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Different Grounds for Admission: Its effects on recruitment and achievement in medical education

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Abstract The purpose of this study is to examine effects of the admission system to higher education on background diversity of students and study efficiency. By using data from a longitudinal project, the students admitted to medical education on different admission grounds are compared. The results indicate that admissions based on upper secondary grades best promote the goal of diversity. In addition, those students perform nearly as well as those admitted via step-wise procedures. The step-wise procedures promote study efficiency, but tend to favour applicants with upper-middle class and Swedish backgrounds compared to those admitted via grades. Those admitted on the basis of SweSAT scores perform more poorly than those admitted via grades and step-wise procedures. Furthermore, the results indicate that admission via SweSAT scores contradict rather than promote the goals of increasing social, educational and national diversity in higher education.

Introduction
In Sweden, a centralised and unified admissions system to higher education is well established, with aims to promote social, educational, national and gender diversity as well as efficiency in studies (Kim, 1998). In recent years, the government also has emphasised the goal to increase the number of students who begin studies in higher education before the age of 25. Furthermore, the assumption is that uniformity of admission procedures and central co-ordination will guarantee fairness, equal treatment, and an efficient and predictable admission system.

In order to be admitted to undergraduate higher education, the applicant must satisfy general requirements that are the same for all courses and programs. Most courses and programs also have course requirements that vary depending on the subject
area and the type of course. As in other countries, higher education in Sweden has expanded during the second half of the twentieth century. However, the competition for places is still fairly severe, and only about half of those applying are offered a place. The situation varies, however, over programs and where they are offered. The most popular or prestigious programs (e.g. medical education) have more than ten first-choice applicants for every place on offer. Other programs, however, admit all those who apply (National Agency for Higher Education, 2002a).

For a long time, admissions to most programs were generally based on grades from upper secondary school. In the late 1970s, entrance requirements were liberalised and work experience was introduced as a selection criterion in addition to school grades, primarily in order to reduce the influence of social background. For individuals lacking upper-secondary qualifications and who were older than 25 years of age and had at least four years work experience, a scholastic aptitude test (SweSAT), similar to the SAT in the US, was introduced. In 1991, however, all applicants were given the opportunity of taking the test, and to use the results as a voluntary complement to their school grades.

In the early 1990s it was argued, not least by faculty in medical schools, that grades and test scores fail, when used alone, to provide satisfactory information about the applicant's motivation for professional studies or suitability for the corresponding professions. In addition, admissions procedures based on grades and test scores tend to select overly homogeneous groups of students with regard to scholastic aptitude and social, educational and national background (Areskog et al., 1992; Hindbeck et al., 1992; Holmberg et al., 1988). Admission to medical education, it was said, ought to be designed to predict not only study-related skills, but also motivation for such studies and personal qualities of importance for the medical profession. Thus, so called step-wise admission procedures, including interviews and a variety of written tasks, were introduced for professionally oriented programs in which certain personal characteristics or special competencies are required, such as doctors, nurses, psychologists, social workers and teachers.

Thus, the selection procedure used in Sweden for most medical programs involves three selection instruments. Almost all applicants compete on the basis of grades and a great majority has SweSAT scores as well, while considerably fewer applicants also compete through the step-wise procedure. Each applicant is assigned to the ranking list
where he or she has the best chances of being admitted. The academic institutions themselves determine the proportions of admitted students from each of the ranking lists within some limits. Generally, at least a third of the places must be allocated on the basis of grades, and at least a third on the bases of SweSAT scores. However, if professional schools, after having obtained authorisation by the National Agency of Higher Education, are allowed to use step-wise admission, no more than two thirds of the places available in any program may be filled using this alternative procedure as a voluntary complement to high school grades and SweSAT scores (National Agency for Higher education, 2002a).

The purpose of the present study is to examine effects of the admission system by comparing students admitted through different grounds for admission into medical education. The comparison parameters are background variables and efficiency in studies. The admission groups are grades from upper secondary school (UppSecgr), SweSAT scores (SweSAT), SweSAT scores including possible credit points for job experience (SweSAT+JobE) and step-wise procedure (Step-wise).

Previous research on selection effects of different grounds for admission
Previous research indicates that the different selection instruments, i.e. grades, SweSAT scores and step-wise admission, are unequally effective in promoting the goals to attract and select students from different backgrounds and students who are successful in their studies.

Previous research has demonstrated that grades from upper secondary school and SweSAT scores provide good measures for predicting performance in higher education (see Carroll, 1982; Gustafsson, 2000; Schmidt & Hunter, 1998). These two instruments thus measure knowledge and skills of importance for successful studies in most forms of higher education.

