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NON-COMPARABILITY OF FEMALE AND MALE ADMISSION TEST TAKERS

Åsa Mäkitalo

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Department of Education and Educational Research
Göteborg University

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ABSTRACT

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The problem of selection effects has been noted in discussions concerning group differences in several kinds of test results. This discussion also concerned comparison of different groups' achievement in admission tests for entrance into higher education. It cannot be assumed that this group of students are representative and comparable since they to a great extent have been selected to different educational programmes. Still, these comparisons have been made and results of different groups' ability and/or bias in the test have been presented.

Many studies have been conducted to investigate gender differences in results on the Swedish Scholastic Aptitude Test (SweSAT) and several causes of these differences have been proposed. However, one possible cause, the differential selection preceding the actual test situation, has never been thoroughly investigated.

The present study aimed at investigating whether differential selection is a contributing cause of the gender differences found in SweSAT scores. A prerequisite for such an investigation is to have the data necessary to control for initial group differences in achievement among these test takers. All Swedish students go through the same public school from grade 1 through 9. Their achievement under this period was used to control for such differences between females and males. The analyses were conducted on the basis of marks, results on standardized achievement tests and intelligence tests from compulsory school.

The subjects (n=8728) of the study constituted a representative sample of all Swedes born in 1972. The selection effect was obtained by measuring initial differences in achievements between SweSAT takers and others within each sex.

The empirical results consistently showed that male SweSAT takers constituted a more strongly selected group with respect to ability and previous school achievement than did female SweSAT takers. Thus, within the areas where females excelled initially, the selection effect *decreased* their advantage among the SweSAT takers. Within the areas where males excelled, the selection effect *increased* their advantage among the SweSAT takers.

These results show that we cannot assume that selected and self-selected groups are comparable. Thereby, it is argued that it is essential to take the differential selection effects into account.

1. INTRODUCTION

Admission tests for entrance into higher education tend in many countries to show gender differences in results favouring males (Ingerskog & Stage, 1993). Especially the mathematical parts of these tests contribute to the differences. On the American Scholastic Aptitude Test (SAT), which has been used since 1926, items designed to measure mathematical reasoning ability have always shown differences favouring males. The verbal part of the test used to favour females until 1972 when males started to excel even on these items (Ingeskog & Stage, 1993). The Swedish Scholastic Aptitude Test (SweSAT) has since 1977 been used as an instrument for selection among applicants for higher education in Sweden (Wedman, 1992). There have been gender differences in results favouring males on this test too, from the beginning of its use. The test was at first available only for applicants who had reached an age of 25 and had at least four years of work experience. In 1991 the test was given a much more important role when it became an alternative to selection on the basis of average marks from upper secondary school leaving certificate. The new role of the SweSAT resulted in a dramatic extension of its use. As the test became such an important instrument for selection, the gender differences in results were discussed more intensely. In the government bill 1987/88:109, the importance of working towards an elimination of gender differences in results on the SweSAT also is emphasized. The gender differences in results on admission tests like the SweSAT could partially be explained by earlier research results on gender differences regarding the properties of the test itself, the impact of different formats and topics of items, the competitive nature of test situations, differences in cognitive abilities, self-confidence and achievement motivation (Mäkitalo, 1993).

An alternative explanation not yet investigated thoroughly needs further attention. The SweSAT takers are not representative, not even for those who apply for higher education. The structure of the labour market and gender differences in interests and sets of values probably make males and females choose education and profession according to different principles. A number of choices and selections have been made through the school system. The group of males and females that finally takes the SweSAT is therefore a selected and self-selected group. This problem is also discussed by Wainer (1993), who notes that the self-selection might be of great importance for understanding the group differences in results on the SAT. It is difficult to determine how the self-selection to the SAT operates, however, since this requires data for control of initial group differences in achievement. In Sweden, however, we have the data necessary to control for such differences.

The purpose of the present study[1] is to investigate the possible differential selection to the SweSAT to see whether the gender differences in results on the SweSAT may, to some extent, be explained by initial differences in achievement between the male and female SweSAT takers. Swedish students all go through the same public school from grade 1 through 9. Their achievements under this period are used to control for differences between males and females. The analyses are thus conducted on the basis of marks, results of standardized achievement tests and intelligence tests from compulsory school and the selection effect is measured by differences in achievement between SweSAT takers and others, within each sex.

