economies (see e.g. the recent OECD Employment Outlook 2004). It is expected that these economies will face more turbulent conditions than in the past, and that the development of novel production technologies will proceed at a sustained high speed, and this requires a flexible and suitably skilled workforce.

proved. Komvux is a relatively attractive option for reintegrating women because it does not have any entry requirement like for example the requirement that the participant needs to have received unemployment benefits payments. After a child caring phase, women may not be eligible for unemployment insurance and the associated training programs provided by the employment offices.

The empirical approach is structural in the sense that we aim to explain the data in the context of a dynamic job search model augmented with adult education (see Eckstein and Van den Berg, 2006, for a survey on the structural estimation of job search models). A structural analysis enables us to assess the policy effectiveness in counterfactual situations, like a setup in which the course contents or the course length are modified. A structural approach is amenable to the incorporation of income changes over time, like the income while being out of work before program participation, the income during participation, the income during unemployment after participation, and the income while working. In job search models, decisions are taken with an eye on the expected discounted future income streams of the available options. Structural analysis enables us to distinguish between effects on the speed at which jobs are found and effects on income.

We estimate models allowing individuals to choose to move into Komvux whenever they want to. This is in line with the universal availability and unprecedentedly generous funding of the program in the post-1996 period we consider. At the same time we take into account that the income received during participation is uncertain in advance. We also allow for transitions towards an “outside” state where the individual gives up the ambition to find work. This includes additional childbirths.

For the empirical analysis, we use a combination of longitudinal administrative register data which contains the full population of individuals in Sweden. The dataset matches detailed records from employment offices, unemployment insurance agencies, the income tax agency, and the adult education register. The latter contains records of all adult education courses that are followed.

The data include monthly wage register data by employer. These enable the construction of accepted wage variables, which are obviously superior to the annual income from the income tax registers. Concerning income out of work, we have separate information on unemployment benefits, adult education grants, parental leave benefits, and child care fees. The merging and simultaneous use of these data is a non-trivial task as it requires the combination of different sources. We use

information on the eligibility and maximum entitlement period of the various income sources, by applying the relevant guidelines.

We do not address equilibrium effects of adult education. Albrecht, Van den Berg and Vroman (2006) calibrate the effects of Swedish adult education in the period 1997-2002, taking into account that the composition of jobs may respond in equilibrium to changes in the skill distribution. Björklund et al. (2004) show that Komvux recently led to a large flow of teachers from regular secondary education to adult education, and they argue that the program therefore may have generated substantial negative external effects on the quality of regular education. Such effects increase the social costs of the program, but addressing this is beyond the scope of the present paper. We also do not aim to address the use of adult education by young individuals who left the regular school system with low educational levels, as a short-cut towards regular university education (see e.g. Björklund et al., 2004, and Ekström, 2003, for discussions). For this reason we exclude individuals aged below 25 in 1996.

To date, some studies have examined the effects of adult education in Sweden on individual labor market outcomes. Ekström (2003) estimates the effect on annual income of following adult education in the early 1990s, using difference-in-differences. She finds no positive income effects. Albrecht, Van den Berg and Vroman (2004) use similar methods to study effects on annual income and employment status, and they find no significant effects for women aged between 25 and 40. The latter study does not distinguish between recent mothers and other women, and its sample size may be too small to detect any effects. Several other studies have compared individual labor market outcomes between unemployed individuals who enroll in Komvux and unemployed individuals who enroll in labor market training, using propensity score matching or IV methods (see e.g. Axelson and Westerlund, 1999, and Stenberg, 2003). The results depend strongly on the outcome measure, the evaluation method, and the type of labor market training and subpopulation considered.

Some structural empirical studies have estimated job search models that are somewhat similar to ours, in that they allow women to choose at any time for an outside option (Frijters and Van der Klaauw, 2006) or allow for participation in training programs (Adda et al., 2006). In Section 3 we discuss this in more detail. To interpret the effects of program participation, we rely on the theoretical results in Van den Berg (1994), Burdett (1981), and Abbring, Van den Berg and Van Ours (2005).

2 Institutional context

2.1 Adult education

By now, many studies provide detailed descriptions of Komvux and their participants (see, for example, The National Agency for Education, 1999, Axelsson and Westerlund, 1999, Skolverket, 2001, Stenberg, 2003, and Ekström, 2003). We therefore restrict ourselves to a summary.

Our observation window concerning participation in Komvux runs from 1997 to 2002. In this period, the adult education program was larger than ever before in Sweden.² The main objective of the program was to increase the skill level of adult low-skilled workers to the medium skill level, thereby helping these individuals strengthen their position in the labor market. Here, low skilled means having an educational attainment below the level of a 3-year “gymnasium” degree, while medium skilled means having attained this level but not any education beyond that. The 3-year gymnasium degree roughly corresponds to the upper secondary education level or senior high school. Since 1995 this is the lowest possible upper secondary school diploma, whereas before that many individuals left high school with a 2-year degree. The program particularly targets unemployed adult low-skilled workers. In fact, low-skilled employed workers and medium-skilled unemployed workers are also often eligible for Komvux, and the enrollees contain many low-skilled employed workers, working part time or full time. Komvux also includes courses that do not aim at the attainment of a medium skill level but rather an improvement within the class of low skill sublevels.

Komvux focuses on the enhancement of general skills (for example, English, Swedish, and mathematics), as opposed to specific skills needed for particular professions. However, part of Komvux can be spent in orientation courses, vocational courses and work placement. In principle, it is possible to combine upper secondary courses with studies at an elementary level or with a program organized by the National Labor Market Board for the unemployed. The curriculums and grade criteria for the attainment of the medium skill level are roughly the same as in the regular upper secondary education system.

Komvux is organized at the municipal level. The organization may be joint with other municipalities. A municipality may purchase the services of education

²The program in these years is also denoted as “Adult Education Initiative” and “Knowledge Lift”.

providers and/or cooperate with them. However, the municipalities are responsible for admission into Komvux. A single course typically starts twice a year and covers a half-year term. Many courses are offered on a full-time basis, but some are offered as a part-time course or, more specifically, as an evening course.

At the level of the individual, admission into Komvux is in principle free. The underlying view is that Komvux participation must be led by the demand for education. A participant should have ample scope for personal choice regarding the type of study and its timing and location. Whether one can participate in a desired course only depends on the availability of courses and on the entry skill level requirement. Recruitment of participants is sometimes carried out in cooperation with trade union organizations or local employment offices.

Komvux participants may be eligible for a range of income grants and financial study support grants. Most importantly, enrollees may receive “special education support” (UBS). The amount of this is equivalent to unemployment insurance (UI). UBS is only given to Komvux participants who are entitled to UI payments at the date of entry into the program. They must be registered as unemployed or have been employed in the last 5 years and being replaced at the workplace by a long-term unemployed individual. Moreover, the worker must be between 25–55 years old inclusive at the date of entry into the program and must study at the elementary or upper secondary level or attend an orientation course. The funding for the UBS grants is limited. Priority is given to workers without completed education at the elementary level and workers who intend to study Swedish, English, mathematics or social sciences. The grant is typically given for a maximum of one year. Because of the cap on UBS funding, a Komvux participant may not be granted UBS, and she may not know a long time in advance whether UBS will be granted to her or not.

Additionally, special adult study assistance and funding are available as a combination of a grant and a loan. Unemployed individuals can for example apply for a grant (SVUXA) in case they had been working for 3 year and are at least 21 years old. The grant amounts to 65% of the UI benefit or some minimum amount in case an individual is not eligible for unemployment benefits. The funding for SVUXA is limited. A first come, first serve rule is applied.

Employed individuals, individuals taking care of children/handicapped persons or handicapped individuals can apply for a different type of grant in case they study on a elementary or upper secondary level (SVUX). Again, funding is limited, with priority for individuals with a low education level who are in need

of education and take a break from work in order to study.

Individuals who receive SVUXA or SVUX are entitled to a supplementary loan from the government. This loan and the grant together should be equivalent to UI.

Many participants rely on other financial resources than those listed above. An individual who is full-time in Komvux is considered to be out of the labor force unless he/she earns income on the side.

