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University entrance selection and age at admission

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WORKING PAPER 2012:21

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ISSN 1651-1166

University entrance selection and age at admission[1]

by

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November 24, 2012

Abstract

This paper focuses on the predictive validity of the upper secondary grade point average (GPA), when used as selection instrument to higher education. The purpose of the paper is to find out if the predictive strength of the GPA is affected by time, here measured as the time that has passed between when the grades were received (graduation) and university entrance. The data includes approximately 5 900 students admitted to a Business administration or an Economics programme in a Swedish university between the years 1993 to 1996. The predictive validity is studied by correlating the GPA from upper secondary school for the students from each age group with their academic performance, measured by university credits. The results show that there is a weak positive correlation between grades and university credits, but that the predictive strenght decreases with time, to be insignificant about three years after upper secondary school completion. Implications are discussed.

Keywords: admission, selection, prediction, higher education, validity
JEL-codes: I71

1 We would like to thank Val Klenowski, Uwe Dullek, Helena Holmlund, Björn Öckert, Martin Lundin, Karl-Oskar Lindgren, and seminar participants at the Department of Learning and Professional Studies, Faculty of Education, Queensland University of Technology, for useful comments and help.
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1 Introduction

When the number of eligible applicants to higher education exceeds the study positions available, a selection must take place. This selection is not without problems, however. There are a number of expectations on the admissions system and how it should work, but no generic solution for what is the best model for ranking the students in the selection process (Wolming, 2001). In most systems, indicators of previous achievements are being used for elegibility purposes, often in the form of a school leaving certificate, but also for ranking the students, for instance by calculating the upper secondary school grades (or equivalent) into a grade point average (GPA). The assumption is generally that a meritocratic selection, ie. where indicators of ability or achievement are used to rank the students, is perceived as fair, but also most efficient in the aspect that the most able, and hence potentially successful applicants are selected. In measurement terminology, a selection instrument is said to have predictive validity if it ranks the applicants according to their performance on a future criterion measure, for instance academic success.

In Sweden, two instruments are used in the selection to higher education; the upper secondary school GPA and a standardised and centrally administered admissions test, the SweSAT. The test is optional and has the purpose of functioning as "a second chance" for students who are unable to compete with their grades. It is not an instrument for adding new information to another selection instrument, as can be found in some other systems, but to be used separately. This means that if a student is applying with both a GPA and a test score, s/he will be put in two admissions groups, and selected on the basis of which instrument that ranks him or her the highest (Stage, 2004).

There are extensive research concerned with selection instruments' predictive validity, seeking to answer the question "how does the test score or the grade average predict future academic performance?". The general finding is that even though neither grades nor admissions tests seem to predict future achievement very well, grades are still better, espeically when it comes to predicting first year performance in higher education (see, for instance, Henriksson & Wolming, 1998; Svensson, Gustafsson, & Reuterberg, 2001). The conclusion is generally that grades are functioning satisfactory, and further investigations are scarce.

In the prediction studies mentioned above, a common assumption regarding why grades constitute the better selection instrument has to do with the instruments' characteristics and their link to classroom performance: capturing study skills, indistriousness etc. Even though alternative instruments such as the admissions test is knowledge sensitive, as has been shown by Lexelius (2004), it does not attempt to measure the type of knowledge directly specified in the school curriculum in the same way.

The instruments' ability to measure what is being taught in schools has been argued to be an important factor for the validity of the selection instruments, especially in the GPA vs admissions test debate that has been very intense in the USA in recent years (see, for instance, Atkinson, 2001). If this is true, time between previous education and admission should be a variable to consider in the selection since knowledge learned in school is, to some extent, perishable. An interesting question is therefore if the grades will give the same information over time, or if they have a "best before date"? There appears to be very little knowledge on if and, if so, how the predictive validity of upper secondary school GPA and other instruments are affected by time. If time does matter, this will not be a problem as long as the students admitted to universities are young.