For predicting study success, grades from the previous school level measured on a comparable scale are often considered to be the most valid instruments for selection to further education (Carroll, 1982; Gustafsson, 2000). Grades are based on teachers’ long-term assessments of school-based performance. However, in Sweden, ever since the introduction of grades as the sole basis for admission to higher education, their usefulness as the main selection instrument has been questioned (see Henrysson &
Wedman, 1995). With regard to group differences, approximately 10 percent of the variance in grades can be explained by socio-economic background in favour of the upper-middle class, a relation that seems to have remained quite stable during the 1990s. Grades are higher for students born in Sweden. Furthermore, studies have shown that there is an apparent relation between gender and grades in favour of females (see Gustafsson & Westerlund, 1994; Gustafsson et al., 2000). In the 1990s, the norm-referenced grades were replaced by goal-related grades, a shift that caused the usefulness of grades as selection instruments to be questioned. There are, however, indications that even goal-related grades have higher predictive validity than SweSAT scores (Gustafsson 2003).

Results presented by Reuterberg (1998) show substantial socio-economic differences in favour of the upper-middle class for SweSAT scores as well. Furthermore, Reuterberg and Hansen (2001) demonstrated that there are selection effects due to foreign background in favour of test-takers born in Sweden. Sackett et al. (2001) call attention to the fact that racial group differences are repeatedly observed in scores on standardised tests, such as SAT. Like the SAT (Wilder & Powell, 1989; Willingham & Cole, 1997; Rosser, 1989), the SweSAT (Reuterberg, 1997; Stage, 1992) shows gender differences in favour of the male test-takers. Such group differences can be interpreted as being a consequence of bias in the test. An alternative explanation is that self-selection effects cause the differences in test scores. It has, however, been shown that self-selection effects cannot fully explain the group differences in SweSAT scores (Mäkitalo & Reuterberg, 1996; Reuterberg, 1998; Reuterberg & Hanson, 2001). Further, Cliffordson (2004) has shown that students with higher grades tend to take the test at an earlier age. The correlation between SweSAT scores and grades from upper secondary school was about 0.50.

Each selection instrument used in a step-wise procedure has its own properties with respect to self-selection and other kinds of selection effects. The design of the procedure is therefore important. The first step is often based on grades and/or SweSAT scores. The second step often comprises various written tests, aimed at measuring personal characteristics as indicators of suitability for the profession. They are seldom standardised for selection purposes, and thus little is known about their properties as selection instruments. However, they have good face validity and give powerful signals
to faculty and to prospective students that personal qualities are taken into account. The final step is normally based on an interview aimed mainly at assessing personal factors likely to be important for both medical student performance and professionals. The interview is a controversial selection method and up until the last decade researchers generally agreed that the validity was poor. Nowadays, there is agreement among researchers that the interview is far more valid than has previously been believed, as long as it fulfills certain psychometric demands (e.g., Campion et al., 1997; Cliffordson, 2002; Edwards et al., 1990; Mårdberg, 1999). To which extent personality factors are important for success in medical studies seems unclear, even if inclusion of such factors has been found to significantly add to the prediction of efficiency in medical studies (Powis, 1994; Shen & Comrey, 1997).

So far, a limited number of institutions in Sweden have applied for permission to use step-wise admission procedures. The interest is evident in many medical schools, whereas other educational providers are more reluctant for a number of reasons. The costs incurred in developing and implementing these alternative tests are high. Besides, the Agency has set relatively strict conditions for the granting of authorisation. In addition, surprisingly little is known about how step-wise procedures actually work as admission criteria with respect to background variables and study efficiency.

Results presented by Cliffordson (in press) showed that those who applied to medical education through the step-wise procedure at two of Sweden's medical schools were older compared to those admitted via grades and SweSAT scores. Furthermore, the self-selection in favour of students with an upper-middle class background or university-educated parents and of Swedish students was generally greater in this group. The students admitted in the Step-wise group seemed to be even more homogeneous, with respect to social, educational and national backgrounds and they had lower grades and SweSAT scores compared to the other groups. However, the results varied between different step-wise designs, indicating self-selections to be strongly dependent upon the type of instrument used in the first step. Furthermore, selection effects caused by the admission procedure appeared to be dependent on the number of steps and/or the type of instrument used and the number of applicants selected in each step. Follow-up studies undertaken by two medical schools showed that students admitted through the step-wise procedure performed as well as students admitted via the regular system. Furthermore,
the percentage of interruptions in programs of study and drop-outs was lower in the step-wise group, and no differences due to social background were found (Areskog & Holmberg, 1996; Hindbeck et al., 1994; Ritzén et al., 1999).