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[1] This study is part of a project the main purpose of which is to investigate the factors involved in the reqruitment to higher education in Sweden. Within this project a study of the social selection to the SweSAT is also included. Later on a study of the selection to the SweSAT containing both gender and socio-economic background in one and the same analysis will be conducted. Also will the different elections impact on the selection be investigated.

2. PREVIOUS RESEARCH

The SweSAT contains six time limited subtests, with items that require several abilities. In the following, the SweSAT subtests and what they are designed to measure is briefly presented:

- Vocabulary (WORD) measures understanding of words and concepts. Synonyms are to be identified in a list of alternatives.
- Data Sufficiency (DS) is a numerical test that is designed to measure problem solving and reasoning abilities.
- Reading Comprehension (READ) measures reading comprehension in a wide sense.
- Diagrams, Tables and Maps (DTM) is designed to measure the ability to interpret information that is presented in either of these forms.
- General Information (GI) measures knowledge from many different areas that may be acquired in different contexts.
- Study Techniques (STECH) measures certain studying skills, such as search strategies to find information.
- English Reading Comprehension (ERC) which measures reading comprehension in English in a wide sense.

In 1992 the STECH test was replaced by the ERC test, otherwise the SweSAT has been very much alike from one year to another. The items are all in the format of multiple-choice. The SweSAT result (which is transformed to a normed scale) is obtained by summing the correctly answered items from all subtests .Gender differences in results on the SweSAT have been reported in many studies (see Stage, 1985, 1988, 1990, 1992). The total gender difference used to average about 8 points out of a total of 144. Since the STECH test was replaced by the ERC test, the difference has on average amounted to 10 points out of a total of 148 (Ingerskog & Stage, 1993). Normally approximately as many males as females take the SweSAT. In Table 1 the gender differences in results on two test occasions of the SweSAT are presented.

Table 1. Gender differences in results on two sets of the Swedish Scholastic Aptitude Test (spring of 1991 and 1992), expressed as standardised mean differences. Positive values mean that males performed better, negative values that females performed better.

Subtests	Spring of 1991	Spring of 1992
WORD	.21*	.23*
DS	.71*	.64*
READ	.24*	.20*
DTM	.70*	.58*
GI	.54*	.43*
STECH	.32*	
ERC		.40*

The greatest differences have always been found on the quantitative tests, DS and DTM, which is also apparent on the two test occasions presented above. This is not very surprising, since items that require mathematical ability usually show a difference in favour of males (Hyde, Fennema & Lamon, 1990). What is remarkable though, is that there is a gender difference in favour of males even on the other subtests. Special studies have been conducted of the DS test (Henriksson, Stage, Lexelius 1986; Stage, 1987) and the DTM test (Wester-Wedman, 1992a, 1992b, 1992c; Mäkitalo, 1993). These studies, focus upon item content, item position, problem-solving strategies, format and testing time, to see whether it is possible to reduce the gender differences on these tests.

The results of Fennema and Sherman's (1977a) study, indicate that selection effects may be responsible for some of the gender differences in mathematics results, effects that are probably influenced by socio-cultural factors. In the search of explanations to the differences in results on the SweSAT, little attention has been focused upon the selection to the SweSAT and what impact the gender selection might have upon the differences in results.

The processes of selection and self-selection

There are several choices to be made by the student that are of importance if one wants to fully understand the selection and self-selection to the SweSAT. This study, however, is only focused upon the total gender selection to the SweSAT and does not take into account to what extent the steps in between contribute to this total selection. Nevertheless it is important to put the question at issue in its context. I shall start in a discussion of more general differences in female and male choice of education, that might have been affected by the structure of the labour market and by traditional sets of values in society as a whole. Fennema and Sherman (1977b) found that tenth- and eleventh-grade females, especially at lower achievement levels in Mathematics, did not intend to continue to study Mathematics as often as did males. Even though the girls did not see Mathematics as a male domain, the results indicated that variables associated with the female sex-role were negatively influencing the election of Mathematics courses. This sex-role influence was found to work through factors such as confidence, usefulness and the perceived expectations of significant others. These kind of views and sets of values are to a great extent socio-historical and in Sweden they once permeated the formal opportunities of females to get an education at a higher level. Even though Swedish women since 1873, have had the right to pass an academic examination, it was for many decades useless in an important sense, since the formal opportunities to compete with males for services was not given until 1923. The females were, in addition to this, also obliged to resort to the few and expensive private schools for girls. Not until 1927 did females get access to the former male public schools, which were almost totally free of charge until 1905 (Florin & Johansson, 1993).