However, at least in Sweden this would be an important issue to consider since a fairly large number of students enter university several years after graduating from upper secondary school. The median age of new beginners in Sweden is 23 years, the proportion of new beginners under the age of 20 is less than 20 per cent, and the proportion over the age of 30 is more than 20 percent, making Sweden one of the OECD countries with the oldest student populations (The National Agency for Higher Education, 2008).

The traditional prediction studies are important from the perspective of efficiency and manageability but they also leave a few questions unanswered about when and where an instrument is most optimal to use. The purpose of this study is therefore to investigate if, and if so how, the predictive validity of the upper secondary GPA is affected by time. To study this, the idea is to find out if the upper secondary GPA predicts academic success differently for new beginners of different age. The outcome variable is the number of credits obtained at years one and five after admission. To make the student group as homogeneous as possible, the study is limited to one type of

university programme, in this case the Business administration (BA) and Economics (Ec) programmes for a limited period of time. These programmes are regarded suitable for this study since there is a selection among the applicants to these programmes, and the programmes are very similar between universities across the country. There is also a variation in the number of achieved credits, which means that it can serve as criterion variable. The sample used in the empirical analysis is based on students born between 1972 and 1975 that where admitted between 1993 and 1996.

The paper is structured as follows: the next section will describe the admissions system and also briefly the GPA when used in the selection to higher education. There will also be given a brief overview of previous research focusing on predictive validity and the effect of age and academic performance, relevant for this study. In the following section, the data and method will be described. In the fourth section, the results of the analysis will be presented. In the final section of the paper, the results will be discussed and some suggestions for further research will be made.

2 Selection to higher education in Sweden

In order to get admitted to a Swedish university, certain eligibility requirements must be met. The basic requirements are generally that the applicants must have graduated from upper secondary school (or equivalent). For entry to most university programmes, there are also special requirements, usually in terms of more advanced courses in core subjects such as Swedish, English, and Mathematics etc, which most of the theoretically oriented upper secondary school programmes are providing. If there are more eligible applicants to higher education than there are study places, there will be a selection according to a meritocratic principle, where students are ranked and selected on the basis of their merits, i.e. their school grades (for a more thorough description of the Swedish admissions system, see, for instance, Stage 2004).

The GPA (grade point average) is calculated as a mean value of the upper secondary school grades. As described in the data section of this paper, the GPAs included in this study are based on grades from the former, norm-referenced grading system. Grades were then given on a scale from one to five, with three being equivalent to average performance (with each cohort as the norm group). The GPA included the grades given the final term, all given equal weight. The grades became criterion referenced in the

mid-1990s. The model for calculating the GPA was also changed, to include basically all grades, weighed on the basis of course length. The GPA from the criterion-referenced system was not introduced in the admissions system until 1997. For more information about the new GPA and its characteristics as selection instrument, see Wikström (2005).

2.1 Previous research

There is an extensive research on predictive validy of admissions instruments internationally and also a number of studies on how the Swedish selection instruments and admissions system work (see, for instance, Cliffordson & Askling, 2006; Henriksson & Wolming, 1998; or, for an overview, Wolming and Wikström 2010). The majority of Swedish validation studies have focussed on comparing the instruments in terms of the average number of credits taken by students admitted from each quota group to see how the instrument work relative each other (Lyrén, 2008). The findings are generally that the predictive strenght is slightly higher for the grades than for the test. Using credits as criterion for academic performance (or success) is pragmatic but not without problems, as will be discussed later.

Studies on the relationship between age and performance in higher education have been scarce in Sweden. There are some international studies however, that suggest that age is not so important for academic performance. According to Tumen, Shulruf & Hattie (2008) the most common finding seems to be that there is a negative correlation between age and academic achievement, but that this can be questioned since there are a number of studies showing that this may be an effect of selection rather than age. A review by Richardson (1995) also shows that age is not necessarily negatively correlated with performance, and points out examples where the opposite has been shown. McClure, Wells & Bowerman, (1986) and Sulaiman & Mohezar (2006) have also investigated the effect of age in Business Administration programs (MBA) in the U.S and found that when controlling for other explanatory variables age does not explain academic performance. We therefore conclude that there is no common consensus about the relationship between age and performance.

