Short Run Effects on Wage Earnings of the Adult Education Initiative in Sweden

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Abstract

This paper seeks to evaluate the effects of the Adult Education Initiative (AEI) in Sweden. Focus is on the unemployed who were offered full-time comprehensive education at compulsory or upper secondary levels. The AEI is compared with the vocational part of Labor Market Training (LMT) using register data of annual wage earnings as outcome variable. Bias caused by the selection process into programs is dealt with using two separate methods; a method of matching on the propensity score and a classical selection model. The results indicate less beneficial effects on wage earnings of the AEI relative to LMT. When using subsamples, there is evidence of smaller effects for groups with a weak position on the labor market. Estimation results are more positive for females, and individuals residing in the Stockholm county. The latter may imply that a general labor market measure, such as the AEI, is more dependent on a diversified labor market than LMT.

Keywords: Adult education, labor market training, wage earnings
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1. Introduction

The Adult Education Initiative (AEI, *Kunskapslyftet*) in Sweden was in effect from 1997 to 2002. It offered the unemployed comprehensive education at compulsory or upper secondary level. It may be perceived as a new form of labor market measure as the tradition had been to offer subsidized employment, vocational training, relief work or other forms of work related training. The AEI was primarily targeted at unemployed individuals with no more than two year upper secondary education. The idea was to improve the prospects of those with a weak position on the labor market and also to encourage further studies. For individuals with a two year upper secondary school diploma, a year of studies within the AEI would open up for university studies, which normally demand a three year upper secondary school diploma. Other aims of the AEI were to reduce unemployment, promote economic growth and even out educational differences within the labor market.

As mentioned, the AEI was presented primarily to unemployed individuals but also to those in employment with a short education, on the condition that their employer agreed to hire somebody in long term unemployment as their replacement. The education was mainly offered by municipal adult education centers, *komvux*, which is an established institution within the Swedish educational system. Existence of a well functioning body to meet the increased demand for adult education, was a cornerstone for the implementation of the AEI. Municipalities received financial support from the government to supply extra seats at komvux.

The purpose of this study is to evaluate the short run effects of the AEI on wage earnings, using the vocational part of labor market training (LMT) as comparison group.[1] The comparative study of this paper could be seen as one between a traditional, practical, program and a theoretical one. Evaluating the relative effects of these programs provides information not only for the Swedish policy-makers. The general and clear set up of the AEI also makes it interesting for policy makers in other countries.

The vocational part of LMT had several objectives in common with the AEI. They were both primarily intended for job searchers who were unem-

[1]The active nature of the Swedish labor market policies makes it difficult to use "non-participants" as a comparison group.

ployed or at risk of becoming unemployed. Both programs offered a training grant equal to the size of the unemployment insurance (UI) and completion of a program which lasted more than six months qualified the participant for a new period of unemployment benefits.[2] The policy declarations of both the AEI and LMT targeted individuals with a weak position in the labor market as particularly important. The similarities in objectives and the large number of participants in LMT and the AEI makes them suitable for a comparative study. For many individuals, LMT would have been the alternative had the AEI not existed.

There are two lines of economic literature which this evaluation is related to. One group of studies seeks to evaluate the returns of formal education, and another evaluates the effects of labor market programs. There is a vast literature on the effects of education on incomes. In summary, it has suggested an "iron law of wage differentials" which points to an average return of four to five per cent for another year of formal schooling, e.g. Card (1999). Swedish studies such as Isacsson (1999), Kjellström (1999) and Meghir and Palme (1999), have used rich data to correct for ability bias, but the results do not substantially decline compared with the findings in earlier studies. These results are of course interesting from the perspective of the AEI, but they concerned the effects of formal education which was completed at a young age. Education for adults may produce different effects. Alm Stenflo (2000) provides the only existing economic evaluation of studies at the adult education centers komvux. She found positive effects on both employment and income but selection into programs was taken into account only through a few observable variables.

There have been many evaluations of LMT in Sweden. In their survey, Calmfors *et al.* (2002) reported results from twelve different studies of LMT which used data from the 1980's or the first half of the 1990's. The results have a tendency to show negative effects with data from the early 1990's. Carling and Richardson (2001) is one of few studies with data from the late 1990's. They compared LMT with seven other labor market measures. The evidence indicated that the effects of LMT were superior to only three of the other programs.

[2]The UI benefit level is based on the income before unemployment. It presumes membership in a UI-fund for at least 12 months. During this period, one must have worked at least part-time for six months.

There are a few earlier studies of the AEI, i.e. of formal education as a labor market program. These include Westerlund (2000), Axelsson and Westerlund (2001) and Stenberg (2002). All three studies used different measures of unemployment as outcome variables. Stenberg (2002) used the vocational training part of LMT, employing the incidence and duration of unemployment as separate outcome variables. Taking into account selection on unobservables, the results indicated that the AEI reduced the probability of unemployment incidence but increased unemployment duration time. The other two studies also used participants in LMT as a reference group, but included those in preparatory training in LMT. Summarizing their results, they indicate beneficial effects of the AEI on both unemployment duration time and incidence to unemployment. However, in general, outcomes are not estimated with explicit correction for selection effects. When this is done in Axelsson and Westerlund (2001) by way of a two-step Heckman estimation, using the total number of days in unemployment as dependent variable, there are no significant differences between the programs.

This paper is the first evaluation study of the AEI to use annual wage earnings as the outcome variable. Wage earnings in 1999 are compared for those that participated in the AEI and LMT during the fall of 1997. Individuals that go on to further education are excluded from the analysis. The question studied then concerns a comparison between the AEI and LMT for those that did not continue in education after program participation.

Empirically, two separate approaches are used. The first is a method of matching on the propensity score and the second is a classical selection model. Matching is non-parametric and thereby avoids the functional form restrictions of ordinary least squares. It also corrects two sources of potential bias that are not necessarily taken into account in regressions. These may arise either due to the lack of overlap in observable characteristics or due to different distributions in observable characteristics between the groups compared (see e.g. Heckman *et al.*, 1999).

The remainder of the paper is structured so that the data is described in the following section. Section three presents the empirical methods and the estimation results. Section four concludes.