Thus, previous research suggests that there are conflicts in the goals of the admission system between, on the one hand, the goal to increase background diversity in higher education and, on the other hand, the goal to promote efficiency in studies. Differences in grades and SweSAT scores can partially be explained by background variables such as gender and socio-economic, educational and national backgrounds. The focus of the present study is to examine how the admission system actually works from a system perspective, with a particular focus on background diversity and study efficiency.

Method

Participants and procedures

The study is based on data extracted from a large scale longitudinal project, in which information has been collected from different official registers covering every individual in Sweden born during the years 1972 to 1984 (about 1 350 000 individuals). For this study, those individuals born in the years 1974 to 1982 (in all 922 169 individuals) and who were admitted to medical education during the years 1993 to 2000 were examined. A group of 7 648 applicants for medical education at all six of Sweden’s medical schools was identified. Of those a total of 2 972 were admitted via one of the four admission groups.

The total number of students admitted to medical education during the period was 6 185 (VHS, official statistics), and the number admitted each semester was relatively constant over the period. The study covers approximately 49 percent of the total number of students admitted. However, the number of admitted students included in the study increased over the period and covered approximately 16 percent in 1993, 58 percent in 1997, and 68 percent in 2000. The explanation for this is that the available data successively increases the coverage of different age groups, from one cohort at the beginning of the studied period to covering all cohorts included in the current study at the end of the period. Thus, a limitation of the study is that data for those admitted who were older than 26 year is not available.
At the beginning of the period the distribution of admission grounds in the group studied differed from the distribution for all those admitted (VHS, official statistics). For example the UppSecgr admission group was greater and the SweSAT group smaller, which can be explained by the distribution of age in the studied group. However, in the middle and at the end of the period the distributions were more or less equal among the group studied and all admitted. The most prominent difference between the studied group and all those admitted during the period is that those admitted by SweSAT+JobE were considerably fewer in the studied group, which also can be explained by the age restriction (19-26 years) in the studied group. A number of those admitted by SweSAT+JobE were students with high SweSAT scores but without credit points for job experience. They are not to be considered as representative for this admission group. The 18 students admitted by SweSAT+JobE were therefore excluded from the analyses. The Step-wise admission group involved several step-wise designs, which differ between medical schools. Hence, differences according to design (see Cliffordson, in press) do not emerge in the present study.

**Methods of analysis and variables**

The different admission groups were compared with respect to background variables and efficiency in studies, as measured by achieved credit points, interruptions in studies, drop-outs and obtained degrees. Means and standard deviations are presented, or the number of valid cases and as percentages. Since the study is based on data from all individuals in respective cohort no statistical tests are performed.

Obtained credit points was measured in two main ways: (1) Points obtained from the first through the fifth year (per semester) of medical studies and (2) average number of points obtained per semester over the full length of the studied period. The average points per semester was calculated in two alternative ways, by either excluding or including periods of interruptions and drop-outs. The latter value expresses the effect of periods of interruptions and drop-outs.

Years were measured as academic years starting with the autumn semester. For those admitted in the spring this means that the first year included only one semester. There were no available data describing the number of credit points obtained by students who matriculated in the autumn semester of 2000. Hence, the presentation of
the number of points obtained during the first year of studies includes students who matriculated the first time in the autumn semester of 1993 through to the spring semester of 2000. The corresponding results for the second through to the fifth year of studies include students who matriculated the first time in the autumn semester of 1993 through to the spring semester of 1999 (second year), 1998 (third year), 1997 (forth year), and 1996 (fifth year).

Average points excluding interruptions in studies and drop-outs was measured by dividing the total number of credit points by the number of matriculated semesters. Average points including interruptions and drop-outs was measured by dividing the total number of credit points by the number of semesters from the first to the last matriculated semester, and from the first matriculated semester to the end of the studied period up to 11 semesters, respectively. A program in medicine normally spans 11 semesters.

The variables used were:
- Gender.
- Age, for the years they were first matriculated at medical school.
- Socio-economic background, based on parents’ education and employment: Upper-middle class (SOC I), lower-middle class (SOC II) and working class (SOC III).
- Educational background, on the basis of the parents’ education: University or university college (EDU I), upper secondary school (EDU II), compulsory school (EDU III).
- National background, which was treated in such a way that individuals were categorised into two groups: Born in Sweden and at least one of the parents born in Sweden or born abroad and both parents born in Sweden (NAB I), born in Sweden and both parents born abroad or born abroad and at least one of the parents born abroad (NAB II).
- Average grades, based on marks achieved in the subjects studied in upper secondary school. Marks were measured on a five-point scale where 1 is the lowest and 5 is the highest. However, a new version of the upper secondary school curriculum was successively implemented in the mid 1990s, which is why another grading scale used in upper secondary schools (ranging from 0 to 20), is also present in the study.
- **Number of SweSAT sessions**: This variable indicates each student’s number of SweSAT sessions.