Young Swedish females have since then increased their educational investments and nowadays more females than males attend higher education. In the autumn of 1991, 51% of the admitted applicants to the public higher education were females (Forneng & Jansson, 1991). The choices of educational programmes however, are still reflecting traditional sex roles (Franke-Wikberg, 1981). Emanuelsson & Murray (1989) found that females and males to a great extent attend different programmes in upper secondary school. The choices of vocational programmes of 2 years especially constitute a parallel to the traditional sex roles in society. The most common choices among females are economy

and social science, while the main part of the males attend technical- and natural science programmes. In Table 2 the proportion of males and females in different sectors in upper secondary school in 1989 is presented.

Table 2. The proportion of females and males on different sectors in upper secondary school 1989 (Wernersson, 1991).

Sector:	Females (%)	Males (%)
Humanistic and social science	23	8
Health/ social/ consumption	26	2
Economic	29	14
Scientific /technical	15	38
Technical /industrial	6	35
Agriculture /silviculture	1	3

As we can see the major part of the males are to be found within the scientific/technical and technical/industrial sectors. The females are not as concentrated, but are especially rare within the technical/industrial sector (Wernersson, 1991).

There are several choices and selections that are being made during a students school-period:

-The choice of alternative courses in compulsory school;
-The choice of attending upper secondary school or not;
-The choice of upper secondary programme;
-The selection to upper secondary programmes;
-The chance of completing the programme that was chosen;
-The choice of attending higher education or not; and
-The choice of taking the SweSAT or not

In compulsory school the first choice, regarding alternative courses in English and Mathematics in grades seven through nine, takes place. The students can choose either a general course or an advanced course. Emanuelsson & Murray (1989) investigated the streaming of students into these alternative courses, studying especially social background, school achievement and the impact of courses taken for participation in upper secondary school. They found that males emphasized knowledge and interest more than females, as significant for their choice of course in Mathematics. In the choice of course in English, however, the opposite was found. Females emphasized knowledge and interest more than males. The interest in the subject was generally most important for taking an advanced English course, while knowledge and educational career plans were most important for taking an advanced course in Mathematics. Emanuelsson & Murray (1989) also found that with the same set of combinations of alternative courses in English and Mathematics, males and females were equally distributed to programmes of 3-4 years in upper secondary school. They were also equally distributed to theoretical and vocational programmes of 2 years. This grouping of programmes is useful to us, since the 3-4 year theoretical programmes give the broadest qualification to higher education. In summary, Emanuelsson

and Murray show that the male and female students, may explain their choices of alternative courses differently. The results, however, indicate that the choice of alternative courses does not influence males and females differently, in attending either theoretical or vocational programmes in upper secondary school.

In a study of the social selection to upper secondary and higher education, Härnqvist (1993) found that school marks in grade 9 had the greatest impact on the choice of theoretical programmes (of 3-4 years) in upper secondary school. This is not at all surprising, since the marks constitute the selection instrument. Also the theoretical choices of subjects in grade 7 through 9 (the choice to study French or German instead of Economy, Art or Technology) and the general achievement level in grade 6 was important. This early achievement level was more important for females' educational choice, while variables from seventh to ninth grade was more important for the males. With similar social background, achievement and theoretical choices, the males more often took the opportunity to attend longer programmes, but since females excelled in school achievement and more often made theoretical choices, the number of females still was greater at theoretical upper secondary education. Social background (parents' education and occupation) was not clearly related to the selection to upper secondary school, but it influenced the choice of upper secondary programmes.

Härnqvist's (1993) results also showed that the marks from theoretical upper secondary programmes of three to four years, had a strong effect on the choice of higher education, especially for the male students. Even in the theoretical programmes of two years, the marks had a greater impact than type of programme, on the choice of higher education. The subjects of his study, however, were all born in 1967, and therefore did not at the time of their examination, have the opportunity to apply on the basis of the results from the SweSAT.

Gustafsson, Reuterberg & Westerlund (1992) studied effects of gender selection among SweSAT applicants. They found that boys constitute a more positively selected group than girls. Härnqvist & Svensson's (1980) study showed that a large part of the talented girls from homes with low socio-economic status, did not choose university-preparatory programmes in upper secondary school. This could be a partial explanation, since these talented girls probably do not take the SweSAT. Gustafsson, Reuterberg & Westerlund (1992) also showed that natural science students are the most positively selected, while human science students constitute the least positively selected group. In Table 2 we can see that the major part of the students within the scientific/technical sector are males, while the sector of humanistic and social science is dominated by females. The choice of upper secondary programme thus seem to be of importance in the selection process.