2. Data

The data has been collected from several official administrative registers. First, all individuals that were registered in adult education at komvux, some time during the autumn semester of 1997 are included. Second, data includes the stock of individuals registered in the event history database *Händel,* of the Swedish National Labor Market Board (AMS) on the 15th of October 1997. To clarify, individuals are registered in Händel as long as they are registered at an employment office as either openly unemployed or on a labor market program, including LMT but not the AEI. This is why participation in adult education has been collected separately. Information on wage earnings has been obtained from the Swedish National Tax Board. The data has been merged with official registers by Statistics Sweden (SCB), including information on the individual's age, educational level, gender, citizenship, place of residence, civil status and family situation.

When the AEI began, the government introduced a special grant for education and training (UBS) which was equal in size to the UI. Eligible to apply for UBS were those between 25 and 55 years of age who studied at elementary or upper secondary levels and who were entitled to the UI when the studies were initiated. If the individual was employed, the employer must have agreed to fill the vacancy with a long term unemployed person. In the following, the definition of a participant in the AEI must have been registered in adult education at some point during the autumn of 1997, *and* received the special grant UBS during the same semester. According to this definition, there were 55,965 participants in the AEI during the fall of 1997.[3] The participants in the vocational training part of LMT in Händel included 21,867 observations.

The Report of the Government Commission on adult education (SOU 1998:51) summarized enrollment to different educations among those unemployed that had been offered UBS in the autumn of 1997. These fractions are presented in Table 1. The vast majority attended "core courses" which include mathematics, Swedish, social science and English. LMT spans over

[3]The data only include those with UBS that enrolled in komvux. The Report of the Government Commission (SOU 1998:51) informed that eight per cent, among those offered UBS, enrolled in folk high schools. These offer, besides classes in traditional subjects, variety of courses such as art, music and drama.

Table 2.1: Enrollment of unemployed with UBS.

	% of AEI
Preparatory course	4.9
Mainly compulsory level	12.8
Upper secondary level	
core courses	10.6
core courses & other theoretical	52.4
core courses & other vocational	19.3
Total	100.0

a wide range of occupations and most branches of the labor market. AMS (1999) reports as the five largest, technology & science, health care, administration, manufacturing and service. Sometimes the vocational training took place directly at a company, partly or in its entirety.

In order to make the two program samples comparable, observations are excluded according to several criteria. Here, some of these are discussed. In the Appendix, there is a comprehensive list of all the conditions and the numbers excluded for each criterium.

As mentioned above, the AEI was also offered to individuals in employment. To exclude those coming from employment, and then returning to their old jobs after the AEI, individuals with zero days in Händel in 1997 are excluded. However, it is still possible that we have individuals coming directly from employment onto the AEI. Some individuals may have been unemployed at the start of the year, then found employment, and from employment entered the AEI.

The introduction of the AEI in the autumn of 1997 was announced during a campaign in May 1997. To make it plausible that individuals made an actual choice between LMT and the AEI, those in LMT who had enrolled before the 1st of May 1997 are excluded. Along a similar way of reasoning, those that were in adult education in the spring semester of 1997, and then enrolled in the AEI in the autumn, are also excluded. These individuals would presumably

have gone to adult education in the autumn of 1997, even if the AEI had not been introduced.

The AEI was intended to be offered as one year of full time (or part time) studies. This is also how it was carried out, except for this first group that enrolled in 1997. During the first year of the AEI, the participants were offered a second year of studies with the special grant UBS. This prolongation of the program was not repeated in the following years of the AEI, so those who continued the AEI in the autumn of 1998 are excluded. To keep program lengths reasonably similar, a limit number of days in LMT was set to 365 days and the program must have ended by the first of July 1998. The intention is that both groups will have at least six months to find work before the start of 1999, the year for which the outcomes are measured.

A major problem with studying short run effects of the AEI is that many individuals continued their studies after completing the program. As the outcome variable under study here is the wage earnings in 1999, it makes little sense to include those who still had not re-entered the labor market. For this reason, those who were in education during some part of 1999 are excluded. Of course, avoiding this problem creates a new one as we exclude a large number of individuals. This exclusion criterium concerned 28,455 individuals from the AEI (3,471 from LMT) of which 57 per cent were part of those who prolonged their UBS with an extra year. Thus, the large number from the AEI still in education in 1999 is partly explained by the prolongation of UBS to include the autumn of 1998. Finally, outliers with wage earnings in excess of SEK 300,000 are excluded, representing .06 per cent of the original sample.[4] The yearly gross wage earnings include gross salary and holiday compensation, but not taxable benefits or transfers such as the UI.

There are 22,975 observations remaining after these exclusions, of which 57.5 per cent are in the AEI. The exclusion due to studies in 1999, mentioned above, causes 7,961 observations to be left out only because of this condition (77 per cent of these are from the AEI). The average wage earnings of the excluded individuals were in 1996 SEK 55,300 compared with the remaining sample which had SEK 58,600.

The length of time spent in LMT varies greatly. The average is 146 days.

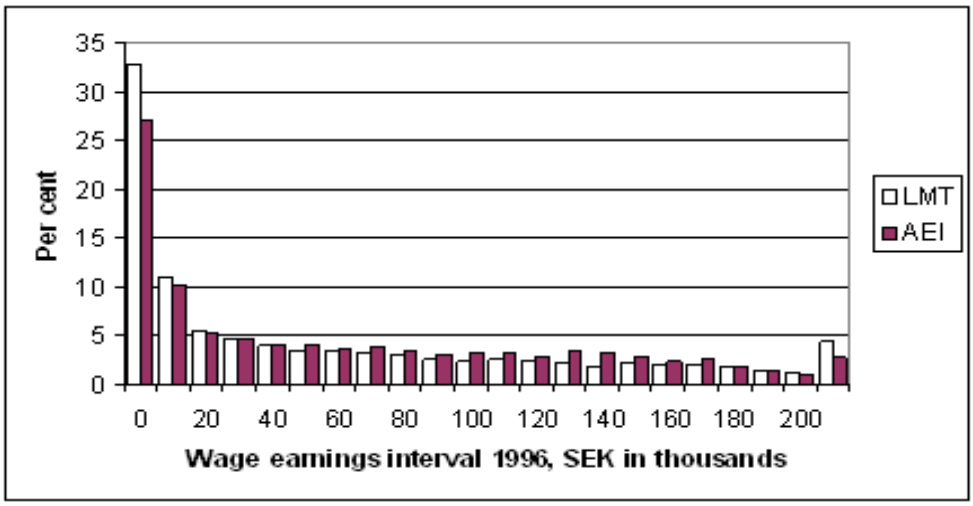
[4] A dollar was on average worth SEK 6.70 in 1996 and SEK 8.27 in 1999.