- **Normed SweSAT scores**: The raw scores on the Swedish Scholastic Aptitude Test (SweSAT) were transformed into a normed score, ranging from 0 to 20, in such a way that variations in the difficulties of different versions of the test were taken into account. For those applicants who had taken the test twice or more times, the highest score was considered in the admission procedure.

- **Credit points**, achieved in medical school. This variable indicates the volume of coursework completed, and the rate of studies normally is 20 credit points for each semester.

- **Drop-outs and interruptions in studies**.

- **Obtained degrees**, is presented as a percentage of the possible number of degrees that could be obtained given the length of the program, i.e. 11 semesters.

**Results**

The presentation of results is divided into four steps. First, proportions of matriculated students in the three admission groups are presented. Next, the results from the inquiry into background variables, i.e. age, gender, socio-economic, educational and national backgrounds are discussed. Then the results pertaining to achievement variables, i.e. grades, SweSAT sessions and test scores are presented. Finally, results from analyses aimed at investigating efficiency in studies, i.e. credit point obtained, interruptions in studies, drop-outs and obtained degrees, are described.

**Admissions and matriculations**

The proportion matriculated of those admitted at medical education (Table 1) was two percent greater for the Step-wise group compared to the UppSecgr group, whereas the SweSAT group showed a two percent lower proportion. Among all those who were admitted five percent did not matriculate at any time during the studied period.

(Insert Table 1 about here)

**Comparisons with respect to background variables**
Females were overrepresented in the UppSecgr and the Step-wise groups, but not in the SweSAT group (Table 2). Those admitted through the UppSecgr group were youngest and those admitted by the Step-wise group were oldest.

(Insert Table 2 about here)

The result demonstrated a general selection effect in favour of those with upper-middle class backgrounds (Table 3). Only 28 percent of all those who were matriculated were recruited from lower-middle class social groups, while 5 percent had a working class background. These percentages can be compared to 45 and 28 percent, respectively, for the population as a whole. This pattern was most obvious for the SweSAT group, whereas the Step-wise and UppSecgr groups showed lower effects.

(Insert Table 3 about here)

An overrepresentation of those having parents with university education was evident for all groups (Table 3). Among all matriculated students only 10 and 5 percent had parents with only upper secondary school and compulsory school backgrounds, respectively, which can be compared to 38 and 22 percent for the population as a whole. The proportion with a university education background was greatest for the SweSAT group followed by the Step-wise and UppSecgr groups.

To sum up, the UppSecgr group favoured females and this group also had the youngest students. Oldest were those admitted through the Step-wise group. All groups had an overrepresentation of those having upper-middle class backgrounds and those having parents with university backgrounds. This pattern was, however, strongest for the SweSAT group, which was also the only group favouring males, and it was least
pronounced for the UppSecgr group. Furthermore, for this group the proportion of students with foreign backgrounds was above the average for the population as a whole. On the contrary, an underrepresentation of foreign students was evident among those admitted through the SweSAT and Step-wise groups, but most obvious for the SweSAT group.

Comparisons with respect to achievement variables
Grades for upper secondary school were available for 94 percent of all those matriculated, 65 percent with norm-referenced grades and 29 percent with goal-related grades. Compared to the average grade for the population both norm-referenced and goal-related grades for the studied group was about 2.2 sd units higher (Table 4). Differences in grades between the groups varied between about 0.05 and 1.7 sd units, the UppSecgr group having the highest grades and the Step-wise group the lowest.

(Insert Table 4 about here)

On average 90 percent of those matriculated had taken the SweSAT once or several (up to 12) times (Table 5). The number of sessions was highest for the Step-wise group, and lowest for the UppSecgr group. As expected, the highest scores were shown for those admitted by SweSAT, and the lowest for those admitted via the UppSecgr group.

(Insert Table 5 about here)

Thus, the UppSecgr group had the highest grades, the lowest number of test sessions and the lowest test scores. The Step-wise group showed the lowest grades, the highest number of test sessions, higher test scores compared to the UppSecgr group but lower compared to the SweSAT group.