Forneng and Jansson (1991) conducted a study of admitted applicants to higher education in the autumn of 1991. A majority of those who were selected by average marks from upper secondary school were females, while a male majority was found among those who were selected by SweSAT results. Their study indicates that the most talented females to a large extent apply on the basis of average marks and this group may thus not be represented in several studies of results on the SweSAT.

Even if the choice of alternative courses in English and Mathematics does not seem to affect males and females differently in attending theoretical or vocational programmes in upper secondary school, the selection and self-selection to different programmes within these groups, may be of great importance. There is reason to believe that the choice of

theoretical programmes especially contribute to the selection process, since they give the broadest qualification for admittance into higher education. The marks in upper secondary school were shown to have great impact on the choice of attending higher education, in which the SweSAT becomes an alternative selection instrument (Härnqvist, 1993).

3. METHOD

Subjects

This study is based on a sample of students born in 1972. Longitudinal data from two data bases are used. The major part of the information was collected by a longitudinal research project called Evaluation Through Follow-up (ETF), (Härnqvist, Emanuelsson, Reuterberg & Svensson, 1994). The following information was collected to this data base:

- In grade 6 information was collected through intelligence tests, knowledge tests, replies to questionnaires on attitudes to school, spare time interests, self-evaluation and future plans. Also parents' replies to conditions of home environment, attitudes to school and education were collected.
- In grade 9 marks and results on standardized achievement tests, given to all students in these grades were collected.
- One year after compulsory school data from questionnaires on the students' current situation and view of compulsory school was collected.
- In addition, yearly administrative data has been collected, consisting of study options, courses taken etc.

The material includes about 9000 students, of which 95 % were born in 1972 . These 95%, or more accurately 8728 subjects, are all part of this study. From another data base 'BACE 72', that includes everyone born in 1972, the ETF-sample was supplemented by marks from grade 9 and scores from six sets of the SweSAT (from the spring of 1990 to the autumn of 1992). In Table 3. the number of males and females that has taken the SweSAT is presented.

Table 3. Numbers of males and females out of the total group, that has taken the Swedish Scholastic Aptitude Test under the period 1990 to 1992.

	Males	(%)	Females	(%)	Total
SweSAT applicants	1035	46,2	1203	53,8	2238
Total group	4449	51,0	4279	49,0	8728

In Table 3 all subjects in the study are included, even those who don't apply for higher education. 28 % of the females, and 23 % of the males have taken the SweSAT during 1990 to 1992. Earlier studies of gender differences in results on the SweSAT and of the selection effects have not been able to take into account the whole group out of which the subjects are a part, the sample has not been representative. The data material used in this study, therefore gives an opportunity to study effects of selection through the school system.

Variables

In order to see if male and female SweSAT takers are comparable, measures of their earlier achievements are necessary. In this study, marks from compulsory school, results from standardized achievement tests and intelligence tests are used as a basis for analysis of selection. These variables are used to measurement group differences in performance. A multiple regression analysis was made on each of the different variables presented in Table 4 (for a more detailed presentation see Reuterberg, 1994):

Table 4.
Dependent variables and abbreviations.

Variables:	**Abbreviations:**
Language domain:	
Verbal test - opposites, grade 6	Oppos6
Standardised achievement test, reading grade 9	SWachr9
Standardised achievement test, writing, grade 9	SWachw9
Marks in Swedish, grade 9	Swed9
Marks in English, grade 9	Engl9
Social science domain:	
Marks in Geography	Geog9
Marks in History	Hist9
Marks in Religious studies	Reli9
Marks in Civics	Civi9
Practical/Spatial domain:	
Spatial test - Metal folding, grade 6	MF6
Marks in Art education, grade 9	Art9
Marks in Crafts, grade 9	Craf9
Natural science domain:	
Achievement test - Mathematics, grade 6	Mach6
Inductive test - Numerical series, grade 6	NS6
Standardised achievement test, Mathematics, grade 9	Mach9
Marks in Mathematics, grade 9	Math9
Marks in Biology, grade 9	Biol9
Marks in Physics, grade 9	Phys9
Marks in Chemistry, grade 9	Chem9
Marks in Technology, grade 9	Tech9
General School Achievement:	
Sum of intelligence tests, grade 6	Testsum
Grade Point Average, grade 9	GPA