Two thirds spend between 60 and 240 days on the program with the remainder evenly shared between fewer than 60 days and more than 240 days. By the 1st of January 1998, 49 per cent of the participants in LMT had completed their programs. Among the participants in the AEI, 23.4 per cent did not continue into the spring term of 1998, i.e. they left the program before the 1st of January 1998. If one approximates the lengths of the autumn and spring semesters, average program time of the AEI is in the region of 220 days. With no satisfactory individual record of drop outs from either program, the interpretation of the concept "participation" should be *started program* rather than *completed program*. The existing information on the frequency of drop outs is based on survey data. AMS (1999) reported that for the vocational training part of LMT, the drop out rate in the second quarter of 1998 was approximately 15 per cent. Concerning the AEI, The Report of the Government Commission on adult education (SOU 1999:39) stated that ten per cent interrupted their studies.

The period 1996 to 1999 was one in which unemployment decreased in Sweden. The yearly average unemployment rate was 8.05 per cent for 1996 and 5.60 per cent for 1999. As expected, the average wage earnings of the sample increased. In 1996, the average was SEK 59,900 for participants in the AEI and SEK 55,400 for those in LMT. In 1999, the figures were SEK 88,000 for the AEI and SEK 104,700 for LMT. Thus, interestingly, the relation between the program participants' averages was reversed between 1996 and 1999. The same impression is given by the number of days spent in unemployment. The average in 1996 was 259 days for both programs. In 1999, AEI participants had, on average, 227 days in unemployment while those in LMT had 204 days. This reveals a rather poor labor market record of the sample. Note, however, that the registers do not separate part-time unemployment from full-time unemployment.

Figure 2.1 and Figure 2.2 present the wage earning profiles in 1996 and 1999 of the participants on the two programs. There are two columns for every wage earning interval with LMT displayed in white. The wage earning intervals are, starting from left, zero wage earnings followed by SEK 1-10,000, and then intervals of SEK 10,000 until SEK 200,000 progressing to the highest interval which is between SEK 200 - 300,000. Proportions with zero wage earnings stand out as very high as well as percentages in the highest income

Figure 2.1: Wage earnings distribution 1996.



interval in 1999. While the zero wage earners were reduced from 29 to 20 per cent between 1996 and 1999, the percentage with incomes with SEK 200 - 300,000 went from 3.6 per cent in 1996 to 12.5 per cent in 1999.

Table 2 presents the overall frequencies and fractions of various characteristics of the participants in the AEI and LMT. The last two columns show the mean wage earnings in 1999, and the difference in the mean wage earnings between the programs within each subgroup. The numbers in these two columns are most naturally compared with the average for the whole sample which is given in the top row. The negative differences in wage earnings, throughout the period, between the AEI and LMT, indicate that LMT participants had on average higher wage earnings in 1999 than AEI participants.

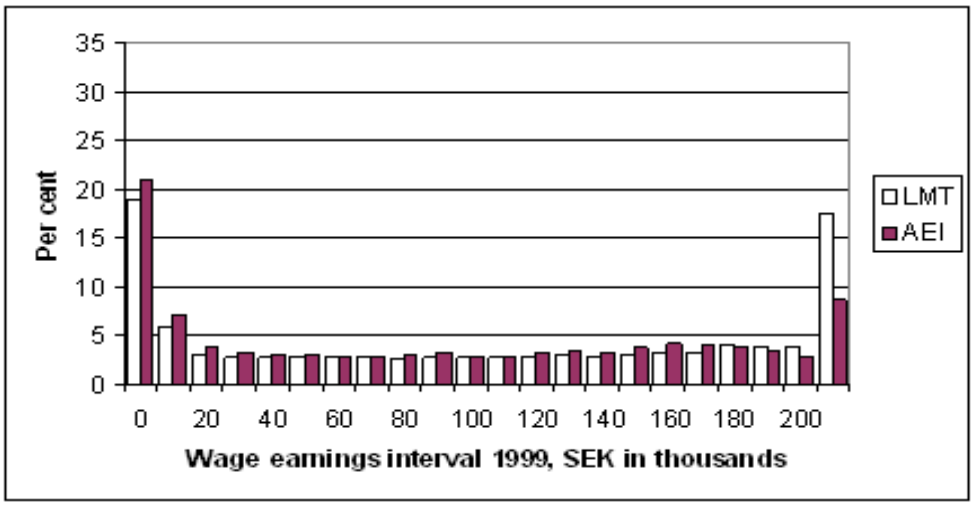
Comparing the participants in the respective programs, the sample in the AEI was on average younger, while those in LMT had higher educational levels and a higher fraction of males. Young age groups had higher than average wage earnings in 1999 which was also the case for those with a higher education and for males.

For both programs, the biggest educational group was, those with a two year upper secondary school diploma. For the AEI, the proportion was particularly high, at 61.8 per cent. This was expected, given that this was the major target group of the AEI. As can be seen, 15.8 per cent of those in the AEI had more than an upper secondary education. It was also possible to receive

Table 2.2: Frequencies, fractions in programs and mean wage earnings for various characteristics.