The state channels funds to the municipalities to finance Komvux. The amount of funding depends on the municipality's unemployment rate and skill level distribution, and on the scope of the municipality's program. A conservative estimate is that, in the first years of its existence, the state spent at least SEK 3.5 billion (US \$400M) per year on Komvux. This equals almost SEK 1000 per labor force participant in Sweden. The spending covered the creation of some 100,000 annual study slots as of 1997. In practice, the funding was more than sufficient to meet the demand for Komvux (see Statskontoret, 1999). This fact is important for our analyses because it implies that there was no quantity rationing.

The following gives an indication of the size of the program in terms of numbers of enrollees. In the fall of 1997, 538,004 individuals (out of a population of 8M) were (i) aged between 25 and 55, and (ii) participated in the municipal adult education, or were unemployed (in the sense of actively searching), or participated in one or more training programs. About 220,000 of these participated in Komvux, and of these about 56,000 received UBS. About 35,000 Komvux participants were also registered as unemployed, so they are necessarily only part-time in Komvux. Another 5,000 participated both in Komvux and in employment training. The number of registered unemployed, including those participating in Komvux and/or training programs was about 330,000. For comparison, the number of pupils in regular upper secondary school was about 300,000, while the number of individuals participating in employment training programs was about 40,000.³ The figures do not sum to the total of 538,004 because some individuals fall into more than one category. Typically, the number of individuals enrolled

³Participation in adult education is so large that the substantial increase in the unemployment rate in 2004 has been attributed to the cutbacks in the adult education program shortly before, the argument being that many individuals who would otherwise have been recorded as non-participants due to their participation in Komvux are now registered as unemployed instead (Swedish Institute, 2005). Note that this suggests that quantity rationing may be an issue after our observation window.

in Komvux is about 50% larger than the full-time equivalent of the number of occupied slots. This indicates that many enrollees are part-time participants. Skolverket (2001) provides a wealth of additional information on the composition of participants and courses.

2.2 Unemployment insurance

The eligibility requirements for unemployment insurance are as follows:

- (i). General requirement: Being registered as unemployed, immediately available for work, and actively seeking paid work,
- (ii). Work requirement: Having worked already for some time in the last 12 months or having finished full-time studies,
- (iii). Membership requirement: Member of an Unemployment Insurance Fund

An individual is entitled to income-related unemployment benefits if she meets all three requirements. In the time period from 1996 to 2004 the replacement ratio, the number of benefit days and the maximum level repeatedly changed (see Table 2.2). As an example, in 2001, benefits replaced up to 80% of the previous wage. The maximum benefits amounted to SEK 580 per day, or SEK 680 for the first 100 days. If individual met only the requirements (i) and (ii) the she could receive the so-called “basic amount”. This equalled SEK 240 per day in 2001. Benefits were payable for up to 300 days in 2001, with a maximum of five days per calendar week. Payment is stopped in case of participation in an active labor market program or adult education program or in case of parental leave, and can be continued thereafter. The Unemployment Insurance Fund may decide to extend the period of benefit by an additional 300 benefit days. Anyone not granted another 300 days or having used up 600 benefit days and still being unemployed can obtain a place in the activity guarantee program.⁴ During participation in a

⁴This activity guarantee program was introduced in August 2000 for unemployed individuals who are, or risk becoming, long-term unemployed (more than 2 years of unemployment) (EUROSTAT, 2003). It intended to put an end to the vicious circle between unemployment measures and unemployment benefits. Participants receive intensive guidance in groups of 10-15 people while having access to all standard labor market policy programs. A job seeker and her job counselor are expected to jointly work out an action plan. All activities are full-time. The job seeker participates in the activity guarantee program until she finds a job for more

program of ALMP individuals receive the so called “activity support” which is equivalent to UI.

2.3 Parental leave

Parents have the right to be absent from work for a period of one and a half years after child birth, without any compensation from the state. In addition, there is a way to leave work and receive “parental allowance” income, organized by the national insurance system. Specifically, if a parent is drawing a parental allowance (maximum of 450 days in 2001) as part of the national social insurance system she is entitled to leave work.

To be entitled to earnings related parental insurance one has to have been working for a minimum amount of days (about 3/4 of a year). In 2001 the social insurance paid 80 % of the annual salary up to 7.5 times the so called “higher price base amount”, which for 2001 is SEK 36,900. The higher price base amount is linked to the consumer price index in order to ensure that the benefits maintain their value (Ministry of Health and Social Affairs, 2001). The earnings related parental allowance is based on the *estimated* earnings the individual would have had during the parental leave.

In 2001, parents who received a baby are entitled to 360 days of earnings related benefits. Parents on low income or no income at all receive a minimum guaranteed benefit of SEK 60 per day. In an additional 90 days, parents receive benefits at the universally applicable flat rate that also amounts to SEK 60 per day in 2001. The 450 days of cash benefits are divided equally among parents. A parent may transfer 180 days to the other parent. In contrast to the unemployment benefit system the days considered also include Saturdays and Sundays. In the time period from 1995 to 2004 the replacement ratio, benefit days and payment ceiling underwent some changes (see Table 2).

Finally, all parents who were full time employed were given the legal right to reduce work hours at own cost to 75% until the child is 8 years old.

than six months, begins a regular course of studies, or chooses to leave the program. Those who are eligible for income-related benefits from an Unemployment Insurance Fund receive activity support during participation in the activity guarantee program (payment by the social insurance) in the same amount. Others receive SEK 143 per day.

Year	Compensation rate	Income-related benefits			Work requirement	Basic Insurance / KAS	
		Duration (in working days)	Ceiling	Duration (in working days)		Compensation	Duration (in working days)
1996	75%	300	SEK 564	5 months	SEK 230	150	
1997	75%	300	SEK 572	5 months	SEK 230	150	
1998	80%	300	SEK 580	6 months	SEK 240	300	
1999	80%	300	SEK 580	6 months	SEK 240	300	
2000	80%	300	SEK 580	6 months	SEK 240	300	
2001	80%	300	SEK 580, 680 for 100 days	6 months	SEK 240	300	
2002	80%	300	SEK 680, 730 for 100 days	6 months	SEK 270	300	
2003	80%	300	SEK 680, 730 for 100 days	6 months	SEK 320	300	
2004	80%	300	SEK 680, 730 for 100 days	6 months	SEK 320	300	

Table 1: Unemployment Benefits (Source: Swedish Institute 1997, 2001, 2005; Regner, 2002; Benmarker, Carling, and Homlund, 2005; and EUROSTAT, 2003).

Table 2: Parental Leave Benefits

Year	Total Days	Reserved for father+ mother	duration	Income dependent compensation		Compensation remaining days	PBA
				compensation rate	ceiling if without/ little income		
1995	450	30+30	360	80%	7.5*PBA	SEK 60	SEK 35.700
1996	450	30+30	360	75%	7.5*PBA	SEK 60	SEK 36.200
1997	450	30+30	360	75%	7.5*PBA	SEK 60	SEK 36.300
1998	450	30+30	360	80%	7.5*PBA	SEK 60	SEK 36.400
1999	450	30+30	360	80%	7.5*PBA	SEK 60	SEK 36.400
2000	450	30+30	360	80%	7.5*PBA	SEK 60	SEK 36.600
2001	450	30+30	360	80%	7.5*PBA	SEK 60	SEK 36.900
2002	480	60+60	390	80%	7.5*PBA	SEK 120	SEK 36.900
2003	480	60+60	390	80%	7.5*PBA	SEK 150	SEK 38.600
2004	480	60+60	390	80%	7.5*PBA	SEK 180	SEK 39.300

Source: Swedish Institute, 1997b, 2000; Ministry of Health and Social Affairs 2003, 2005; National Social Insurance Board 2001, 2002, 2003, 2004, 2005, see <http://www.forsakringskassan.se/>

2.4 Child care

Since 1995, municipalities are legally obliged to supply day care for parents who work or study. During 2001 to 2002 a number of reforms were introduced with the aim of improving access to child care for unemployed and those taking parental leave to look after a sibling (unemployed: 1 July 2001; parents taking parental leave: 1 January 2002; see Ministry of Education, 2005). In addition, since 1 January 2003, for 3 hours per day during school term, attendance is free of charge for those aged 4–5 years (this is called universal pre-school).

In general, child care in Sweden is not for free, and during the 1990s child care actually became more expensive. Fees were raised and increasingly linked to family income as well as the child's hours of attendance. This new fee structure worked as a disincentive to find work for mothers who were unemployed or out of the labor force, as a considerable amount of the increase in family income went into child care fees (Swedish Institute, 2004). To counteract this development, a system of maximum child care fees was introduced on 1 January 2002. This involved setting a ceiling for the amount parents could be required to pay for their child (Skolverket, 2003).