Comparisons with respect to study efficiency
As is clear from Table 6, the Step-wise group had the highest credit points per semester during the first three years, and for the following two years the UppSecgr group had the highest achievement. For all five years the SweSAT group had the lowest credit point
mean. Differences in obtained credit points between the Step-wise and UppSecgr groups during the first three years varied between 0.03 and 0.18 sd units in favour of the Step-wise group. For the two following years the UppSecgr group obtained 0.02 and 0.13 sd units higher credit points, respectively. The differences between the Step-wise and the SweSAT groups varied from 0.11 to 0.32 sd units and between the UppSecgr and the SweSAT group from 0.09 to 0.25 sd units.

(Insert Table 6 about here)

In summary, the results indicated that admissions via the Step-wise group produced most credit points with the UppSecgr group following closely behind. However, the advantage of the Step-wise group successively decreased over the years, to become lower than for the UppSecgr group the last two years. Those admitted by SweSAT, consistently produced fewer points than the two other groups.

The average credits point per matriculated semester, measured over the full length of the period, showed a difference between the Step-wise and UppSecgr groups of about 0.2 points or 0.09 sd units per semester (Table 7). The differences between these two groups and those admitted via SweSAT were notably greater, 1.3 points or 0.38 sd units and 1.1 points or 0.33 sd units per semester lower for the SweSAT group, respectively.

Those admitted through the Step-wise group showed the lowest proportion of interruptions in studies and drop-outs. These occurrences were somewhat higher for the UppSecgr group, and highest for those admitted by SweSAT (Table 6). Drop-outs were two and a half to three times more common for the SweSAT group compared to the two remaining groups. However, the number of drop-outs is probably somewhat overestimated at the end of the studied period, as those students noted as drop-outs may have restarted their studies after the end of the studied period, i.e. after autumn semester 2001.

(Insert Table 7 about here)

The average credit points per matriculated semester have also been compared with corresponding estimates which also include interruptions in studies and drop-outs.
The results showed that the difference in credit points between the Step-wise and UppSecgr groups increased about 0.3 points per semester. Furthermore, the results demonstrated increased differences between these two groups and the SweSAT group of about 0.9 and 0.6 points per semester, respectively.

Finally, yet another way to examine efficiency in studies might be to compare proportions of obtained degrees (Table 7). The highest relative number of obtained degrees was found for the UppSecgr group (62 percent), closely followed by the Step-wise group with 61 percent, whereas the number of obtained degrees for those admitted by SweSAT was notably lower (45 percent).

**Discussion and conclusions**

The results demonstrate that there are considerable differences due to both background variables and efficiency in studies depending on the grounds of admission. On the one hand, the results indicate that admissions based on grades from upper secondary school best fulfil the goals of increasing social, educational and national diversity and to increase the number of younger students. In addition, the highest number of obtained degrees was found for this group. On the other hand, the students admitted through step-wise procedures demonstrate the highest credit point production and the lowest occurrence of intermissions in studies. The students admitted through SweSAT scores show poorer achievement and consist of a more selected group when it comes to background diversity of students.

**Background diversity**

Several previous studies have investigated group differences due to gender, socio-economic and national backgrounds on selection instruments used for admission to higher education (e.g., see Cliffordson, in press; Gustafsson *et al.*, 2000; Reuterberg, 1997, 1998; Reuterberg & Hansen, 2001; Ritzén *et al.*, 1999; Sackett *et al.*, 2001). Generally, the results from the present study are in accordance with previous results, but there are some differences.
It is well known from previous research that grades favour females (e.g., Gustafsson et al., 2000) and SweSAT favour males (e.g., Reuterberg, 1997), which were also the results from the present study. For the step-wise procedures, the effect due to gender, and other background variables, depends on the instruments used in the procedure (Cliffordson, in press). According to the present study the step-wise procedure shows less favouring of females than grades and more than SweSAT scores. These results are due to the fact that some medical schools use grades and SweSAT scores as the first step in the procedure, while others only use SweSAT scores.

Furthermore, the results from previous studies show differences in grades in favour of students from the upper-middle class, and for those who have university educated parents and Swedish backgrounds (Gustafsson et al., 2000) as well as for SweSAT scores (Reuterberg, 1998; Reuterberg & Hansen, 2001). Even if the present results generally demonstrate advantages for students from the upper-middle class and for those having parents with university backgrounds, the results also indicate that admissions by SweSAT scores to a higher degree favour students with such backgrounds than admission by school grades. In addition, the present results demonstrate an overrepresentation of students with foreign backgrounds among those admitted via upper secondary grades compared to the population. The results for those admitted through the step-wise procedures show less such favouring compared to those admitted by SweSAT scores and greater compared to the grades group, quite likely for the same reason as was true for the effects due to gender. Sackett et al. (2001) also argue that users of standardised tests (i.e., SAT and SweSAT) "…often face difficult choices when trying to optimize both the performance and ethnic diversity of chosen individuals."