	N	% of AEI	% of LMT	$\overline{WE}_{99}$	Diff. in $\overline{WE}_{99}$ AEI-LMT
				(SEK in 1000's)	
Total	22,975	57.5	42.8	95.1	-16.8
AEI	13,217	100.0	.0	88.0	
LMT	9,758	.0	100.0	104.8	
Zero W.E. in 1996	6,780	27.0	32.9	69.6	-26.8
W.E. 150 - 300,000 in 1996	2,821	11.9	12.9	137.1	-10.6
Age 25-29	5,391	28.1	22.4	99.6	-27.6
Age 30-34	5,474	25.2	22.0	95.0	-22.7
Age 35-39	4,059	17.3	18.1	97.9	-13.9
Age 40-44	3,116	12.8	14.6	95.1	-8.3
Age 45-49	2,445	9.4	12.3	92.1	-11.0
Age 50–55	1,990	7.2	10.6	79.7	-8.9
Elementary school	757	3.1	3.5	78.6	-7.8
9-year compulsory sch.	3,976	19.3	14.6	83.3	-18.0
2-year secondary sch.	12,335	61.8	42.8	95.8	-12.6
3-year secondary sch.	2,846	9.1	16.9	99.6	-20.3
University $\leq$ 3 years	2,054	5.3	13.9	109.0	-21.6
University $>$ 3 years	1,007	1.4	8.4	104.1	-16.4
Stockholm county	3,141	13.1	14.4	101.4	-5.6
Inland of Norrland	1,700	7.5	7.2	103.4	-20.2
High educ. level in munic.	11,084	44.7	53.0	95.7	-16.0
Born outside Sweden	3,932	14.5	20.7	85.4	-23.5
Swedish citizens	20,934	93.6	87.8	95.3	-16.4
Scandinavian, not Sw.	501	1.9	2.5	85.0	-5.3
European citizen	920	2.2	6.5	108.1	-38.2
Outside Europe	620	4.6	3.2	77.5	-9.9
Disabled	2,795	11.3	13.4	59.1	-13.3
Male	9,682	33.3	54.2	103.3	-15.7
Male, $\geqslant$ 1 child at home	2,417	8.1	13.7	113.6	-16.0
Male, married	3,065	9.7	18.2	109.6	-11.5
Female	13,293	66.7	45.8	89.1	-13.4
Female, $\geqslant$ 1 child at home	7,996	42.1	25.0	88.8	-13.5
Female, married	5,153	24.5	18.3	94.4	-10.5

Figure 2.2: Wage earnings distribution 1999.



the special grant UBS if one had formally completed upper secondary level education. The conditions for thise could be that the individual did not have passes in all subjects, lacked sufficient knowledge in one or more subjects, had a particularly long unemployment period or had an "old" secondary school diploma.

The northern part of Sweden, Norrland, constitutes almost 60 per cent of the area of Sweden but contains only 13 per cent of the population. Most of the cities in this area are along the coastline. The inland of Norrland is constituted of those municipalities that have no coastline. It is a region with permanently higher than average unemployment rates. The Stockholm county on the other hand, is its opposite in this respect. Apart from the regional labor markets, there may be different program effects as both the AEI and LMT are implemented locally.

"High educational level" is a dummy variable for municipalities. It takes the value one if the fraction with, at least, a completed three year upper secondary school in the municipality is above the median value of the Swedish population. It equals one for 67 of the 288 municipalities, representing 54.4 per cent of the population and 48.5 per cent of the sample.

3. Econometric methods and empirical results

The purposes of this section are to present the evaluation problem and the estimation methods to be used in the empirical analysis, i.e. the method of matching on the propensity score and the selection model. The section begins with a presentation of the methodological problem of evaluating the effects of a program on wage earnings. The presentations of the respective methods are then made in separate subsections, starting with matching on the propensity score. The estimation results are displayed in connection with each method.

3.1. Evaluating program effects

Theoretically, evaluation literature assumes that individuals are in one of two states with potential outcomes y_1 for treatment (participation in program) and y_0 for no treatment (in this study, another program, LMT). Hence, for each individual there is *a pair* of outcomes of which only one can be observed. Most evaluation studies seek the average treatment effect on the treated, $E[y_1 - y_0|D = 1]$ where D equals one for participation and zero for non-participation. In general, the focus is on comparing the expected outcomes of samples of participants with those of non-participants. The outcomes of the non-participants then serve as an estimate of what would have happened to the treated individuals had they not participated ($E[y_0|D = 1]$). The bias b can be written as

$$b = E[y_0|D = 1] - E[y_0|D = 0]$$

The method of matching, as well as OLS, are based on the assumption that observable variables can take account of this bias. The classical selection model instead uses a set up where, under certain assumptions, bias is corrected for by taking into account systematic differences in unobservable characteristics.

3.2. Matching on the propensity score

The method of matching assumes that, conditional on some observable characteristics x, outcomes are independent of the assignment to treatment. Formally, the assumption made is

$$y_0 \perp D \mid x$$

where $\perp$ denotes stochastic independence. Given such an assumption, an important result is that it is consistent to assume the outcomes to be independent of the assignment to treatment, conditional on a function $p(x)$, the so called propensity score.[5] The matching procedure is then reduced to matching on a scalar so the loss of a large number of observations is avoided. A common support condition is added; $0 < p(x) < 1$ so there is a positive probability that both $D = 1$ and $D = 0$ can occur for every value of x.

The type of matching estimator used here is a so called one-to-one matching with replacement. The strategy is to pair each treated individual i to some comparable, non-treated individual. The outcome of a treated individual, y_i, is associated with the outcome of his "neighbor" j from the comparison group. The definition of who is to be seen as the neighbor of individual i, with propensity score p_i, is the non-treated individual with the p_j closest to p_i. Formally, this can be expressed

$$|p_i - p_j| = \min_{k \in \{D=0\}} \{|p_i - p_k|\}$$

If there is no value of p_j within some pre-specified distance $\delta > 0$, the treated unit i is left unmatched. Thus matching occurs according to

$$\delta > |p_i - p_j| = \min_{k \in \{D=0\}} \{|p_i - p_k|\}$$

in which case the treated individual i is matched to the non-treated individual j. The mean difference in outcomes between the matched pairs is the estimated program effect.

The method of matching seeks to replicate a social experiment. After conditioning on observable characteristics, matching assumes that individuals are randomly distributed between the two programs. The characteristics are balanced between the groups *as if* assignment was random.

One advantage with matching is that it is non-parametric, i.e. it avoids the functional form restrictions of OLS. Matching also seeks to correct for two other sources of bias, characterized by Heckman *et al.* (1998), which originate from the observable x-variables. One emerges from values of x that do not overlap between participants and non-participants. This makes the evaluator compare non-comparable persons. The other is due to differences in the *distribution* of

[5] A result first derived in Rosenbaum & Rubin (1983).

x (that do overlap) between participants and non-participants. This causes comparable persons to be weighted in incomparable fashions.[6] The matching method corrects both of these sources of bias.

Full results of the probit model, which estimates the propensity scores, $p(x)$, are presented in Table A.1 in the Appendix.[7] One of the explanatory variables in the equation was not defined in section two, the municipal fraction in adult education. It consists of the number of participants in adult education in a municipality divided by its population.