- (i). At pre school facilities, the fee charged is less than or equal to 3%, 2% or 1% of the family's income, depending on whether it is the first, second or third child. There is a maximum amount of SEK 1,140 per month for the family's first child, SEK 760 for the second child, and SEK 380 for the third child.
- (ii). In the school age child care system, the fee charged should be less than or equal to 2 % or 1% of the family's income, depending on whether it is the first or second child. The fee should not be higher than SEK 760 per month for the family's first child and SEK 380 for the second and third child.

Local authorities can decide whether they introduce the fee ceiling. The state offers compensation to those who do. In the first year 288 out of 290 local authorities joined. The remaining two joined later.

The maximum fee substantially reduced the amount parents pay for child care. In 2001, fees contributed 18% to the gross child care cost. In 2002, after the reform, the percentage declined to 11%. The new fee system increases the subsidy rate for most families and should tend to increase the labor force participation for

mothers (Kolm and Lazear, 2006). A first report evaluating the new fee structure shows that the reform indeed increased female labor force participation but not the hours worked (Mörk, Lindqvist and Lundin, 2006).

3 The model of job search and adult education

Job search theory tries to describe the behavior of unemployed individuals in a dynamic and uncertain environment. In this section we develop a job search model that takes account of participation in adult education before finding a job, as well as other institutional and behavioral aspects of the labor market. The model is nonstationary and in discrete time. It can be regarded as a generalization of the nonstationary job search model as developed by Van den Berg (1990a). Because of that, we avoid technicalities.

Consider first the process leading to employment, in absence of an adult education program, for a woman who has given birth at time zero. Job offers arrive at random moments in time. If one is not employed then in every period there is a probability $\lambda(t)$ that an offer arrives, in which t denotes the elapsed duration since childbirth. A job offer at time t is a random drawing (without recall) from the distribution $F(w|t)$ of wage offers w . In line with the theoretical and empirical literature on search theory, we do not distinguish jobs by the weekly number of hours worked. Equivalently, we assume that all jobs are full-time jobs. Every time an offer arrives, the decision has to be made whether to accept the offer or reject it and search further. We assume that once a job is accepted it will be kept forever at the same wage. This means that we exclude job-to-job transitions. Later on we will examine the consequences of relaxing this assumption. During the spell out of work, per-period income $b(t)$ is received.

Nonstationarity arises if $b(t)$, $\lambda(t)$ or $F(w|t)$ change as a function of t . Such changes may be due to business cycle effects, policy changes, institutional features of the environment facing the searcher, or stigma effects. We assume that job searchers have perfect foresight in the sense that they correctly anticipate changes in the values of these functions of t . Individuals do not know in advance when job offers arrive, or which w are associated with them.

Unemployed individuals aim at maximization of their own expected present value of utility over an infinite horizon. We assume that utility is intertemporally separable. The instantaneous utility function equals $u(w)$ in case one works at a

wage w , whereas it equals $v.u(b)$ in case one is out of work and income is equal to b . We assume that u strictly increases in its first argument. The parameter v represents the non-pecuniary component of instantaneous utility out of work relative to employment.

Let r be the rate of discount (meaning that utility one period ahead has weight $1/(1+r)$), and let $R(t)$ denote the expected present value at t , when following the optimal strategy. It follows that

$$R(t) = v.u(b(t)) + \frac{\lambda(t)}{1+r} \mathbb{E}_{F(w|t)} \max\left\{\frac{(1+r)w}{r}, R(t+1)\right\} + \frac{1-\lambda(t)}{1+r} R(t+1) \quad (1)$$

In this equation, the expectation is taken over the wage offer distribution with c.d.f. $F(w|t)$.

We now introduce adult education into the model. Consider first the “treatment effects” of having participated in adult education. We allow program participation to affect both the per-period probability of receiving a job offer and the wage offer distribution. The latter reflects any productivity differences due to the human capital accumulation in adult education. The former reflects the corresponding increase in the number of suitable vacancies. It also reflects any job search assistance efforts that are made because of the program participation. For example, the case worker of the individual may make additional efforts to find a job for the individual upon finishing program participation. Richardson and Van den Berg (2001) argue that this is the major reason for the fact that unemployed individuals in Sweden have a higher exit rate to work after a spell of labor market training. We use an index i in $\lambda_i(t), F_i(w|t)$ to denote whether the structural determinant refers to the periods before ($i = 0$) or after ($i = 1$) program participation.

Now consider the program enrollment mechanism. In accordance to the actual Komvux setting, we assume that an individual can move into the program in every time period. For computational convenience we assume that the decision to enroll and the decision to accept or reject a job offer are made sequentially within a period. That is, before having received any job offer in a given period, the individual decides whether to enroll or not. An enrollment opportunity at time t is a random drawing (without recall) from the distribution $G(z)$ of utility levels z within the program. Recall that a feature of the Komvux program is that the budget for special income support is limited, as a result of which one is not guaranteed to obtain a certain amount of income support. It is important to

allow an individual's observed and unobserved characteristics to affect G . For example, some individuals may have a strong dislike for adult education in general, and some individuals may never qualify for any income support. Every time an enrollment opportunity arrives, the decision has to be made whether to accept it or to reject it and search further. For now we take the program to last one period.

Let $R_0(t)$ denote the expected present value at t before program participation and before having received a job offer at t and after having decided not to enroll into the program at t , and let $\widetilde{R}_0(t)$ denote the same present value except that it is evaluated *before* having decided whether to enroll into the program at t . Finally, let $R_1(t)$ denote the expected present value at t after program participation before t . Equation (1) is now extended to

$$R_0(t) = v.u(b(t)) + \frac{\lambda_0(t)}{1+r} \mathbb{E}_{F_0(w|t)} \max \left\{ \frac{(1+r)w}{r}, \widetilde{R}_0(t+1) \right\} + \frac{1-\lambda_0(t)}{1+r} \widetilde{R}_0(t+1) \quad (2)$$

$$\widetilde{R}_0(t) = \mathbb{E}_{G(z)} \max \left\{ R_0(t), z + \frac{1}{1+r} R_1(t+1) \right\} \quad (3)$$

$$R_1(t) = v.u(b(t)) + \frac{\lambda_1(t)}{1+r} \mathbb{E}_{F_1(w|t)} \max \left\{ \frac{(1+r)w}{r}, R_1(t+1) \right\} + \frac{1-\lambda_1(t)}{1+r} R_1(t+1) \quad (4)$$

Note that after enrollment at t , there is no job offer in period t . Also note that (3) can be simplified substantially if certain functional forms for G are adopted, like a discrete distribution with two points of support.

The optimal strategy now follows from a comparison of the expected present values of the available options. Before program participation, a job offer at t is acceptable if and only if

$$w > \frac{r}{1+r} \widetilde{R}_0(t+1)$$

which defines the reservation wage $\phi_0(t) := r\widetilde{R}_0(t+1)/(1+r)$. Analogously we define $\phi_1(t) := rR_1(t+1)/(1+r)$. Finally, an enrollment opportunity is acceptable if and only if $z > R_0(t) - R_1(t+1)/(1+r)$ which leads to a adult education income lower threshold $\xi(t) := R_0(t) - R_1(t+1)/(1+r)$.

With an appropriate terminal condition (like stationarity of the model after a certain time out of work), the full model can be numerically solved in a recursive fashion. In particular, the optimal strategy can be determined at any t and for any values of the model parameters.

Before program participation, the conditional per-period probability of enrolling at t (conditional on being out of work and not having enrolled yet) equals

$$1 - G(\xi(t))$$

Let the binary variable $d(t)$ indicate whether the individual has participated in adult education before t ($d(t) = 1$) or not ($d(t) = 0$). The exit probability to work at t equals

$$\theta(t|d(t)) = [G(\xi(t))\lambda_0(t)(1 - F_0(\phi_0(t)|t))]^{1-d(t)} + [\lambda_1(t)(1 - F_1(\phi_1(t)|t))]^{d(t)}$$

Subsequently, the model can be extended by allowing for transitions into states where the option to find work is given up, like being a non-participant with no desire to move into work, or having another child. The simplest way to do this is to introduce an additional exit state with corresponding exit probability, say, ζ , by analogy to Van den Berg (1990b).