Efficiency in studies

Those admitted via the step-wise procedures had the highest point production, in spite of lower grades from upper secondary school and lower SweSAT scores than the SweSAT group. It is reasonable to expect that those admitted via step-wise procedures are relatively well-motivated students. They also show the highest number of test sessions and the highest proportion of matriculated students of those admitted, which strengthen this assumption. Furthermore, those admitted via upper secondary grades
obtain somewhat fewer points, and those admitted via SweSAT scores produce by far the lowest average number of credit points.

The difference between the grades group and step-wise procedures is small (0.2 points per semester), whereas the differences between these two admission groups, on the one hand, and those admitted by SweSAT scores, on the other, are greater (1.1 and 1.3 point per semester, respectively). While these measured differences might at first sight appear relatively slight, make the cumulative effect for a program spanning 11 semesters, at least the two latter differences appear more momentous (2.2, 12.1 and 14.3 points, respectively).

If periods of interruptions and drop-outs, transformed to credit points, also are added, the differences increase to 6, 18.5 and 24.6 points, respectively, the two latter differences being equivalent to about one semester of studies.

The results presented here are in accordance with those from a corresponding study for engineering programs (Svensson, 2004). However, the patterns for background variables are more marked and the difference obtained between those admitted by grades and by SweSAT scores are greater in the present study. The step-wise procedures are not used for admission to engineering programs. Medical students generally achieve more credit points than do engineering students. Furthermore, those admitted who decide not to enrol on the program they were admitted to were lower for medical students. Interruptions and drop-outs also are fewer for medical students.

The proportions of students who obtained their degrees within the normal space of time are greatest for those admitted by upper secondary grades and slightly lower for those admitted by step-wise procedures. Furthermore, according to the results presented by Svensson (2004), the proportion of obtained degrees is lower for those admitted by SweSAT scores.

The conclusion is that admissions by SweSAT scores contradict rather than promote the goals of increasing social, educational and national diversity in higher education. In addition, efficiency in studies for those students is relatively low compared to those admitted by upper secondary grades and step-wise procedures. For upper secondary grades and step-wise procedures the results are more complex. Admissions by the step-wise procedures do promote study efficiency, but not the goals to select students with diverse social, educational and national backgrounds. However,
previous results presented by Cliffordson (in press) demonstrate selection effects due to background variables to be dependent upon the design used, which does not emerge from the present results. Grades from upper secondary school seem to be the admission ground that best promotes the goal of diversity. In addition those students perform almost as well as those admitted by step-wise procedures. Proportions of interruptions in studies and drop-outs were, however, greater for these students compared to those admitted via the step-wise procedures. The step-wise admission procedure is quite costly compared with the use of grades. But, it has been argued (e.g., Areskog & Holmberg, 1996) that the loss of revenue for one drop-out during the first semester exceeds the expenses for the yearly admission procedures.

As mentioned above, previous research shows grades from upper secondary school to be the most valid instrument for predicting study success in further education. However, the results from the present study indicate that the step-wise procedure works as well as grades. Furthermore, both national and international research has demonstrated that SweSAT and SAT scores provide good measures for predicting performance in higher education. However, in this study those admitted through SweSAT scores perform poorer than those admitted via both grades and step-wise procedures. Thus, it does seem quite interesting to investigate why the step-wise procedure results in the selection of more successful students. Further research should also be devoted to investigating how the step-wise procedure should be designed to meet the goal both regarding background diversity of students and study efficiency.
Acknowledgement
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References


Figure caption

Figure 1. Average number of credit points per semester excluding and including drop-outs and periods of interruptions in studies, respectively.
Table 1. Number of admitted and matriculated.

<table>
<thead>
<tr>
<th>Ground for admission</th>
<th>Admitted</th>
<th>Matriculated</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>$N$</td>
<td>$N$ - %</td>
</tr>
<tr>
<td>Upp.sec. grades</td>
<td>1 460</td>
<td>1 380 - 94.5</td>
</tr>
<tr>
<td>Step-wise</td>
<td>1 074</td>
<td>1 040 - 96.8</td>
</tr>
<tr>
<td>SweSAT scores</td>
<td>420</td>
<td>387 - 92.1</td>
</tr>
<tr>
<td>Total group</td>
<td>2 954</td>
<td>2 807 - 95.0</td>
</tr>
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</table>

Table 2. Gender and age.