The probit estimation of participation shows the important result that a high educational level in the municipal population have negative effects on the probability of enrolling on the AEI. It indicates that the AEI had an effect of levelling out differences in educational levels across municipalities. This result was also found in Stenberg (2002). The estimations also indicate a higher propensity to enroll in the AEI in the Stockholm county, among those with a short education and those with low wage earnings in 1996.

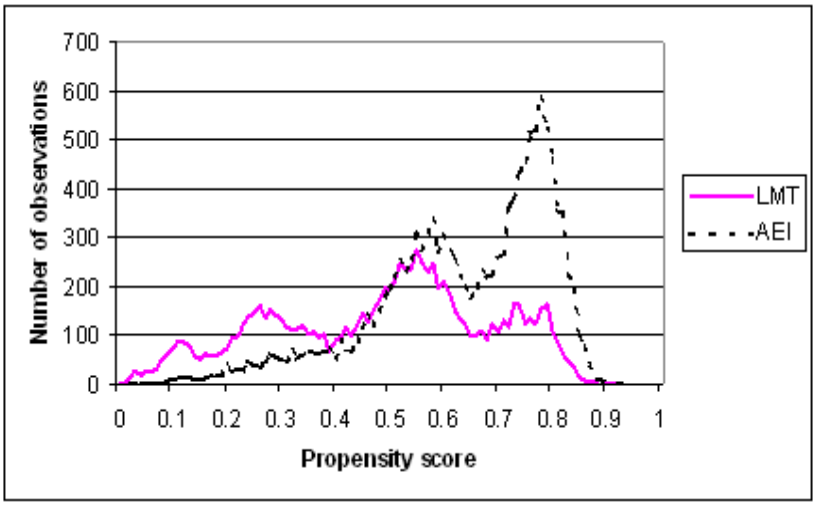
Distributions of the estimated propensity scores for the respective programs are shown in Figure 3.1. It is based on discrete values approximated with two decimal places. There is overlap at most values of $p(x)$, except at the tails which include less than twenty observations. The estimated mean difference in wage earnings in 1999, between matched samples of participants in the AEI and LMT is SEK -15,436 (δ is set to .01) which is significantly different from zero (absolute t-value of 9.12). A similar result is obtained if one uses OLS, SEK -17,129. The complete results of the OLS estimation are presented in Table A.2 in the Appendix.

In Table 3, below, the estimation results of several subsamples are presented using the method of matching and OLS. Both methods show consistently negative effects on wage earnings of the AEI relative to LMT. Most of the coefficients are significantly different from zero,. When interpreting this, one must keep in mind that approximately half of those enrolled in the AEI

[6] At each value of the covariates, with matching the weights are proportional to $\Pr(D = 1)$. With OLS they are proportional to the variance, i.e. $\Pr(D = 1)[1 - \Pr(D = 1)]$ (see Angrist, 1998).

[7] Reference groups are: for the Stockholm county and the inland of Norrland, the rest of Sweden; for the age groups, those above 50 years of age; for the educational groups, Elementary level; for the foreign citizens, Swedish citizens; for the gender and civil status dummies; unmarried females with no children under the age of 16 at home.

Figure 3.1: Distribution of the estimated propensity score for the AEI and LMT.



are not included in the study as they were still in education.

The parameter values of the OLS regressions are in general larger in absolute values than the matching estimates. As could be seen in Figure 3, lack of overlap in the observed variables is not a big problem in this sample. The differences between the model estimates are presumably due to the linear functional form restrictions of OLS and due to differences in the distributions of the explanatory variables between the AEI and LMT.

When one separates men and women into two different samples, the results for females are more beneficial. There may be a gender pattern in how the AEI and LMT compare. This is in accordance with Martin and Grubb (2001) who reported that formal classroom training helps women to a greater extent than men.

The use of regional samples yields some interesting results as they put individuals in more similar labor markets. If one compares Stockholm county and the inland of Norrland the results imply that the AEI has been relatively favorable in the Stockholm county. It is an interesting finding which may suggest that a labor market program with more theoretical contents, would be relatively more advantageous in a diversified labor market. When one separates the municipalities with respect to the educational levels of their populations, there are only small differences in the coefficient values, both being close to the one of the total sample.

Table 3.1: Matching and OLS estimates of the effect of the AEI.

Dependent variable; wage earnings 1999.

Sample used	N	Matching	OLS
Total sample	22,975	-15,436*	-17,129*
Male	9,682	-18,233*	-20,019*
Female	13,293	-11,739*	-13,802*
Stockholm county	3,141	-7,453	-11,926*
Inland of Norrland	1,700	-14,270*	-19,175*
High educ. in munic. =1	11,084	-15,788*	-18,657*
High educ. in munic. =0	11,891	-16,306*	-15,837*
No secondary school	4,733	-15,876*	-17,528*
2-year sec. school	12,335	-11,333*	-15,156*
> 2-year sec. school	5,906	-20,466*	-19,557*
Zero W.E. in 1996	6,780	-20,784*	-22,339*
W.E. 1 - 50,000	6,518	-13,869*	-18,159*
W.E. 50,001 - 150,000	6,860	-10,565*	-12,754*
W.E. 150,001 - 300,000	2,817	-10,029	-11,076*
Born in foreign country	3,932	-20,616*	-22,808*
Foreign citizens	2,037	-14,298*	-21,704*
Disabled	2,795	-9,872*	-10,436*

Note: *significantly different from zero at the five per cent level.

An important target group of the AEI were those with a two year upper secondary school education in 1997. Participation in the AEI would allow them to complete a three year upper secondary school diploma. One would expect more of a positive result for this group, if the three year secondary school diploma contains a stronger signalling effect than for other participants in the AEI. The pattern in Table 3 is that those with a two year secondary school prior to program participation had a slightly better effect of the AEI relative the full sample results.

Conditioning on different levels of wage earnings in 1996 shows coefficient values which increase with the level of wage earnings before program. For zero wage earners in 1996, the estimated coefficient on the AEI dummy is lower than for the full sample. If these individuals have particularly weak positions in the labor market, a possible interpretation is that connection to a given profession of programs in LMT, is a more successful measure for this group.