The above model is too complicated to derive the comparative statics effects of the size of the differences $\lambda_1(t) - \lambda_0(t)$ and $F_1(w|t) - F_0(w|t)$ on the time path of the exit probability to work. In a simpler framework, results from the literature can be applied. Consider a stationary continuous-time model where enrollment opportunities arrive randomly. The results in Van den Berg (1994) imply that for a wide range of families of wage offer distributions, the size of $\lambda_1 - \lambda_0$ has a positive effect on θ in the sense that θ after participation exceeds θ before participation. Burdett (1981) derives similar results for improvements in the location of the wage offer distribution due to program participation.

In general, the existence of a beneficial program also implies that individuals apply a higher reservation wage before entering the program than they would do in absence of the program (Abbring, Van den Berg and Van Ours, 2005). Thus, the program may actually reduce the transition probability to work at low durations.

Below we discuss the empirical implementation of the model developed in this section. We pay substantial attention to the modelling of different types of

measurement errors in the data. We therefore first describe the data we use, in Section 4.

4 The data

4.1 The data registers

Our dataset covers the population of inhabitants in Sweden. These individuals have been longitudinally traced in a number of different administrative registers covering (subsets of) the period 1994–2003. Our dataset matches the records of individuals across these registers.

The first register is the official Swedish register of labor market statistics RAMS. It is obtained from yearly income tax declarations. It includes information from the population register, which is used to create the sample. The register provides observations on an annual basis of various types of income that each individual may receive together with the months an individual may work. Specifically, we observe individual wage incomes and income from self-employment. The RAMS data also provide information on the employer. More information on income definitions is provided in Subsection 4.2.

The second register is the so-called HÄNDEL dataset, which is based on registers at the employment office and is compiled by the Swedish Labor Market Board. It includes all individuals who ever registered as unemployed starting from September 1991. Registration is voluntary but is required in order to receive or apply for unemployment compensation or to participate in any type of labor market program, so in fact almost all unemployed are in these data (according to Carling, Holmlund and Vejsiu, 2001, more than 90% of the individuals who are ILO-unemployed according to labor force surveys also register at the employment offices).

The HÄNDEL data provide labor market histories for all its individuals on a daily basis, with dates of transitions between different labor market states and between open unemployment and participation in training programs and work experience programs. However, because participation in Komvux is regarded as an out-of-the-labor-force activity, HÄNDEL by itself does not allow for observation of spells of Komvux participation.

The third register (ASTAT) is from the unemployment insurance fund. It provides week by week information on the amount of unemployment compensation

that is received.

The fourth register (KOMVUX) contains individual records on participation in any adult education program. These data are available for the years 1985–2002. From this we can follow participation in adult education on a basis of six-month periods at the individual level. Therefore, for all individuals for all semesters there is a specific variable recording whether the individual has been in Komvux in that semester. This includes those whose participation is subsidized as well as those who do not get subsidy. There is also information about whether the course(s) taken were day or evening courses, about the level of education prior to participation, and about the municipality where the course was taken. For the years 1997–2002, additional detailed information on adult education experiences is available, like grades and course content. The register is available until and including the year 2002.

The fifth register (LOUISE: Database for Education, Income and Employment) contains detailed information on additional income sources on an annual basis (i.e. educational grant, paternity leave benefits, social allowance) and individual specific information (i.e. education, municipality and marital status). These data are collected by Statistics Sweden.

In addition, we use the “generation register”. This data set provides information on the month of birth and identifiers for the parents.

4.2 Variable definitions, sample selection, and data summaries

The Appendix to the paper contains a detailed description of the data registers, the variables in the registers, and the way we select our sample and construct the variables of interest from these registers. We also provide an account of the practical problems and inconsistencies that arose. In this subsection we restrict attention to the main issues.

We first consider the following treatment: being in Komvux with 500 to 1,250 attended hours within one uninterrupted participation spell. This is equivalent to one to 1.5 years in comprehensive upper secondary school. We only include individuals who attend adult education for at most for 2 years. This is equivalent to one to 1.5 years in comprehensive upper secondary school. We only include individuals who attend adult education for at most for 2 years.

We do not consider treatments consisting of Komvux participation periods

that are interrupted by semesters out of Komvux.

We restrict attention to women who are between 25 and 45 on December 31, 1996. This is because individuals below 25 have access to different active labor market programs, educational opportunities, and remuneration eligibilities while unemployed or in education (see e.g. Larsson, 2003). As noted in Section 1, young individuals who left the regular school system with low educational levels may use Komvux as a short-cut towards regular university education (see e.g. Ekström, 2003). In such cases, it takes many years after enrollment in Komvux before the individual returns to the labor market.

Initially we consider low-skilled and medium-skilled individuals, i.e. having at most three years of upper secondary education or the equivalent at the start of the treatment. We also restrict attention to individuals who do not participate in any active labor market program at any time in the observation window.

The modernization of Komvux was implemented starting in the second half of 1997 (which we denote by 97-II). We take this as the first possible treatment semester. Given the period of 10 months (i.e. about 2 semesters) of maternity leave (See the Appendix), this effectively means that we consider women who give birth in 96-I or later. The major increase in the size of Komvux ended at the end of 02-II. It is likely that the removal of such a major program affected all individual transition rates in the labor market. Since we do not have many time periods after 02-II in some essential data registers, we decide to stop following individuals after 02-II. For women giving birth to a child in 01-I, the earliest possible treatment semester is 02-I. These women then have one or two semesters to be treated and at most one semester in another state, before the end of the observation window. Such outcomes are not very informative on the parameters of interest, especially since we focus on Komvux participation spells of 2 to 3 semesters. We therefore also restrict attention to women giving birth in 00-II or earlier.

We assume that each child birth in this period of 96-I to 00-II is immediately followed by a 10-month maternity leave period. After that, the individual can move between the states of Komvux, unemployment, non-participation, employment, and “bearing another child”. We do not follow individuals for more than 1 semester after a transition into employment or into “bearing another child”. Initially we merge unemployment and non-participation into one state which we call non-employment.

The data then contain 14,586 women who gave birth in the period 1996–2000

and who were non-employed after the maternity leave. Of these, 412 participated in Komvux during the non-employment spell after childbirth (see Table 3).

The structural analysis requires outcome variables in a semester format. We therefore assign one state to each individual in each semester, according to which of the actually occupied states in that semester was most dominant (see the Appendix for details). We also assign an income variable to each of these actually occupied states. The structural analysis also requires income levels in counterfactual states. For employment and Komvux these are drawings from distributions to be estimated. For non-employment and parental leave these are constructed from other data (see Appendix).

The construction of the employment income (i.e. wage) variable deserves some discussion. These are taken from firm registers. Specifically, the employment information and the wage data is taken from the wage information which firms are obliged to give to the tax authorities. For every calendar year, all firms have to inform the tax authorities about the employment duration of each employee (on a monthly basis) and on his/her yearly wage. The employment duration of an individual in a specific year is given by the start month and the end month. In addition, there is a variable for the wage paid during this employment relationship.

4.3 Descriptive statistics

Among the 14,174 who did not enter Komvux, 72% moved to part-time or full-time employment, 16% had another childbirth before entering Komvux or employment, and 12% have non-employment spells that are right-censored at December 29, 2003. Among those who entered Komvux, 76% moved to employment, 15% had another child, and 9% were right-censored. In 1996 the future participants in adult education are less educated than the average sample.

Table 4 presents the estimates of a Proportional Hazard Model for the duration until work, as measured after maternity leave. This is a continuous-time analysis. Birth of a next child is treated as independent right-censoring of the duration outcome. The moment of inflow into Komvux (if observed before the exit to work and before the end of the observation window) is included as an exogenous time-varying explanatory variable. The results show that individuals who enter Komvux move faster to employment.