Even though the research question in this study is if the Swedish selection instruments into higher education predict academic success differently for new beginners of different age, the core in this study has to do with if there is a time effect

measured as the time that has passed beween upper secondary graduation and time for admission. Very little is known about this. The only study found is by Talento-Miller & Guo (2009) who investigated the predictive validity of grades when used for predicting the performance at the graduate level in MBA programmes in the U.S. These programs often use grade point averages that go way back in time as students are required to work for a number of years before they can apply. The correlation between undergraduate GPAs and first year MBA outcomes, as well as between GMAT scores and academic performance were found to decrease as the UGPA and GMAT scores became older. Apart from this study there seems to be little known about how grades or test scores work when there is a time gap between when these were received and when the education begins.

3 The data

The data used in this study has been collected by Statistics Sweden (SCB) and comprises information about all individuals who were born between 1972 and 1975 (N=445,297). The data includes information about the students' background, such as birth year, sex, socioeconomic background, immigrant status, previous study results, SweSAT scores, their grades and GPA from elementary school. There is also information about admission (from what qouta group the student was admitted), the year of admission, place of study and information about progress (credits) at the university level, from the year of admission up until year 2002 (minimum 7 years).

From the population described above we have selected students who were admitted (and registered) in a Business Administration and Economics programme in Sweden in the autumn semesters of the years 1993 through 1996 (n=5979). The reason for omitting those who were admitted in the spring is that the numbers are low, and it is not clear how their credits were reported.

One purpose of the data selection is to study a university programme where the number of applicants is larger than the number of study places, meaning that a selection takes place. The Business Adminstration and Economics programs are regarded suitable for this purpose. Students in these programmes are also rather homogeneous over time, which is an advantage here.

The cohorts have been selected to make it possible to collect educational data for a number of years, also after they were admitted to higher education. The fact that we choose students born between 1972 and 1975 who were admitted between the years 1993 and 1996 means that they are between 18 and 24 years of age at the time of admission. In the period of time when these students went to university, there was also no shortage in the job market, meaning that the likelihood that students would drop out because of early employment in a relevent area is relatively small. The selected students received their upper secondary grades from the former, norm-referenced system. This should not be a disadvantage for this analysis since the norm-referenced grades are more suitable for ranking students compared to criterion-referenced grades (Wikström, 2005). There also seems to be a strong correlation between the former and the present grades (Stage, 2003) which supports their comparability and hence their relevance for this type of study.

A number of observations contain missing information in backround information (see below), which is slightly reducing the sample used in the estimation. For more details regarding variable definitions, see the Appendix.

3.1 Description of data

Students admitted to the Economics and Business Administration programmes are higher achieving in terms of grades compared to the rest of the population. The proportion of immigrants and students from a lower socioeconomic background is lower than the population, which is coherent with students in higher education in general. The proportion of female students is also lower (46 percent compared to 54 percent), which is unusual for university students nowadays where females on average are outnumbering the male students; According to the National Agency for Higher Education (2008) 40 percent of the female students graduate from academically oriented upper secondary school programmes, compared to 30 percent of the male students, and 64 percent of the students who continue to university and graduates with a diploma are women. As these figures are more recent however, the numbers could have been more even some years earlier, as male students previously were dominating in higher education.