The sample of those born in foreign countries have negative coefficients which are higher in absolute numbers compared with the full sample. This may indicate that the AEI was not a successful labor market measure for those who had cultural barriers to overcome. However, the results of the sample of foreign citizens, of which 94 per cent were born in a foreign country, are not as clear. One of the explicit targets of the AEI was to promote the prospects of those with weak positions in the labor market. On this evidence, it seems not to have succeeded in comparison with LMT. The only finding that contradicts this is the result of those with a reported working disability. The effects of the AEI are here more beneficial vis-à-vis the total sample.

3.3. The selection model

This subsection will present the classical selection model. A well known problem in evaluation studies is that individuals, consciously or not, act systematically on the basis of unobservable characteristics such as motivation or ability. It may influence both the program enrollment decision and the outcome following the program. Studies that evaluate educational measures usually assume that it is the individuals with higher motivation and/or ability that select into education. Under such circumstances, the effect of education estimated by matching or by OLS, will be biased upwards. It is reasonable to believe that

we have selection on unobservable characteristics into the two programs under study. However, it is not evident that individuals with higher abilities or with greater motivation favor one of the programs over the other. This means that the bias, caused by unobservables, may be positive as well as negative.

In an econometric selection model two equations are specified. One equation models the participation decision

$$D_i^* = z_i\gamma + u_i \tag{3.1}$$

where

$$\begin{aligned} D_i &= 1 \quad \text{if} \quad D_i^* > 0 \\ D_i &= 0 \quad \text{if} \quad D_i^* \leq 0 \end{aligned}$$

and the other the outcome

$$y_i = w_i\beta + D_i\alpha + e_i \tag{3.2}$$

The vectors z_i and w_i contain explanatory variables. A widely used selection model is the Heckman two step method (see e.g. Greene (2000), ch. 22). The "unobservable" part of the respective regressions, i.e. e_i and u_i, are assumed to be correlated (correlation coefficient ρ) and have a bivariate normal distribution. With this assumption, the first step is used to produce an additional variable, the inverse Mill's ratio, which is often referred to as "Heckman's lambda" (λ henceforth). Including this in the outcome regression makes OLS estimates consistent. The coefficient associated with λ indicates the sign of ρ, i.e. the direction of how participation is linked to the outcome variable. If this coefficient is significant, it implies that there is a selection on unobservable variables that is correlated with the outcome.

The parameters of the selection model converge without the use of instruments, i.e. variables in the participation equation that are excluded from the outcome equation, but it suffers from identification problems. Coefficient estimates show values which are quite implausible. This means that stronger identification assumptions are needed in order to improve the model. Roughly speaking, there are two conditions for a variable to serve as a valid instrument. First, it should contribute to the explanatory power of the participation equation, and second, it should not affect the structural form of the earnings equation.

The variable indicating the fraction enrolled in komvux fulfills the criteria of an instrumental variable (IV), but excluding it from the earnings equation was not sufficient to solve the identification problem. In our search for good IV's, we note that the educational level dummies appear to contribute little to the overall explanatory power of the earnings equation (see Table A.2 in the Appendix). This is probably because the sample under study consists of a negative selection of the population with higher educational levels. The differences in average wage earnings in 1999, displayed in Table 2, can therefore be reasonably explained by other explanatory variables.

Table 4 presents estimates of the selection model using the same subsamples as in Table 3. The parameter estimates of the outcome equation of the selection model, for the full sample, are presented in Table A.2 in the Appendix (second column). The estimation results pertaining to the participation equation are identical to the estimation results of the propensity score, presented in Table A.1 in the Appendix.

A rudimentary test of whether the excluded variables, the municipal fractions in adult education and the educational dummies, are valid instruments, can be performed by using a two step procedure. First, one obtains probit estimates of the fitted values of the participation in the AEI. Second, one replaces the AEI dummy with these fitted values in two different OLS estimations, one *with* the excluded IV's and one without. A likelihood ratio test can then be performed where the null hypothesis is that the IV's should not enter the structural form of the earnings equation. For the full sample, the test value rejects the null hypothesis, i.e. it indicates that the instruments are not valid.The other condition for instrument validity, that the instruments should be good predictors of the pobit of participation, is always fulfilled.

In Table 4, there are ten subsamples with p-values exceeding .05 which all indicate a positive selection into the AEI. Using the sample of males the validity of the IV's cannot be rejected, p-value of .319, the coefficient on λ is 23,183 ($|t|$ of 4.41). There are ten samples where one can not reject the null hypothesis of valid instruments. Eight of these show significantly positive coefficients associated with λ, the other two are insiginificantly different from zero. For these subsamples, the estimates with matching and OLS overestimate the effects of the AEI. If an unobservable characteristic is to influence the matching estimates, it must correlate with some of the observable ones.

Table 3.2: Selection model and matching estimations of the effect of the AEI for various samples.

Dependent variable; wage earnings 1999.

Sample used	N	Sel. mod.	p-val.	Matching
Total sample	22,975	-38,871*	.000	-15,436*
Male	9,682	-57,643*	.319	-18,233*
Female	13,293	-31,695*	.000	-11,739*
Stockholm county	3,141	-28,929*	.212	-7,453
Inland of Norrland	1,700	-62,695*	.227	-14,270*
High educ. in munic. =1	11,084	-35,397*	.135	-15,788*
High educ. in munic. =0	11,891	-37,209*	.000	-16,306*
No secondary school[a]	4,733	-29,188	.819	-15,876*
2-year sec. school[a]	12,335	-9,216	.025	-11,333*
> 2-year sec. school[a]	5,906	-41,167*	.092	-20,466*
Zero W.E. in 1996	6,780	-60,746*	.290	-20,784*
W.E. 1 - 50,000	6,518	-45,366*	.012	-13,869*
W.E. 50,001 - 150,000	6,860	-23,617*	.183	-10,565*
W.E. 150,001 - 300,000	2,817	-16,126	.517	-10,029
Born in foreign country	3,932	-52,776*	.009	-20,616*
Foreign citizens	2,037	-63,717*	.016	-14,298*
Disabled	2,795	-32,399*	.658	-9,872*

Note: *significantly different from zero at the five per cent level.

[a]In the samples of the various educational levels prior to program, the IV:s used are the respective educational levels available.