When adding additional regressors such as age and educational level in 1996

Table 3: Some sample statistics

program participation	2.7%
<i>of these:</i>	
move to employment	76%
move to childbirth	15%
right-censored	9%
Less than 9 years of schooling	13%
9 years of compulsory school	19%
Less than 3 years of upper secondary education	49%
3 years of upper secondary education	19%
no program participation	97.3%
<i>of these:</i>	
move to employment	72%
move to childbirth	16%
right-censored	12%
Less than 9 years of schooling	6%
9 years of compulsory school	17%
Less than 3 years of upper secondary education	50%
3 years of upper secondary education	27%
country of origin:	
= 0 (Scandinavian)	83%
= 1 (other)	17%
birth order:	
first	34%
second	34%
third	19%
fourth	9%
fifth and more	4%
Age in 1996:	
25 - 29 years	53%
30 - 34 years	34%
35 - 39 years	11%
40 - 45 years	2%

Table 4: Parameter estimates of a Proportional Hazard model for the individual transition rate to work

	estimate	st.error
program participation (time-varying)	0.63	(0.05)
country of origin	-0.82	(0.04)
birth order	-0.01	(0.01)
<i>Education, reference category: less than 3 years of upper secondary education</i>		
Less than 9 years of schooling	-0.63	(0.06)
9 years of compulsory school	-0.55	(0.03)
3 years of upper secondary education	-0.15	(0.02)
<i>Age in 1996, reference category: 35–39 years</i>		
25–29 years	0.48	(0.04)
30–34 years	0.30	(0.04)
40–45 years	-0.27	(0.09)

the basic result does not change (see Table 4). Note that women with 3 years of upper secondary education (in 1996) have a significantly lower estimated transition rate to employment than women with up to two years of upper secondary education.

Table 5 shows that the estimated adult education coefficient varies with the initial education level. Under the assumption of absence of selection effects, women without any secondary education gain most (in terms of employment rates) from participating in adult education. It is also remarkable that the coefficient for women with 3 years of upper secondary education is larger than for women with only 2 years of upper secondary education.

Table 5: Parameter estimates of a Proportional Hazard model for the individual transition rate to work - interaction of education and treatment effect

	estimate	st.error
treat*edu1	1.58	(0.21)
treat*edu2	1.09	(0.13)
treat*edu3	0.41	(0.07)
treat*edu4	0.85	(0.12)
country of origin	-0.82	(0.04)
birth order	-0.02	(0.01)
<i>Education, reference category: less than 3 years of upper secondary education</i>		
Less than 9 years of schooling	-0.68	(0.07)
9 years of compulsory school	-0.57	(0.03)
3 years of upper secondary education	-0.16	(0.02)
<i>Age in 1996, reference category: 35-39 years</i>		
25-29 years	0.48	(0.04)
30-34 years	0.30	(0.04)
40-45 years	-0.27	(0.09)

In order to increase the sample size we now also included individuals who participate in ALMP programs after childbirth and treat spells as censored in case individuals go into ALMP. At this point women who participated in a ALMP

program before childbirth are still excluded. This sample consists of 630 treated women and 18,700 non treated women. The estimated effect of program participation is slightly smaller for this sample (see Table 6).

Table 6: Parameter estimates of a Proportional Hazard model for the individual transition rate to work - entry in ALMP as censored

	estimate	st.error
program participation (time-varying)	0.49	(0.05)
country of origin	-0.86	(0.03)
birth order	-0.02	(0.01)
<i>Education, reference category: less than 3 years of upper secondary education</i>		
Less than 9 years of schooling	-0.50	(0.06)
9 years of compulsory school	-0.50	(0.03)
3 years of upper secondary education	-0.12	(0.02)
<i>Age, reference category: 35-39 years</i>		
25-29 years	0.43	(0.03)
30-34 years	0.28	(0.03)
40-45 years	-0.27	(0.08)

Next, to increase the homogeneity, we exclude women with 3 years of upper secondary education (in 1996) and individuals who participated in adult education in 1996 and/or the spring of 1997. With this restriction we basically exclude all participants who upgraded their educational level to medium skill before the autumn of 1997. For this sample the estimated effect of adult education is slightly higher (see Table 8).

When requiring individuals to participate in adult education for 500-1250 hours during 4 semesters, the sample consists of 418 treated and 12,564 nontreated (see Table 7). We observe 87 % of the treated to exit into employment and 78% of the untreated. We now vary the treatment definition in two dimensions, notably number of attended hours and maximum number of semester (see Table 7).

From Table 8 it follows that the treatment coefficient depends on the number of attended hours. The more hours individuals participate in classes, the higher

Table 7: Alternative Definition of Treatment

	Reference Def.	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6
max. no of semester attended hours	4	3	5	2	4	1	2
	500–1250			250–1000		100–750	
no. of observed treated	418	309	458	302	538	177	393

Table 8: Parameter estimates for alternative definition of treatment

Estimates	Ref. Def.	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6
acc. Tab. 5 treat	.54 (.06)	.61 (.07)	.52 (.06)	.45 (.08)	.47 (.06)	.50 (.12)	.45 (.07)
acc. Tab. 6 treat*edu1	1.46 (.22)	1.53 (.26)	1.35 (.21)	1.44 (.30)	1.65 (.18)	1.42 (.31)	.132 (.23)
treat*edu2	1.06 (.13)	1.09 (.14)	1.03 (.12)	.59 (.19)	.69 (.13)	.49 (.26)	.50 (.17)
treat*edu3	.37 (.07)	.45 (.08)	.36 (.07)	.38 (.09)	.34 (.06)	.37 (.15)	.36 (.08)

is the treatment effect. However, the results also suggest the presence of a lock-in effect. The longer a women needs to finish a class the smaller the effect on the employment rate. With regards to the distribution of the numbers of participants it seems advisable to choose treatment definition 4. On average, this definition of treatment is equivalent of half one year of schooling. Although it is said that study grants are usually given for one year, data on the study grant shows that this is not the rule.

In order to investigate whether non-scandinavian women and scandinavian women are affected differently by participating in adult education we interact the participation variable with an indicator for the country of origin for our new reference sample. This estimated parameter indicates a much stronger treatment effect for non-scandinavian women. This interaction term leads, however, to a reduction of the effect for very low educated women. This might be due to the fact, that very low educated women in the majority of cases non-scandinavian.

If women go back to their job after maternity leave they might want to improve their labor market position by participating in courses of adult education. Given the above described sample selection and the reference participation definition we find the following observations concerning participation in adult education (see Table 9). Women after child birth participate in adult education more often in case they have a job directly after the maternity leave compared to when they are nonemployed.

Table 9: Sample information concerning participation in Adult Education during consecutive spells, conditional on the first spell after maternity leave being employment, for Alt. 6

Order	Type of spell	Participation in KOMVUX during the ongoing spell
1	employment spell after birth	1,465
2	nonemployment spell	152
3	employment spell	93

References

- Abbring, J.H., G.J. van den Berg, and J.C. van Ours (2005), “The effect of unemployment insurance sanctions on the transition rate from unemployment to employment”, *Economic Journal*, 115, 602–630.
- Adda, J., M. Costa Dias, C. Meghir, and B. Sianesi (2006), “Evaluating dynamic treatment: The Swedish active labour market programmes”, Working paper, UCL and IFS, London.
- Albrecht, J.W., G.J. van den Berg, and S.B. Vroman (2004), “The Knowledge Lift: The Swedish adult education program that aimed to eliminate low worker skill levels”, Working paper, IFAU, Uppsala.
- Albrecht, J.W., G.J. van den Berg, and S.B. Vroman (2006), “The aggregate labor market effects of the Swedish Knowledge Lift program”, Working paper, Free University, Amsterdam.
- Axelsson, R. and O. Westerlund (1999), “Participants in the Knowledge Lift in autumn 1997 and comparison groups: labor market and income conditions before education”, Working paper, Umeå University, Umeå (*in Swedish*).
- Bennmarker, H., K. Carling, and B. Holmlund (2005), “Do benefit hikes damage job finding? Evidence from Swedish unemployment insurance reforms”, Working paper, IFAU, Uppsala.
- Björklund, A., P.A. Edin, P. Fredriksson, and A. Krueger (2004), “Education, equality, and efficiency – An analysis of Swedish school reforms during the 1990s”, Working paper, IFAU, Uppsala.
- Burdett, K. (1981), “A useful restriction on the offer distribution in job search models”, in G. Eliasson et al., editor, *Studies in labor market behavior: Sweden and the United States*, I.U.I., Stockholm.
- Calmfors, L., A. Forslund, and M. Hemström (2001), “Does active labour market policy work? Lessons from the Swedish experience”, *Swedish Economic Policy Review*, 8, 61–124.
- Carling, K., B. Holmlund, and A. Vejsiu (2001), “Do benefit cuts boost job findings? Swedish evidence from the 1990s”, *Economic Journal*, 111, 766–790.
- Eckstein, Z. and G.J. van den Berg (2006), “Empirical labor search models: a survey”, *Journal of Econometrics*, forthcoming.