The grading system in Sweden has (since the 60's) been based on a norm-referenced procedure (Wedman, 1992). Standardized tests in a number of subjects were developed, which are still given to all students in a certain grade in order to establish the achievement level of the individual class. The marking procedure is thereby, at least theoretically, based on the level of each class compared to all other classes in the same subject in Sweden. Even though students choose alternative courses of different difficulty levels in English and Mathematics, the marks in ninth grade are not corrected according to this difference, which make them incomparable. The same problem arose with differences in Mach9, which presented two tests with different levels of difficulty (adjusted to these alternative courses). A structural equation model with latent variables was used to control for differences in achievement level containing all subject areas (Reuterberg, 1994). From the model used to control for differences in performance in all subject areas, constants reflecting the differences in marks and test results then were estimated. The students' marks and results at the advanced courses were corrected by adding the correction factors to their original marks and results. Note that this correction will have effect on the example of marks in Mathematics below and on GPA in Figure 1.

The multiple regression model

A multiple regression model was used to analyze how the selection to the SweSAT can be explained by initial differences in test results and marks (which comprises the whole ETF sample). To obtain a concrete measure of the interaction between sex and the choice of taking the SweSAT or not (Sex∗SweSAT) with respect to ability, the multiple regression analyses were conducted with previous achievement as dependent variables (for a more detailed presentation see Reuterberg, 1994). The different test results and marks thus constituted dependent variables and were analyzed separately, but with the same independent dichotomous variables presented below.

SweSAT	(SweSAT-takers=1, Others=0)
Sex	(Females =1, Males=0)
Sex∗SweSAT	(The interaction between SweSAT and Sex)

The analyses thus concerned observed variables that preceded the choice of taking the SweSAT or not, as in the following equation:

$$\text{Mark}=\text{Constant} + B_1(\text{Sex}) + B_2(\text{SweSAT}) + B_3(\text{Sex}*\text{SWESAT})$$

With this equation we get the expected marks for four different groups:

- female SweSAT takers (Sex=1, SweSAT=1, Sex∗SweSAT=1)
- other females (Sex=1, SweSAT=0, Sex∗SweSAT=0)
- male SweSAT takers (Sex=0, SweSAT=1, Sex∗SweSAT=0)
- other males (the reference group) (Sex=0, SweSAT=0, Sex∗SweSAT=0)

The SweSAT coefficient shows the selection among SweSAT takers and others within the reference group of males. The Sex∗SweSAT coefficient shows the difference between the

selection of males and the selection of females (if it is negative, the selection among males is stronger than among females).
Let us take the expected marks in Mathematics as an example:

	Constant:	B_1Sex:	B_2SweSAT:	B_3Sex*SweSAT:	Mark:
Female SweSAT takers:	3.45	+ .12	+ 1.29	- .32	= 4.54
Other females:	3.45	+ .12			= 3.57
Male SweSAT takers:	3.45		+ 1.29		= 4.74
Other males	3.45				= 3.45

The SweSAT takers' expected marks are higher than for those who have not taken the SweSAT. The difference between the female groups is not as great as the difference between the male groups. The SweSAT males thus seem to constitute a more positively selected group than the SweSAT females. This gender difference in selection is expressed by the negative interaction term Sex*SweSAT. To make possible a comparison of different dependent variables, the selection among males and among females was transformed into z-values (by dividing the difference with the standard deviation for the total group).

4. RESULTS

The gender selection to the SweSAT

In the presentation of the results of the multiple regression analyses the marks have been grouped, into different areas (Reuterberg, 1994). The Verbmark consists of the marks in English and Swedish, Socmark of the marks in Geography, History, Religious studies and Civics, Spamark of the marks in Art education and Crafts and Scimark contains the marks in Mathematics, Biology, Physics, Chemistry and Technology. The selection effects among males and females are presented in z-values (the unstandardized B-coefficients are also presented). In Table 5, the gender selection to the SweSAT is presented.

Table 5. The selection to the Swedish Scholastic Aptitude Test among males and females, expressed in B-coefficients and z-values. The differential selection effect is also presented (* significant on a 5 % level).