Table 1. Descriptive statistics: admissions groups and age at admission

Year	Age	GPA	SweSAT	Other	Total
1993	18	9	2	1	12
	19	466	92	6	564
	20	354	98	9	461
	21	165	115	4	284
Total		*994*	*307*	*20*	*1321*
1994	19	557	109	4	670
	20	538	169	3	710
	21	253	190	2	445
	22	117	130	1	248
Total		*1465*	*598*	*10*	*2073*
1995	20	460	159	4	623
	21	260	187	3	450
	22	138	128	1	267
	23	68	74	2	144
Total		*926*	*548*	*10*	*1484*
1996	21	298	205	5	508
	22	169	138	2	309
	23	70	108	0	178
	24	45	60	1	106
Total		*582*	*511*	*8*	*1101*

Table 1 shows that the number of students admitted from the GPA group is about three times as large as the SweSAT group in 1993, but that the numbers become more even over time. This is not likely to be an effect of the admissions groups changing, but that the population included here gets older, since students are more likely to apply only with their grades if they continue to higher education directly after their graduation. Note also that a few students every year are admitted on the basis of other selection criteria. In the analysis that follows we will disregard the small number of 18 year olds in 1993, since this group is too small to study separately. Missing information decreases the final sample used in the estimations. Upper secondary school grades are missing for 464 observations, and missing social background reduces the sample by another 59 observations, meaning that the sample used contains 5,454 observations.

4 Research strategy

The predictive strength of selection instruments is generally estimated by the correlation between the outcome on the instrument and some criteria for academic success. As previously mentioned, the criterion is often somewhat problematic in prediction studies. In Swedish higher education, grades are often difficult or impossible to use since courses may differ in content or depth, or different grading strategies or standards have been applied. Therefore, in most Swedish validation studies, the criterion for academic success is the number of credits achieved per term or study year. This will also be the case in this study. The problem with using credits is that they only provide rough information about how well the student is performing in school. Still, the number of credits indicates if the student is capable of passing the courses and keeps a normal study pace, which is sufficient here.

A second question regards at what point in time achievement should be measured. Most international studies focus on the achievement the first year after admission. There are advantages and disadvantages of such an approach. The advantage of limiting the study to the first year at university is that it is less likely that students are performing seemingly worse due to sabattical leaves and maternal leaves since these types of absences from educational programmes are more likely to happen later on in the education. A disadvantage is that it is unknown what happens after the first year, and since the purpose of the university education is to provide the students with a full education and hopefully a degree, the first year progress will be insufficient information. Moreover, first year studies contain basic level courses which are easier to pass compared to courses given during later years. Since the programme length is normally 3.5 years of full time studies, and one year of full time studies equals 40 credits[4], this means that programme completion normally requires 140 credits.

However, students may add courses to the programme, meaning that there is no definite upper limit on the number of credits obtained within the programme. They may also complete by taking a bachelor's degree, which requires three years full time studies. To measure academic success we will use the number of credits obtained five years after admission. This will give any students who, for some reason, have had a

[4] 40 credits per year for full time studies is according to the credit system used when the data for this study was collected. In the present system, the number of credits would be multiplied with 1.5.

study break enough time to complete their studies. However, we will use the number of credits obtained after year one as a comparison.

In order to study how the predictive strength of the selection instrument varies with the age of students at admission, we estimate correlations between the selection instrument and the outcome measures. A potential problem when comparing the predictive strenght of a selection instrument, such as grades, over different admission ages is that students admitted at different points in time may not necessarily be comparable because of group-wise differences in traits that are known to affect educational outcomes. Therefore, in addition to reporting raw correlations, we also estimate partial correlations where we condition on a number of observable characteristics. The characteristics we control for are if the individual is native born, social group, and sex. Besides purely individual characteristics there are also other differences that may affect the correlations. One such factor is if the student has been graded in upper secondary school within an academic track programme, or if the student participated in a programme that does not meet the special requirements for admission into a Business Administration and Economics programme. In the latter case, the student may have complemented the grades to meet the requirements after upper secondary school completion, or by taking extra courses during upper secondary school. In either case, the grades are not necessarily comparable for students on academic track and non-academic track programs.