- Ekström, E. (2003), “Essays on inequality and education”, Working paper, Uppsala University, Uppsala.
- Eriksson, R. (2005), “Parental leave in Sweden: The effect of the second daddy month”, Working paper, SOFI, Stockholm.
- Fay, R.G. (1996), “Enhancing the effectiveness of active labour market policies: Evidence from programme evaluations in OECD countries”, Working paper, OECD, Paris.
- Friberg, N. (2000), “Thematic review on adult education: Sweden”, Working paper, OECD, Paris.
- Frijters, P. and B. van der Klaauw (2006), “Job search with nonparticipation”, *Economic Journal*, 116, 891–927.
- Heckman, J.J., R.J. LaLonde, and J.A. Smith (1999), “The economics and econometrics of active labor market programs”, in O. Ashenfelter and D. Card, editors, *Handbook of Labor Economics, Volume III*, North-Holland, Amsterdam.
- King, C.T. (2004), “The effectiveness of publicly financed training in the United States: Implications for WIA and related programs”, in C.J. O’Leary et al., editor, *Job Training Policy in the United States*, 57–100, W.E. Upjohn Institute for Employment Research, Kalamazoo, Michigan.
- Kolm, A.-S. and E. Laszear (2006), “Policies affecting work patterns and labor income for women”, mimeo, Stockholm.
- Larsson, L. (2003), “Evaluation of Swedish youth labour market programmes”, *Journal of Human Resources*, 891–927.
- Martin, J.P. and D. Grubb (2001), “What works and for whom: a review of OECD countries’ experiences with active labour market policies”, *Swedish Economic Policy Review*, 8, 9–56.
- Ministry of Education (1998), “Adult education and life long learning. the situation before and during the first year of the Knowledge Lift”, Working paper, Ministry of Education, Sweden, Stockholm (*in Swedish*).
- Ministry of Education (2005), “Quality in pre-school”, A summary of government bill 2004/05:11, Ministry of Education, Sweden, Stockholm.
- Ministry of Health and Social Affairs (2001), “Social insurance in Sweden”, fact sheet, Ministry of Health and Social Affairs, Stockholm.

- Ministry of Health and Social Affairs (2003), “Swedish family policy”, fact sheet, Ministry of Health and Social Affairs, Stockholm.
- Ministry of Health and Social Affairs (2005), “Swedish family policy”, fact sheet, Ministry of Health and Social Affairs, Stockholm.
- Ministry of Industry (2001), “Sweden’s action plan for employment”, Working paper, Ministry of Industry, Sweden, Stockholm.
- Mörk, E., L. Lindqvist, and D. Lundin (2006), “How much does the new child care fee system affect the parents decision to work?”, Report, IFAU, Uppsala (*in Swedish*).
- National Agency for Education (1999), *The Adult Education Initiative*, National Agency for Education, Stockholm.
- National Social Insurance Board (2001), *Social insurance in Sweden 2000*, National Social Insurance Board, Stockholm.
- National Social Insurance Board (2002), *Social insurance in Sweden 2001*, National Social Insurance Board, Stockholm.
- National Social Insurance Board (2003), *Social insurance in Sweden 2002*, National Social Insurance Board, Stockholm.
- National Social Insurance Board (2004), *Social insurance in Sweden 2003*, National Social Insurance Board, Stockholm.
- National Social Insurance Board (2005), *Social insurance in Sweden 2004*, National Social Insurance Board, Stockholm.
- OECD (2002), *Employment Outlook 2002*, OECD, Paris.
- OECD (2004), *Employment Outlook 2004*, OECD, Paris.
- Regnér, H. (2002), “Changing conditions for labor market policy”, in J. Palme et al., editor, *Welfare Conditions*, 81–118, Socialdepartementet, Stockholm (*in Swedish*).
- Richardson, K. and G.J. van den Berg (2001), “The effect of vocational employment training on the individual exit rate from unemployment to work”, *Swedish Economic Policy Review*, 8, 175–213.
- Skolverket (2001), “The Knowledge Lift and upper secondary adult education Fall 2000?”, Working paper, Skolverket, Stockholm (*in Swedish*).

- Skolverket (2005), “Fees in the pre–school and after school child care system”, Working paper, Skolverket, Stockholm (*in Swedish*).
- Statskontoret (1999), “How much does the Knowledge Lift cost?”, Working paper, Statskontoret, Stockholm (*in Swedish*).
- Stenberg, A. (2003), “An evaluation of the adult education initiative relative labor market training”, Working paper, Umeå University, Umeå.
- Swedish Institute (1997), “Equality between women and men”, fact sheet, Swedish Institute, Stockholm.
- Swedish Institute (1997), “Swedish labor market policy”, fact sheet, Swedish Institute, Stockholm.
- Swedish Institute (2000), “Equality between women and men”, fact sheet, Swedish Institute, Stockholm.
- Swedish Institute (2001), “Swedish labor market policy”, fact sheet, Swedish Institute, Stockholm.
- Swedish Institute (2004), “Child care in Sweden”, fact sheet, Swedish Institute, Stockholm.
- Swedish Institute (2005), “Swedish labor market policy”, fact sheet, Swedish Institute, Stockholm.
- Van den Berg, G.J. (1990), “Nonstationarity in job search theory”, *Review of Economic Studies*, 57, 255–277.
- Van den Berg, G.J. (1990), “Search behaviour, transitions to nonparticipation and the duration of unemployment”, *Economic Journal*, 100, 842–865.
- Van den Berg, G.J. (1994), “The effects of changes of the job offer arrival rate on the duration of unemployment”, *Journal of Labor Economics*, 12, 478–498.

A Data Appendix

The basic sample consists of women who are low or medium skilled in 1996 and who gave birth in the time period from 1996 to 2004. We only consider prime aged women (25 to 45 years in 1996) for whom it is at most their fifth child. In total we observe 208.420 women fulfilling the selection criteria.

A.1 KOMVUX

The KOMVUX data is collected at a semesterly frequency, i.e. there are separate records for every semester and every course an individual participates in. Often, records already indicate if a course is supposed to last longer than one semester. Then the start and formal end date of records collected at consecutive semesters are the same. The separate records differ with respect to the information which changes over consecutive semesters as for example number of teaching hours and grade in case the course was graded. Sometimes, however, one record reports an end in one semester and another record reports a restart in the following semester. There are also cases where records report individuals attending a specific course type more than once in the same semester.

The data contains a drop-out date in case an individual ends a course prematurely. Note that there is no strict relationship with respect to the reported drop-out date and the semester for which the main part of the information is collected (in the following denoted as reporting semester). The drop-out date can lie before and after the reporting semester. There are missings in the variables for the end date and drop-out date.

We observe 43,844 women of our basis sample attending the adult education program between II/1997 and II/2002 after having given birth. In total 82,739 women of our basic sample have participated in adult education before that time period, i.e. between I/1986 and I/1997.

We perform the following steps to make the data accessible for the analysis:

- (i). We discard individuals permanently from our sample in case at least one of the following 4 conditions applies:
 - (a) Attending courses that started before II/1997: 375 women
 - (b) Attending courses that end after II/2002: 4,245 women
 - (c) Courses with missing end dates: 441 women

- (d) Implausible start, end or dropout date (for example, courses with negative durations): 13 women

Remaining women participating in adult education: 38,770. The data set contains 479,570 different records describing their participation in adult education.

- (ii). Records are discarded from the treatment sample if the following applies:
 - (a) Start and end date coincide. (1671 cases)
 - (b) Zero teaching hours. (1820 cases)

Remaining number of participating women: 38,572

- (iii). Decisions and assumptions concerning the drop-out variable: On semester level 10 % of the records report a drop out (46,180 cases)
 - (a) In 2,827 cases the drop out occurs before or on the start date of the course. We delete these cases. 38,657 participating women remain.
 - (b) Drop-out dates can also lie after the formal end date (1,806 cases). Individuals who drop out after the end date of the course always have a missing in their grade. We assume that these individuals participated in the course but did not successfully pass it.
 - (c) On the basis of the information on teaching hours and the drop-out date, a variable is created giving the hours of attendance. 579 records have 0 hour of attendance. These cases were discarded. 38,455 participating women remain.
 - (d) We define a new end variable, providing information on the time an individual stopped attending a course. Consequently, in case an individual dropped out of a course before the formal end date, we use the drop-out date as the new end date.