	Sex	SweSAT	Sex*SweSAT	Z	Difference
Oppos6	males	5.30*	0	.89	.08
	females		-.45	.81	
SWachr9	males	15.17*	0	1.05	.30
	females		-4.28*	.75	
SWachw9	males	.66*	0	.91	.21
	females		-.17*	.70	
Verbmark	males	1.04*	0	1.19	.24
	females		-.21*	.95	
Socmark	males	1.18*	0	1.31	.28
	females		-.25*	1.03	
MF6	males	4.45*	0	.60	.13
	females		-.99*	.47	
Spamark	males	.55*	0	.87	.11
	females		-.07*	.76	
Mach6	males	7.25*	0	1.07	.29
	females		-1.75*	.78	
NS6	males	7.49*	0	.91	.18
	females		-1.55*	.73	
Mach9	males	23.11*	0	1.19	.35
	females		-6.78*	.84	
Scimark	males	1.22*	0	1.33	.32
	females		-.29*	1.01	
Testsum	males	17.24*	0	1.00	.18
	females		-2.98*	.82	
GPA	males	.95*	0	1.30	.25
	females		-.18*	1.05	

All z-values are positive regardless sex, which implies that SweSAT takers as a group are positively selected. As we can see in Table 5, the results are very clear also regarding the differential selection effects. There is not one single variable that shows a harder selection among females than among males. These results thus show that males taking the SweSAT constitute a more positively selected group than females on the basis of all marks as well as all test results. The differential selection effect (the difference between males' and females' selection) is largest on the basis of the ninth grade standardized achievement test in Mathematics (where the difference amounts to .35) and the marks within the same domain (.32). The Swedish reading comprehension (.30) also show great differences, as does the mathematical achievement test in grade 6 (.29).

The marks also show strong differential selection effects (GPA, .25). The strongest effect is, as noted earlier, found within the Natural science domain followed by the Social science domain (.28) while the marks within the Practical spatial domain, show less effect (.11).

Do these results necessarily mean that the SweSAT males do have better marks and better test results than the SweSAT females? To be able to understand how this harder selection of males works, we must take a look at the actual means for these two groups. Table 6, presents the unstandardized group means of female and male SweSAT applicants and also the means of males and females of the total group.

Table 6. Unstandardized group means of marks and results on intelligence, and standardized achievement tests. Comparison between Swedish Scholastic Aptitude takers and total group (*gender difference significant on a 5 % level).

Results/Marks	SweSAT Group: males	females	Total Group: males	females
Oppos6	26.93	27.14	22.93	23.68 *
SWachr9	67.65	67.74	56.06	60.11 *
SWachw9	3.32	2.60 *	1.82	2.26 *
Swed9	3.73	4.06 *	2.96	3.47 *
Engl9	4.39	4.56 *	3.57	3.96 *
Geog9	3.95	3.98	3.10	3.34 *
Hist9	4.05	4.00	3.11	3.29 *
Reli9	3.91	4.09 *	3.02	3.43 *
Civi9	3.99	3.99	3.08	3.32 *
MF6	28.15	27.25 *	24.78	24.77
Art9	3.44	3.82 *	3.03	3.52 *
Craf9	3.62	3.76 *	3.28	3.44 *
Mach6	30.55	28.17 *	25.09	24.27 *
NS6	28.44	26.35 *	22.82	22.14 *
Mach9	80.24	71.30 *	63.40	59.83 *

continues

Table 6 cont.

Math9	4.74	4.54	*	3.77	3.84 *
Biol9	3.91	4.00	*	3.04	3.34 *
Phys9	4.11	3.83	*	3.16	3.17
Chem9	3.97	3.87	*	3.03	3.19 *
Tech9	3.73	3.54	*	3.22	3.14 *
Testsum	83.55	80.75	*	70.59	70.61
GPA	3.90	4.01	*	3.15	3.44 *

In Table 6 it is shown that within the Language domain (Oppos6, SWachr9, SWachw9, Swed9, Engl9) females significantly excel within the total group, while within the SweSAT group this advantage is smaller. It even seems that the SweSAT males' performed better at SWachw9. The harder selection among males within this domain thus decreases the female advantage within the SweSAT group. Within the Social science domain (Geog9, Hist9, Reli9, Civi9) the female advantage in marks within the total group is also much greater than within the SweSAT group, in which males even tend to have higher marks in history. In the Natural science domain (Mach6, NS6, Mach9, Math9, Biol9, Phys9, Chem9, Tech9) the test results show a male advantage within the total group. The selection effect therefore gives an even greater male advantage within the SweSAT group.

Regarding the marks within this domain, all except for the marks in Technology show a female advantage within the total group, while the SweSAT group shows an overall male advantage except for the marks in Biology, which is in favour of females. Within the total group in the General School Achievement domain, females excel in marks (GPA) while the female advantage in Testsum is insignificant. In the SweSAT group, however, the GPA shows a female advantage, while Testsum shows a male advantage.