Finally, as can be seen from *Table 1*, the data is unbalanced in the sense that young entrants are observed during the earlier years of admission, while older entrants are observed during the later years of admission, and as entrants become older a larger proportion becomes accepted by the SweSAT. At the mid 1990's, the number of university students increased dramatically, and one may suspect that grading standards were not necessarily held constant as the number of students increased. Therefore it is important to control for the year of admission, and we will do so by including period specific effects concerning year of entrance. As mentioned above, universities can also, within limits, choose the size of the admission groups. Coupled with the fact that the education standards (as well as grading standards) may differ between the universities, controls are also imposed by including university specific effects.Variable definititions are given in *Table A 1* in the Appendix. As we show in the Appendix (see *Table A 2*),

there are two major differences in observable characteristics with respect to the age of admission. First, the proportion of females admitted during the age of 19 and 20 is substantially larger than for the ages 21 to 24. Second, the proportion of students that participated on an academic track programme decreases with the age at admission. Since partial correlations only take into consideration that characteristics may affect the number of university credits, we will below also report gender specific estimates as well as estimates based on academic track students only.

5 Results

As mentioned above, full time studies normally equals 40 weeks per year, where students are expected to complete one credit per week (according to the system at the time the data was collected) if they pass all their exams. In *Table 2*, we present the average number of credits obtained for the students admitted where we also distinguish the age of admission. Looking at the bottom of *Table 2*, one can see that students entering into a Business Administration and Economics programme on average take just in excess of 30 credits the first year. Looking at the raw data, the students who are 20 years old when entering university on average take the most credits. Five years after entrance, they have taken more than 120 credits on average, which equals a bachelor's degree and, for most students, graduation. Students at ages 22 to 24 at admission take approximately 10 credits less than the average students five years after admission. This is explained by the fact that the credit distribution among younger students is thicker at the upper end as well as thinner at the lower end.[5] In the table, we also present upper secondary GPA. Younger students also have higher grades than older students (GPA of 3.9 compared to 3.5).

[5] 32 percent of the younger students (age 19 to 21 at admission) take more than 140 credits, while only 22 percent of the older students (above the age of 21 at admission) take more than 140 credits. One can also note that a larger proportion of younger students take at least 120 credits (56 percent as compared to 45 percent among the older students).

Table 2. Upper secondary GPA and the number of credits obtained after years one and five.

Age/Group	N	GPA	Year 1	Year 5
19	1134	4,06 (0,48)	32.5 (10.1)	117.5 (44.9)
20	1649	3,96 (0,41)	33.7 (9.4)	120.5 (41.7)
21	1554	3,78 (0,46)	32.6 (10.4)	111.8 (44.6)
22	747	3,58 (0,50)	31.1 (11.6)	103.5 (45.9)
23	285	3,45 (0,51)	30.8 (10.8)	106.7 (46.9)
24	85	3,34 (0,50)	32.5 (12.2)	106.6 (49.0)
All	5454	3,83 (0,48)	32.7 (10.2)	115.1 (44.3)

Note: Standard deviations within parentheses

5.1 Correlations

Table 3 below shows the raw correlations and the partial correlations between GPA and university achievement (credits) after year 1 and year 5 for each age group. In general, the correlations are positive, but appear small. The table shows that the correlations become weaker over time, both for year 1 and year 5. This trend is visible in both the raw correlations and the partial correlations, however more outspoken in the partial correlations. The correlations become insignificant for older age groups (the 23 and 24 year olds), which can be interpreted as if there is no relationship at all between GPA and achievement. However, in the older age groups sample sizes become smaller; especially for ages 23 and 24 (see *Table 1*). The table also shows that the correlation between GPA and university achievement, interpreted as predictive strength, is the highest for the youngest entrants, especially when looking at the partial correlations for year 1. Since the correlations are small in general, however, pairwise differences between the age groups are not statistically significant on the 95-percent level.