Note that if due to (ii) and (iii). no record of participation for an individual is left, an individual is automatically defined as a Komvux nonparticipant and will appear in the sample of nonparticipants, whereas an individual who is discarded under the conditions of (i) is a participant for whom the information is incomplete or inconsistent. As a result she does not appear in the sample of nonparticipants.

(iv). Merging of records of the same course type:

- (a) Double records concerning the same individual and the same time period are identified by way of the course code, number of high school points, number of hours taught, start date and semester reporting period (1032 cases). In the majority of case, double entries are due to individuals switching schools. We give priority to those records which have a valid grade.
- (b) Records for the same individual with the same course code are merged to one spell if they lie within one uninterrupted participation spell in adult education. The records which are merged under this condition to one spell are denoted in the following as “merge set”.
- (c) Naturally, the start date of a merged spell is the earliest start date of all records in a merge set. The end date is the last date within the merge set, at which we observe an individual to attend the course. Furthermore, we report the total number of hours attended. We also provide summarized information on grades. To accomplish this, we take the grade information of the record with the latest reporting semester. In case the merge set has two or more records in this reporting semester, we use the following rule: If there is more than one grade, we take the best grade. Otherwise we use the grade information of the record which has a valid and non-missing entry.
- (d) 358,130 course type specific participation spell are generated out of 476,079 records.
- (e) As mentioned before, some records report start dates which lie before the reporting period and some records report end dates which lie after the reporting period. In the majority of cases we find fitting records in an earlier, respectively later reporting period. We define records as fitting if their reporting semester covers the start or respective end date in question. They do not necessarily need to have the same start or end date. However, this matching process does not work for 7% of the course type specific participation spells. 9,023 spells were supposed to start before the first observed reporting semester and 16,388 spells were supposed to end after the last observed reporting semester without observing a drop out. We give priority to the information which is

related to the reporting semesters. As a result we set the start date of the 9,023 spells to the beginning of the earliest reporting semester within the merge set. The 16,388 spells we treat as dropouts at the end date of the last reporting semester within the merge set.

- (v). Treatment and assumptions concerning the variable grades:
 - (a) 185 records have an invalid coding concerning the grade. The value was set to missing.
 - (b) Courses which last longer than one semester have sometimes also been intermediately graded. We restrict our attention to the final grade.
 - (c) Not all courses are graded. This applies to 27,885 spells after merging records to course type specific participation spells. For example, in the majority of cases, orientation courses end without grading. In the following we will treat these cases as if individuals have successfully passed the course. However, also note that we can not distinguish between those cases where no grade is given and those cases where the data do not provide the real grade.
 - (d) Naturally, we treat spells which end due to a drop out as not passed.
- (vi). Final Selection:
 - (a) In total 6,229 women have more than one uninterrupted participation spell in adult education. We drop these individuals with their uninterrupted participation spells (13,027) from our analysis.
 - (b) After the selection process of individuals, the following distribution of attended hours in uninterrupted participation spells in adult education can be observed:

Hours attended	Freq.	Percent	Cum.
-50	3,862	11.98	11.98
51-100	2,812	8.73	20.71
101-250	4,651	14.43	35.14
251-500	5,153	15.99	51.13
501-750	4,404	13.67	64.80
751-1000	4,042	12.54	77.34
1001-1250	2,666	8.27	85.62
1251-1500	2,002	6.21	91.83
1501-1750	1,172	3.64	95.47
1751-2000	672	2.09	97.55
2000-	789	2.45	100.00
Total	32,225	100.00	

- (c) We summarize course type specific participation into the four categories mathematics, Swedish and English, orientation courses, and all other courses. Dummies for participation in these groups are constructed according to proportion of attended hours:

Dummy = 1 for	under the condition
Mathematics	proportion of attended hours > 25%
Swedish and English	proportion of attended hours > 25%
Orientation Courses	proportion of attended hours > 0%
Other courses	proportion of attended hours > 25%

- (d) A Course category is understood as passed if proportion of passed hours is larger than 75%

A.2 Unemployment spell data (HÄNDEL):

Within HÄNDEL, two complementary registers describe unemployment spells. The first one is INSPER, describing the unemployment duration and the exit state after leaving unemployment. The second is SOKATPER. This describes the

status during the unemployment spell. Unemployment states such as in guidance service, part-time unemployed and participation in a variety of ALMP are listed. We exclusively use the SOKATPER data set. The only additional information which INSPER could offer over SOKATPER is the exit state, which we know anyway by combining the unemployment spells with the employment spells. The unemployment data is reliable starting with 1993. However, we only consider unemployment spells starting after or ongoing on 01.01.1994 as the benefit data is only reliable after that date.

About 70% of the women in our basic sample (146,056 of 208.420) have at least one unemployment spell during the time between 01.01.1994 until 31.03.04. In total we observe 1,506,581 unemployment subspells. We delete those spells with a negative duration (12,890).

We summarized the unemployment states to the following aggregates:

Category	Unemployment state
1)	unemployed
2)	partly unemployed (=part-time unemployed or employed by the hour)
3)	searching for a new job
4)	ALMP
5)	other category not registered

We split the unemployment (status) spells at the middle and the end of every calendar year in order to obtain outcomes on a half-year basis. This results in 2,288,085 potentially split unemployment spells.

A.3 Unemployment benefit registers (ASTAT):

The unemployment benefit data stem from two different data bases. Together, they cover the unemployment benefit payments to all Swedish inhabitants in the time period from 1994 to 2004. The first register, ERSBET, covers mainly the time period from 1994 to 1999 . The second register, ASUBET, covers mainly the time period from 2000 to 2004. The benefit payments are reported by both registers on a weekly basis. The two registers are, however, somewhat different with respect to how and what kind of information is recorded.

A.3.1 ERSBET

The structure of the data is such that on an individual level for each calendar week the number of compensation days for a specific type of compensation is mentioned together with the amount paid for this week. For our basic sample there are 9,012,082 different records of benefit payments. 8644 of those are double entries. A double entry occurs if there are two records for the same type of compensation made to the same individual for the same calendar week. We keep the last added observation.

There are missings in the variable for benefit payments. This is, however, exclusively the case when a time interval is described as waiting period. Therefore we set these cases on a zero benefit level. Sometimes, several records are reported for one calendar week. The main reason for this lies in the fact that on different days of the week individuals are eligible for different types of compensations. There are also specific payment combinations which can occur at the same time. We add payments of parallel records and keep only the aggregated record. This reduces the number of observations to 8,575,751.

A.3.2 ASUBET

For our basic sample we receive 5,789,769 records in ASUBET. The data set contains a marker for individuals with double/wrong entries. We drop those individuals (18 individuals with 1,175 records). The data set does not have missing values in the variable for the benefit payments. We identify additional 58,075 double entries, of which we we keep the latest added entry. Furthermore, we aggregate parallel entries by adding the benefit payments. In total we end up with 5,626,984 records.

A.3.3 Merging of Unemployment Benefit Data Sets

ERSBET and ASUBET partly cover the same individuals. In case there are duplicate records, we keep those from ASUBET. In total there are 1,336,357 duplicate records. We keep in total 12,866,399 records.

A.4 Merging of Benefit and Unemployment Spell Data

The aggregated unemployment status data is the reference point for the merge process of the unemployment and the benefit data. We restrict our data to the end

of 2003, to be precise until 29.12.2003 which is the end of a calendar week. After dropping those individuals who were excluded during the cleaning process of the benefit data, we obtain in total 2,241,098 unemployment status spells for 145,249 individuals and 12,083,677 benefit spells for 178,466 individuals. We merge the weekly benefit data to the aggregated unemployment state data if they overlap for at least 4 days. On the basis of this 4 day criterion 74,461 unemployment benefit records can not be merged to an unemployment spell. For those records we reduce the merge criterion to an overlap of at least one day. If the benefit spell overlaps with more than one unemployment state spell it is only merged to the first overlapping unemployment state spell. This additional one day criterion reduces the benefit records which can not be merged to 54,025. In the third step, also benefit records which are not allocated yet, are merged to unemployment spells which directly succeed or precede. In total, for 4,470 individuals we are not able to allocate on average about 11 weeks of benefit records. We drop these individuals completely from our analysis.

We calculate the average monthly benefit payments for the unemployment spells which are a maximum of 6 months long on the basis of the following formula (sum of benefit payments during the spell/number of days during spell)*7*4.33.