With the exception of wage earnings 150 - 300,000, all samples have positive coefficients on λ. In the case of positive selection into the AEI also in samples with p-values $<.05$, as one may be tempted to believe, the matching estimates would represent a "best-case-scenario" of the effects of the AEI relative LMT.

All the relations between the estimation results of different subsamples in Table 3 that were commented above are valid also in Table 4. The patterns in the results remain unaltered, regardless of method used.

In Table 4, the estimations for the various educational levels may suffer from identification problems which render the results unreliable. None of those samples had a significant parameter in front of λ.

Before concluding, it must be stressed that the negative effects of the AEI relative to LMT presented in this study, still suffer from the fact that a high fraction of their participants continued with studies and therefore, in this short perspective, cannot be included in this evaluation. Also, we cannot say whether the AEI relatively to LMT works more favorably if one could assess its effect over a longer time horizon. The discouraging results of the AEI indicated in this study may therefore be challanged in future studies.

4. Conclusions

This paper evaluates the effects on gross wage earnings from the Adult Education Initiative (AEI) in Sweden. The AEI offered primarily the unemployed, aged between 25 and 55, adult education at compulsory or upper secondary levels. The vocational training part of Labor Market Training (LMT) serves as a reference group. The data under study include the individuals enrolled in the AEI and LMT in the fall of 1997. The outcome variable used is register data of wage earnings in 1999.

Two separate estimation methods have been used. A method of matching on the propensity score and the classical selection model. The results imply that the effects on wage earnings in 1999 of those that participated in the AEI were lower than for those who participated in LMT. Using subsamples, the results indicate that one of the explicit targets of the AEI, to assist groups with a weak position in the labor market, has not been reached. Although negative, the effect of the AEI relative to LMT is increasing in the level of wage earnings in 1996. Another target group of the AEI, those with a two

year upper secondary school, shows slightly more favorable effects compared with the overall sample.

There are signs of differing effects between gender. Females seem to have more beneficial effects of the AEI than males. There is also evidence of the AEI being more beneficial in the Stockholm county compared with a sparsely populated area such as the inland of Norrland. Finally, the participation rate in the AEI seems to even out regional differences in educational levels.

The follow up period of the AEI is still rather short, which means that we know little about its effects in the longer perspective. One of the ideas with the AEI was to encourage individuals to go on to further studies, but those who are involved in full-time education some time during 1999 are not included. This may create sample selection problems for this evaluation of the AEI. Future evaluations of the AEI will be able to include those who went on to further studies.

Appendix

Exclusion conditions

Note that an individual may have been excluded for more than one reason. The numbers excluded are given in paranthesis.

• If not aged between 25 and 55 (AEI 0 and LMT 4,487 obs.).

• If recorded in LMT before the May 1st 1997, when the AEI was announced (4,775 obs.). The information about the AEI was not widely available before that date.

• If recorded as a participant in the AEI during the autumn of 1998 (26,447).

• If recorded in LMT more than 365 days and/or finished the program after the July 1st 1998 (3,438 observations).

• If the participants in the AEI were in adult education already during the spring term of 1997 (15,416 obs.).

• If zero days in Händel in 1997 prior to the program (AEI 8,067 obs.).

• If missing observations (various variables) (AEI 8,016 and LMT 359 obs.).

• If registered in any formal education, adult education, university or other, during the course of 1999 (AEI 28,455 and LMT 3,471 obs.).

• If wage earnings in 1999 are considered as outlier value, in excess of SEK 300,000 (AEI 146 and LMT 313 obs.).

Definitions of data

AEI; Officially domiciled in Sweden and registered in adult education some time during the autumn semester of 1997 and receiving the special grant for education and training. Individuals registered in adult education in the spring 1997 or autumn 1998 were excluded.

CHILDREN; Number of children below the age of 16 living at home.

DISABLED 1997; Classified with a working disability in 1997.

EDUCATIONAL LEVEL; Highest level of education attained by 1997.

INLAND OF NORRLAND; Municipalities in Norrland with no coast line.

LMT; Registered in LMT the 15th of October 1997, with program start later than the 1st of May 1997, officially domiciled in Sweden and aged between 25 and 55.

MUNICIPAL FRACTION IN ADULT EDUCATION; The number of individuals registered in adult education at komvux during the autumn semester of 1997 divided by the municipal population.

MUNICIPALITY WITH HIGH EDUCATION LEVEL; Equals one for the those living in municipalities with a higher than median fraction of individuals with completed three year upper secondary school. It equals one for 56 of 288 municipalities, representing 54 per cent of the population.

REGIONAL EMPLOYMENT GROWTH; Measured for 21 counties as the change in the employment rate in the fourth quarter of 1998 compared with that of a year earlier. Employment figures based on Statistics Sweden and their Labor Force Surveys (*Arbetskraftsundersökningarna, AKU*).

REGIONAL EMPLOYMENT LEVEL; As measured in 21 counties in the second quarter of 1998. Employment figures based on Statistics Sweden and their Labor Force Surveys (*Arbetskraftsundersökningarna, AKU*).

Table A.1: MLE of the probit model participation equation.

Dependent variable; participation in the AEI.

N=22,975

Variable	Coefficient	$\|t\|$
Constant	.418	.98
Munic. fraction in adult edcuation	16.272	9.21
Munic. fraction with $\geq$ 3 yr sec. school	-.004	2.56
Regional employment	.016	3.69
Aged 25-64 in municipality (%)	-3.026	5.58
Stockholm county	.157	3.41
Inland of Norrland	-.082	2.25
Age 25-29	.197	5.34
Age 30-34	.136	3.63
Age 35-39	.050	1.29
Age 40-44	.059	1.50
Age 45-49	.012	.31
9 year compulsory school	.148	2.79
2 year secondary school	.189	3.76
3 year secondary school	-.395	7.34
University $\leq$ 3 years	-.597	10.62
University $>$ 3 years	-1.053	15.72
Disabled 97	-.125	4.63
Born outside Sweden	.214	3.67
Years in Sweden * Born in foreign c.	-.006	2.02
Scandinavian, not Swedish	-.315	4.99
European citizen, not Scandinavian	-.520	9.00
Outside Europe	-.007	.12
Gender (male = 1)	-.448	17.38
Male, married	-.057	1.34
Male, $\geqslant$ 1 child	.130	2.90
Female, married	-.010	.42
Female, $\geqslant$ 1 child	.185	7.23
Wage earnings 1996	2.0 x 10^{-6}	4.30
Wage earnings 1996, mean dev. squared	-5.0 x 10^{-6}	4.23
W.E. of SEK 1 - 50,000 in 1996	-.016	.62
W.E. of 50,001 - 150,000 in 1996	-.030	.57

Table A.2. Regression results of OLS and the sample selection model.