<table>
<thead>
<tr>
<th>Ground for admission</th>
<th>Female</th>
<th>Age</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>$N$</td>
<td>$N$ - %</td>
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<tr>
<td>Upp.sec. grades</td>
<td>1 380</td>
<td>871 - 63.1</td>
</tr>
<tr>
<td>Step-wise</td>
<td>1 040</td>
<td>576 - 55.4</td>
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<tr>
<td>SweSAT scores</td>
<td>387</td>
<td>135 - 34.9</td>
</tr>
<tr>
<td>Total group</td>
<td>2 807</td>
<td>1 582 - 56.4</td>
</tr>
<tr>
<td>Population</td>
<td>922 169</td>
<td>449 465 - 48.7</td>
</tr>
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</table>
Table 3. Socio-economic, educational and national backgrounds.

<table>
<thead>
<tr>
<th>Ground for Admission</th>
<th>SOC I N</th>
<th>SOC I N - %</th>
<th>SOC II N</th>
<th>SOC II N - %</th>
<th>SOC III N</th>
<th>SOC III N - %</th>
<th>EDU I N</th>
<th>EDU I N - %</th>
<th>EDU II N</th>
<th>EDU II N - %</th>
<th>EDU III N</th>
<th>EDU III N - %</th>
<th>NAB I N</th>
<th>NAB I N - %</th>
<th>NAB II N</th>
<th>NAB II N - %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upp.sec. grades</td>
<td>1 380</td>
<td>856 - 62.0</td>
<td>400 - 29.0</td>
<td>66 - 4.8</td>
<td>1 110 - 80.4</td>
<td>136 - 9.9</td>
<td>70 - 5.1</td>
<td>1 214 - 88.0</td>
<td>134 - 9.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step-wise</td>
<td>1 040</td>
<td>676 - 65.0</td>
<td>291 - 28.0</td>
<td>53 - 5.1</td>
<td>865 - 83.2</td>
<td>108 - 10.4</td>
<td>40 - 3.8</td>
<td>980 - 94.3</td>
<td>49 - 4.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SweSAT scores</td>
<td>387</td>
<td>269 - 69.5</td>
<td>104 - 26.9</td>
<td>9 - 2.3</td>
<td>332 - 85.8</td>
<td>28 - 7.2</td>
<td>18 - 4.7</td>
<td>375 - 96.9</td>
<td>11 - 2.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total group</td>
<td>2 807</td>
<td>1 801 - 64.2</td>
<td>795 - 28.3</td>
<td>128 - 4.6</td>
<td>2 307 - 82.2</td>
<td>272 - 9.7</td>
<td>128 - 4.6</td>
<td>2 569 - 91.5</td>
<td>194 - 6.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population</td>
<td>922 169</td>
<td>19.7</td>
<td>45.3</td>
<td>28.3</td>
<td>33.6</td>
<td>38.1</td>
<td>22.2</td>
<td>88.0</td>
<td>7.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: the remaining students consist of an unspecified group (SOC 0=3.0 % in the total group and 6.7 % in the population; EDU 0=3.6 % in the total group and 6.1 % in the population; NAB 0=1.6 % in the total group and 4.1 % in the population).

Table 4. Grades from upper secondary school.

<table>
<thead>
<tr>
<th>Ground for admission</th>
<th>Upper secondary school</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Norm-referenced N - %</td>
</tr>
<tr>
<td>Upp.sec. grades</td>
<td>829 - 60</td>
</tr>
<tr>
<td>Step-wise</td>
<td>731 - 70</td>
</tr>
<tr>
<td>SweSAT scores</td>
<td>278 - 72</td>
</tr>
<tr>
<td>Total group</td>
<td>1 838 - 65</td>
</tr>
<tr>
<td>Population</td>
<td>344 408 - 37</td>
</tr>
</tbody>
</table>

Note 1) Those with grades, % of all.
Table 5. SweSAT scores and number of sessions.

<table>
<thead>
<tr>
<th>Ground for admission</th>
<th>Number of sessions</th>
<th>SweSAT scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$N$ - %</td>
<td>M - SD</td>
</tr>
<tr>
<td>Upp.sec. grades</td>
<td>1 111 - 81</td>
<td>2.30 - 1.28</td>
</tr>
<tr>
<td>Step-wise</td>
<td>1 031 - 99</td>
<td>4.32 - 2.02</td>
</tr>
<tr>
<td>SweSAT scores</td>
<td>387 - 100</td>
<td>3.42 - 1.76</td>
</tr>
<tr>
<td>Total group</td>
<td>2 529 - 90</td>
<td>3.29 - 1.93</td>
</tr>
<tr>
<td>Population</td>
<td>331 579 - 36</td>
<td>2.02 - 1.28</td>
</tr>
</tbody>
</table>

Note: 1) Those with SweSAT scores -% of all; 2) Rang from 1-12 sessions (population 1-16 sessions).
Table 6. Drop-outs, interruptions in studies and credit points per semester obtained the first to the fifth year - students matriculated the first time autumn semester 1993 to spring semester 2000, 1999, 1998, 1997 and 1996, respectively.