A.5 Employment and Wage Data (RAMS)

The employment information and the wage data is taken from the wage information which firms are obliged to give to the tax authorities. For every calendar year, all firms have to inform the tax authorities about the employment duration of each employee (on a monthly basis) and on his/her yearly wage. This obligation determines the structure of the RAMS data which consists of separate registers for every year. The employment duration of an individual in a specific year is given by the start month and the end month. In addition, there is a variable for the wage paid during this employment relationship. We use the registers for the year 1994 until 2003.

Income from the social insurance, as for example parental benefits, is not covered by the data. An individual is counted as employed when being on parental leave, if s/he was employed shortly before. However, we can create maternity leave spells within the employment spells. Eriksson (2005) reports for 2001 an average length of maternity leave of 10 months within the first 18 months after child birth. We use this estimated number of 10 months as the maternity leave

period length in our observation window period (1996 to 2001). The parental-leave compensation rate increased from 75% to 80% in this period, but apart from this the regulations did not change. Before 1996 and after 2001 the parental leave system was changed a number of times (see Table 2).

The benefits received during maternity leave will be calculated with the aid of an additional data set (LOUISE, see below)

There are records where both, the variable for the start month and the variable of the end month, take the value 0. In these cases we set the start month on January and the end month on December.

We exclude women who are self-employed or farmers (17,812 individuals). This results in 2,240.452 records for 185,300 individuals of our basic sample conditional on never being self-employed or farmer in time from 1994 to 2003. Naturally, individuals can have multiple employers in one calendar year. In order to exclude extreme outliers, we drop individuals from our sample with more than 10 employers in one year (365 individuals).

We split employer-specific employment spells into half- calendar-year long segments. We then aggregate employment spells which are parallel, partly overlapping or consecutive within the half calendar year periods. Finally, the average monthly wage is calculated.

A.6 Merging of Employment, Unemployment and Komvux Data

In a first step we delete from our data base all observations from those individuals that we for one of the above mentioned reason excluded. We obtain the following distribution of individuals who are dropped from our analysis (Table 10). Individuals are only mentioned once here, although there can be multiple reasons why they are excluded. Furthermore, we only keep individuals if they never participated in a program of ALMP. We therefore drop 41,837 individuals of whom 4,071 individuals participated in adult education (according to our participation definition) after child birth.

Furthermore we drop those unemployment status spells which indicate that individuals were searching for a new job while being employed (34,963 spells of 16,758 individuals).

In total, 83,316 individuals remain in our analysis.

Table 10: Reasons for excluding individuals from the analysis

Code	Reason	Freq.
Komvux-Data		
111	Participation before child birth	30,533
107	Start before II/1997 and ongoing in II/1997	375
108	End after II/2002	4,245
102	Missing end date	441
103	Start after reporting period	1
104	End before reporting period	1
106	Drop out before II/1997	4
109	Negative duration	7
112	Multiple participation spells	6,229
113	Participation with different hours attended	23,887
Benefit-Data		
301	Individuals with marker	7
Merging Handel-Benefit-Data		
401	No corresponding unemployment status spell	2,701
Employment Data		
501	Self-employed or farmers	12,937
502	More than 10 spells per year	271
	Total	81,670

There is no regularity concerning how women are registered when being unemployed and giving birth to a child, although caseworkers are recommended to deregister individuals during the time of the maternity leave. Sometimes they continue to be registered as unemployed, although not receiving unemployment benefits. Sometimes they are changed to the status partly unemployed, often only for the first few months after child birth. We therefore also create maternity leave spells for unemployed women of 10 months of duration.

A problem is that there are time intervals where people are reported as simultaneously unemployed and employed. Currently, we treat these parallel spells in the following way:

- (i). If unemployment status spell and employment spell overlap for at most 30 days then the employment spell is shortened. The reason for this lies in the fact that we only have the monthly records for the employment data and the unemployment data is recorded daily. The calculated average monthly wage is adjusted accordingly.
- (ii). The unemployment status spell is shortened if it indicates “partly unemployed” and there is an employment spell parallel of more than 30 days. The employment spell for the time of the overlap receives the status “partly employed” (code 3) in case there are benefit payments. For this time period we report the average income from employment and separately the average benefit payments. If the individual does not receive benefit payments then the spell continues to count as employed, despite the overlapping “partly unemployed” record.
- (iii). The unemployment status spell is also shortened if it indicates “unemployed” and there is an employment spell parallel of more than 30 days. The employment spell for the time of the overlap receive the status “employed + unemployed” (code 0) if there are benefit payments. Also for this time period we report the average income from employment and separately the average benefit payments. If there are no benefit payments the overlapping record receives the status “employed”.

For those time periods without records of unemployment or employment we create out of the labor market spells, which can include times of education outside the ALMP, like regular university education. For these out of the labor market spells we also allow for maternity leave spells of ten months.

A.7 LOUISE-Data

With the aid of the annual LOUISE data we define households in which the women live in, separately for each year. The LOUISE data set contains a family identification variable which defines a couple as family in case they are married or live in a registered partnership or live together with a joined child. Children who live in the same house/apartment and are in some kind of financial dependency also belong to the household. We the aid of the family identification and a variable defining the status the partner of the mother (to be) can be identified. We exclude cases where the partner is a mother herself. In addition we drop cases for which we do not have observations for the whole time period (1996 to 2003), which can be due to death or emigration.

The LOUISE data set provides information on parental leave benefits on a yearly basis. We add the amount which is reported in the year of birth and the amount reported in the consecutive year. We then calculate a monthly average over the 10 month which we assume that women take maternity leave.

A.8 Child care fees

A.9 Reduced Form Duration Analysis

For the reduced form duration analysis we initially combine the (partly) artificially split spells according to the following categories:

Category	Sub-Categories
nonemployed (5)	unemployed (2) out of the labor force (4)
employed (6)	employed (1) employed and partly unemployed (3) employed and unemployed (0)

The spell is censored at the time a woman gives birth to a further child, if the spell ends on 31.12.02 or if a women enters a program of ALMP. The potential nonemployment spell begins 10 months after the first observed birth that is after the end of the maternity leave.

To further restrict the employment overlap states (0 and 3) to cases where there are benefit payments reduces the number of overlap cases significantly. For

example exits from nonemployment after maternity leave (and the treatment definition alternative 6, see Table 7) had the following distribution:

Exit into	Freq.	Percent
employed (1)	6,763	52.77
employed and partly unemployed (3)	711	5.55
employed and unemployed (0)	942	7.35
censored	4399	34.33
Sum	12,815	100.00

In case the overlap status would be defined irrespectively of benefit payment we would receive the following distribution of exit states:

Exit into	Freq.	Percent
employed (1)	3,366	26.26
employed and partly unemployed (3)	2,229	17.39
employed and unemployed (0)	2,821	22.00
censored	4,404	34.35
Sum	12,820	100.00

A.10 Discrete Time Analysis

A.10.1 Definition of Employment States

For the discrete time analysis we aggregate the spells into states of 6 month duration. We use the following settings to accomplish this: A period is defined as employed in case an individual was employed for more than 50% of the time. Hereby we weight the overlapping employment unemployment spells in the following fashion: If somebody is defined as employed and unemployed she counts as 30% employed. If she is defined as employed and partly unemployed she counts as 50% employed. These weights take into consideration that the unemployment data is more reliable than the employment data with respect to the time that individuals are employed or unemployed. Also the decision on that an individual has to be employed for more than 50% of the time in order to be count as employed is connected with the inaccuracy of the ANST data. In case a time period is not defined as employed, then it is either defined as in maternity leave,

unemployed, or out of the labor force, depending which of each state is more prevailing. A women is defined as being in Komvux in case she attends a course of 2 to 3 semesters with a minimum of 175 hours each semester. We exclude extreme cases where individuals spend more than 400 hours per semester in Komvux.

A.10.2 Household Income

The Household income consists of a number of different income sources. The main components are the income from employment and the unemployment benefits. For the mothers (to be), these income sources are calculated as described above by way of the ANST data set and the HÄNDEL for the women. The income from employment and the unemployment benefits for their partners are calculated in a similar way. We only do not exclude farmers and self employed or restrict the sample on 10 parallel spells per year when their income from employment is determined. Additional income sources, as social assistance, parental leave benefits, sickness allowance provided by LOUISE data are added.