Dependent variable; wage earnings 1999.				
N=22,975	OLS		Sel. mod.	
Variable	Coeff.	$\|t\|$	Coeff.	$\|t\|$
Constant	-39,269	1.57	-23,550	.93
AEI	-17,129	15.66	-38,871	9.36
Munic. fraction with 3 yr sec. school	-171	1.76	-193	1.96
Munic. fraction 25-64 years old	-9,404	.31	-22,470	.74
Regional growth	-2,456	3.28	-2,440	3.25
Regional employment	1,585	5.95	1,678	6.22
Stockholm county	3,429	1.31	4,151	1.57
Inland of Norrland	5,463	2.59	5,519	2.59
9 year compulsory school	-5,844	1.86	-	
2 year secondary school	2,097	.70	-	
3 year secondary school	4,524	1.42	-	
University $\leq$ 3 years	11,483	3.45	-	
University $>$ 3 years	6,524	1.73	-	
Age 25-29	26,807	12.50	28,308	13.05
Age 30-34	21,195	9.72	22,387	10.24
Age 35-39	21,709	9.59	22,193	9.84
Age 40-44	18,616	8.05	18,981	8.23
Age 45-49	12,439	5.32	12,628	5.38
Disabled 97	-28,935	18.27	-30,343	19.03
Born in foreign country	-13,708	4.04	-12,754	3.79
Years in Sw. * Born in foreign country	-92	.50	-106	.58
Scandinavian, not Swedish	4,860	1.31	1,919	.51
European	23,071	6.93	19,435	5.62
Citizenship outside Europe	-5,206	1.42	-5,534	1.48
Male	13,175	8.72	9,462	5.74
Male, married	3,188	1.28	2,589	1.03
Male, $\geqslant$ 1 child	10,554	4.01	11,829	4.44
Female, married	9,697	6.82	9,737	6.79
Female, $\geqslant$ 1 child	1,935	1.32	2,945	1.96
Wage earnings 1996	.38	13.67	.40	14.14
Wage earnings 1996, mean dev. squared	-.65	10.07	-.69	10.57
W.E. of SEK 1 - 50,000 in 1996	7,937	5.37	7,932	5.32
W.E. of 50,001 - 150,000 in 1996	1,681	.55	1,509	.49

References

Ackum-Agell, S., Forslund, A., Harkman, A., Johansson, E., Lundin, M., Martinson, S. and Persson, K. (2000). Erfarenheter av nittiotalets arbetsmarknadspolitik. *IFAU Working Paper 2000:2*, Uppsala.

Alm Stenflo, G. (2000). Inkomst- och sysselsättningseffekter av kommunal vuxenutbildning. *Temarapport 2000:1 från Prognosinstitutet, SCB*, Stockholm.

AMS (1999). Uppföljning av kursdeltagare som slutat yrkesinriktad arbetsmarknadsutbildning andra kvartalet 1998. *APra 1999:1.*

Angrist, J. (1998). Estimating the Labor Market Impact of Voluntary Military Service Using Social Security Data on Military Applicants. *Econometrica* 66, 249-288.

Axelsson, R. and Westerlund, O. (2001). Inflöde och varaktighet som arbetssökande efter avslutad utbildning - Deltagare i Kunskapslyftet och arbetsmarknadsutbildning höstterminen 1997. *Umeå Economic Studies* 566.

Calmfors, L., Forslund, A. and Hemström, M. (2002). Does Active Labor Market Policy Work? Lessons from the Swedish Experiences. *IFAU Working Paper 2002:4*, Uppsala.

Card, D. (1999). The Causal Effects of Education on Earnings. In Ashenfelter, O. and Card, D. (eds) *Handbook of Labor Economics*, Volume 3A, Ch 30.

Carling, K. and Richardson, K. (2001). The Relative Efficiency of Labor Market Programs: Swedish Experience from the 1990's. *IFAU Working Paper 2001:2*, Uppsala.

Greene, W.H. (2000). *Econometric Analysis.* MacMillan, New York.

Heckman, J., Ichimura, N., Smith, J. and Todd, P. (1998). Characterizing Selection Bias Using Experimental Data. *Econometrica* 66, 1017-1098.

Heckman, J., LaLonde, R. and Smith, J. (1999). The Economics and Econometrics of Active Labor Market Programs. In Ashenfelter, O. and Card, D. (eds) *Handbook of Labor Economics*, Volume 3A, Ch 31.

Isacsson, G. (1999). Estimates of the Return to Schooling in Sweden from a Large Sample of Twins. *Labour Economics 6*, 471-489.

Kjellström, C. (1999). *Essays on Investment in Human Capital.* Ph.D. disser-

tation, SOFI, Stockholm.

Martin, J. and Grubb, D. (2001). What works and for whom: A review of OECD countries' experiences with active labour market policies. *IFAU Working Paper 2001:14*, Uppsala.

Meghir, C. and Palme, M. (1999). Assessing the Effect of Schooling on Earnings Using a Social Experiment. *Working paper No 313*, Stockholm School of Economics.

Rosenbaum, P. and Rubin, D. (1983). The Central Role of the Propensity Score in Observational Studies for Causal Effects. *Biometrika* 70 (1), 41-55.

SOU 1998:51. Vuxenutbildning och livslångt lärande. Situationen inför och under första året med Kunskapslyftet. *Reports of the Government Commissions*, Ministry of Education and Science, Stockholm.

SOU 1999:39. Vuxenutbildning för alla? Andra året med Kunskapslyftet. *Reports of the Government Commissions*, Ministry of Education and Science, Stockholm.

Stenberg, A. (2002). Adult Education for the Unemployed: The Experience of the Swedish Adult Education Initiative. *Umeå Economic Studies* 579*, revised version april 2003.*

Westerlund, O. (2000). Inskrivningstid vid arbetsförmedlingen efter avslutade studier - Deltagare i Kunskapslyftet och arbetsmarknadsutbildning 1997. *Umeå Economic Studies* 526.