It may be asked if the harder selection of males occurs because girls at higher achievement levels do not take the SweSAT or because boys at lower achievement levels do not take the SweSAT? Figures 1 and 2 show the probability of taking the SweSAT at different achievement levels (obtained by the SPSS Probit procedure). In figure 1, the analyses are made on the basis of GPA (corrected), while figure 2 show the probability of taking the SweSAT on the basis of Testsum.

Figure 1. Probability of taking the SweSAT on the basis of GPA
Comparison of males and females.

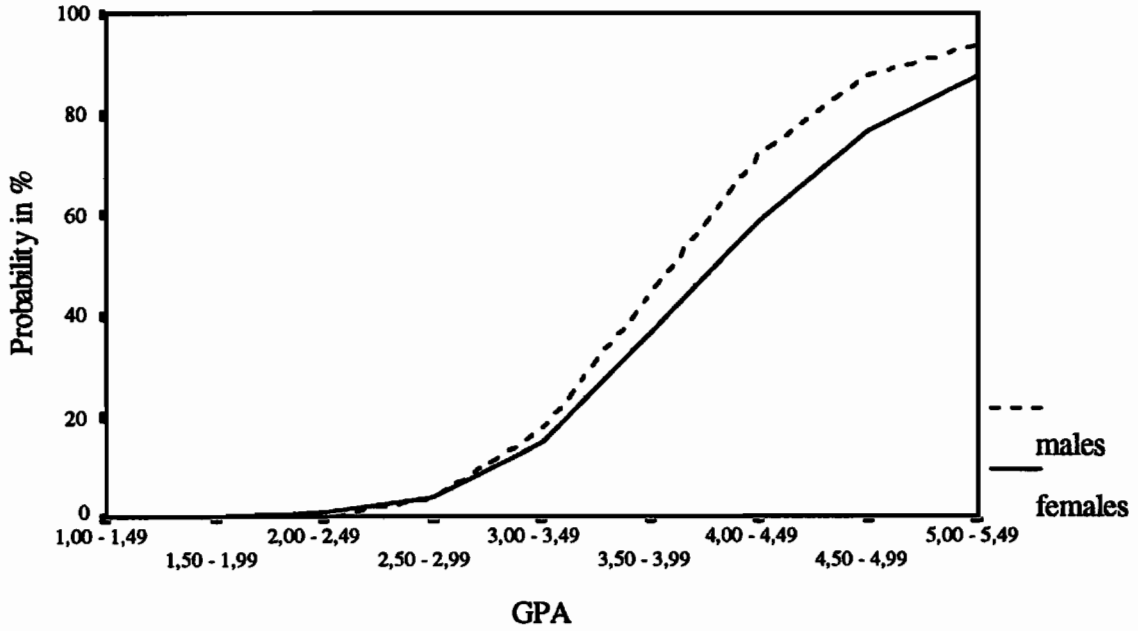
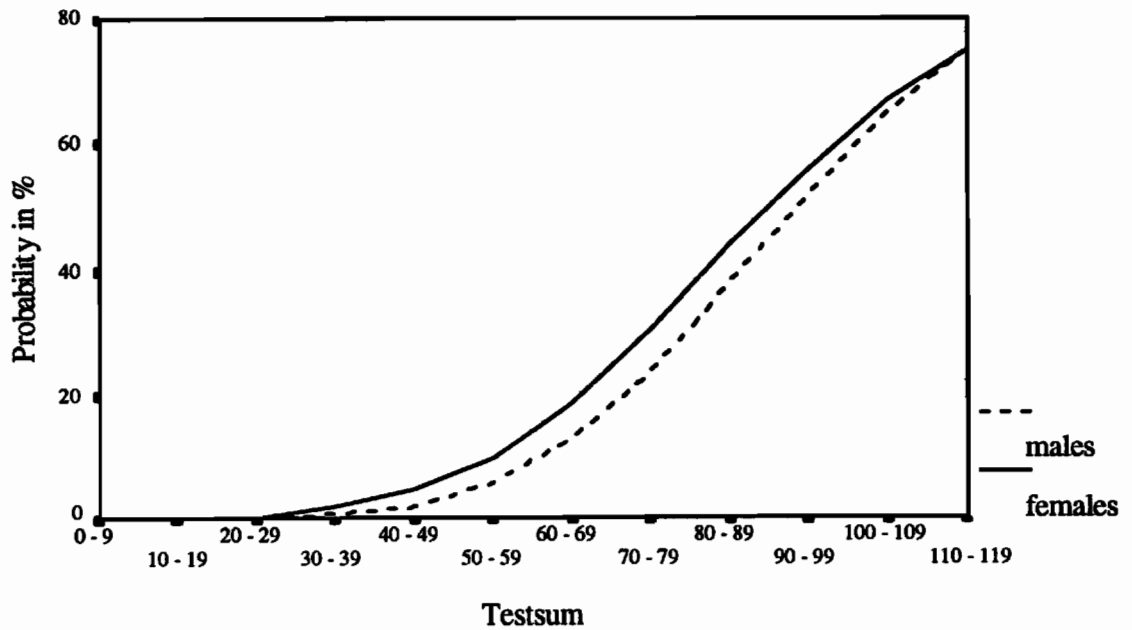