<table>
<thead>
<tr>
<th>Ground for admission</th>
<th>Year</th>
<th>Drop-outs</th>
<th>Interruptions</th>
<th>Matriculated</th>
<th>Credit points</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N - %</td>
<td>N - %</td>
<td>N</td>
<td>M - SD</td>
</tr>
<tr>
<td>Upp.sec. grades</td>
<td>1</td>
<td>1 -</td>
<td>-</td>
<td>216</td>
<td>18.28 - 4.74</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>27 - 2.7</td>
<td>14 - 1.4</td>
<td>943</td>
<td>18.59 - 3.61</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>8 - 1.1</td>
<td>16 - 2.1</td>
<td>731</td>
<td>17.49 - 4.65</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>8 - 1.4</td>
<td>11 - 2.0</td>
<td>544</td>
<td>17.72 - 5.30</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>7 - 1.8</td>
<td>20 - 5.1</td>
<td>367</td>
<td>18.07 - 5.03</td>
</tr>
<tr>
<td>Step-wise</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>910</td>
<td>18.77 - 3.96</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>8 - 1.1</td>
<td>4 - 0.6</td>
<td>711</td>
<td>18.71 - 4.08</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4 - 0.8</td>
<td>10 - 1.9</td>
<td>503</td>
<td>18.42 - 5.17</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>7 - 2.1</td>
<td>4 - 1.2</td>
<td>325</td>
<td>17.60 - 5.40</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>3 - 2.1</td>
<td>3 - 2.1</td>
<td>139</td>
<td>17.36 - 6.32</td>
</tr>
<tr>
<td>SweSAT scores</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>343</td>
<td>17.36 - 4.77</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>16 - 5.5</td>
<td>3 - 1.0</td>
<td>271</td>
<td>18.00 - 4.69</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>7 - 3.0</td>
<td>8 - 3.5</td>
<td>216</td>
<td>17.02 - 5.45</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>10 - 5.5</td>
<td>14 - 7.7</td>
<td>159</td>
<td>16.64 - 6.62</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>4 - 4.0</td>
<td>3 - 3.0</td>
<td>92</td>
<td>16.66 - 6.44</td>
</tr>
<tr>
<td>Total group</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>2 469</td>
<td>18.34 - 4.49</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>51 - 2.6</td>
<td>21 - 1.1</td>
<td>1 925</td>
<td>18.55 - 3.96</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>19 - 1.3</td>
<td>34 - 2.3</td>
<td>1 450</td>
<td>17.74 - 4.98</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>25 - 2.3</td>
<td>29 - 2.8</td>
<td>1 028</td>
<td>17.52 - 5.56</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>14 - 2.2</td>
<td>26 - 4.1</td>
<td>598</td>
<td>17.69 - 5.60</td>
</tr>
</tbody>
</table>
Table 7. Obtained degree from medical school and average credit points per semester during the period autumn 1993 to spring 2000 (excluding and including drop-outs and interruptions in studies).

<table>
<thead>
<tr>
<th>Ground for admission</th>
<th>Credit points per semester excl. drop-outs &amp; interruptions</th>
<th>Credit points per semester incl. Drop-outs &amp; interruptions</th>
<th>Matriculated autumn 1993 -spring 1995</th>
<th>Obtained degree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>M - SD</td>
<td>M - SD</td>
<td>N&lt;sup&gt;1)&lt;/sup&gt;</td>
</tr>
<tr>
<td>Upp.sec. grades</td>
<td>1 216</td>
<td>18.90 - 2.59</td>
<td>17.76 - 3.80</td>
<td>273</td>
</tr>
<tr>
<td>SweSAT scores</td>
<td>343</td>
<td>17.83 - 3.88</td>
<td>16.08 - 5.13</td>
<td>49</td>
</tr>
<tr>
<td>Total group</td>
<td>2 469</td>
<td>18.84 - 2.97</td>
<td>17.73 - 4.03</td>
<td>384</td>
</tr>
</tbody>
</table>

Note: <sup>1)</sup> Number of possible obtained degree given the range of the program.
Excluding drop-outs and interruptions

Including drop-outs and interruptions

Credit points per semester

- UppSec grades
- Step-wise procedure
- SweSAT scores