Figure 1 gives us some supplementary information about the selection processes. It is quite clear that at higher GPA levels (from 3.50) the probability of taking the SweSAT is much greater among males than females.

Figure 2. Probability of taking the SweSAT on the basis of Testsum.
Comparison between males and females.



In Figure 2, it is shown that the probability for females of taking the SweSAT is greater than males, on the basis of test results. The greatest difference is found at medium and lower test results, which indicates that females at these achievements levels more often than males take the SweSAT.

5. DISCUSSION

The empirical results consistently show that male SweSAT takers is a more strongly selected group with respect to ability and previous school achievement than are female SweSAT takers. Even though these results are very clear, the underlying explanations to the harder selection of males are difficult to pinpoint with the information available here. One hypothesis which may be formulated with reference to Forneng and Janssons' (1991) study is that the most talented girls apply with average marks instead of SweSAT results. Their study, however, did not comprise all applicants to higher education, only those who were admitted. The results presented in Figure 1 support the hypothesis that females with high marks choose not to take the SweSAT to the extent that males do, which explains a part of the gender differences in results at the SweSAT. The girls with high marks probably instead apply on the basis of average marks from upper secondary school. It is thus quite obvious that male and female SweSAT takers are not comparable in this sense.

Also Figure 2, shows us that the males and females that take the SweSAT are not comparable (on the basis of test results). Females more often take the SweSAT, than do males, at the same level of test results. The difference is greatest at medium and lower achievement levels. The SweSAT may thus, among 'weaker' students, be seen as a second chance to a greater extent among females than males (which in turn will demand an explanation of its own).

The importance of the effects within the Natural science domain, could have several explanations. It seems that skills in Mathematics is conceptualized as of special importance for educational career plans compared to English (Emanuelsson & Murray, 1989). This also is in accordance with Gustafsson, Reuterberg & Westerlund's study (1992) in which it was found that natural science students constitute the most positively selected group to the SweSAT while humanistic and social science students (of which most are females) are the least positively selected groups. The natural science domain in which Mathematics skills are important, could also be seen as a male area, with quantitative elements, which is known to favour males. Thus may the proportion of males and females in different sectors (Wernersson, 1991) at upper secondary school be of special importance.

Even if female students generally get somewhat higher marks even within the Natural science domain, the advantage is decreased by the selection effects to the SweSAT. In addition, males generally excel on test results within this area, an advantage which is increased by the selection effects. The choice of upper secondary programme also seems to be of great importance in this process. One important result of this study is thus, that within the areas where females excel, the selection effects works to decrease their advantage. In the Natural science domain where males excel, however, the effects of the selection give males an even greater advantage.

The differential selection effect amounts to approximately 0.25 standard-deviation unit, which is about the same size as the gender differences in results on WORD, READ and STECH. It is thus a reasonable hypothesis that the differences in results on these tests could be explained by the differential selection. The differential selection effect may also partially explain the differences in results on the DS and DTM tests. For these latter tests it is clear that this explanation must be supplemented with other explanations, however.

It thus seems that there are several processes at work, which do explain at least some of the gender differences in results on the SweSAT. In further analyses the gender selection

processes should be investigated with the social selection processes in one and the same analysis and it would be most interesting to study the differential selections into different study programmes. Also studies of the strength of these processes and their impact on the SweSAT results should be conducted. The results of the present study also implies that we cannot assume that male and female groups are comparable. In future research it is essential to take the differential selection effects into account, especially in studies at upper secondary school or higher education, where males and females to a great extent have chosen different educational programmes.

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