Table 3. Correlations between GPA and university credits

	Credits after year 1		Credits after year 5	
Age/Group	Raw	Partial	Raw	Partial
19	0.192	0.268	0.195	0.185
	(0.00)	(0.00)	(0.00)	(0.00)
20	0.156	0.208	0.192	0.148
	(0.00)	(0.00)	(0.00)	(0.00)
21	0.193	0.235	0.141	0.128
	(0.00)	(0.00)	(0.00)	(0.00)
22	0.098	0.179	0.072	0.112
	(0.01)	(0.00)	(0.05)	(0.02)
23	0.135	0.204	0.100	0.085
	(0.02)	(0.00)	(0.09)	(0.15)
24	0.139	0.078	0.065	0.020
	(0.21)	(0.48)	(0.55)	(0.85)
All	0.170	0.216	0.181	0.133
	(0.00)	(0.00)	(0.00)	(0.00)

Note: p-values are given within parentheses

Since it is known that students of different gender differ when it comes to educational achievement, and since there is a difference in the proportion of females and males with respect to age at admission, it is relevant to also study female students and male students separately. Below, *Table 4* shows the correlations for female students and *Table 5* shows the correlations for the male students. As can be seen, the trends are similar for both male students and female students, but the correlations for the young entrants appear higher for female students than for male students with a partial correlation over 0.3 after year 1. The partial correlations also show that the GPA has some predictive strength for younger entrants after year 1 but the correlations are very low and insignificant, especially for female students who are 22 and older, when studying the performance after year five.

Table 4. Correlations between grade and university credits; females

	Credits after year 1		Credits after year 5	
Age/Group	Raw	Partial	Raw	Partial
19	0.197	0.315	0.179	0.190
	(0.00)	(0.00)	(0.00)	(0.00)
20	0.105	0.200	0.104	0.057
	(0.00)	(0.00)	(0.00)	(0.10)
21	0.159	0.229	0.184	0.184
	(0.00)	(0.00)	(0.00)	(0.00)
22	0.087	0.191	-0.019	0.018
	(0.17)	(0.00)	(0.77)	(0.78)
23	0.112	0.192	0.161	0.120
	(0.25)	(0.06)	(0.12)	(0.25)
24	0.115	0.097	0.075	0.011
	(0.51)	(0.57)	(0.67)	(0.95)
All	0.156	0.230	0.170	0.119
	(0.00)	(0.00)	(0.00)	(0.00)

Note: p-values are given within parentheses

Table 5. Correlations between GPA and university credits; males

	Credits after year 1		Credits after year 5	
Age/Group	Raw	Partial	Raw	Partial
19	0.152	0.236	0.185	0.180
	(0.00)	(0.00)	(0.00)	(0.00)
20	0.181	0.215	0.233	0.207
	(0.00)	(0.00)	(0.00)	(0.10)
21	0.221	0.242	0.107	0.099
	(0.00)	(0.00)	(0.00)	(0.00)
22	0.098	0.176	0.111	0.164
	(0.03)	(0.00)	(0.01)	(0.78)
23	0.120	0.208	0.050	0.072
	(0.09)	(0.06)	(0.49)	(0.32)
24	0.151	0.082	0.096	0.065
	(0.30)	(0.58)	(0.51)	(0.66)
All	0.164	0.213	0.145	0.164
	(0.00)	(0.00)	(0.00)	(0.00)

Note: p-values are given within parentheses.

As there are differences in characteristics between admission groups (age), it is important to find out if differences in group compositions may explain the differences between the age groups. As mentioned above, one particulary important aspect should be to control for previous education, since it is known that students who have graduated from an academically oriented upper secondary education perform better in higher education (Wikström, 2005). In order to be eligible for entrance to the economics programmes, the students must have graduated from a 3-year academically oriented upper secondary programme. Still, it is possible that some students have chosen another path by complementary education in math, Swedish language and English. One particularly important problem is that students may apply using their GPA irrespective

of if they have graduated from a 3-year programme or not. It is just those grades that one need to complement with that are adjusted. This means that grades may not be comparable since students may have taken different courses during their upper secondary education. In order to take into consideration that students on academic track may have been graded differently, we run the correlation excluding all students that did not participate in an acadmic track programme. This reduces the sample size from 5,454 observations to 5,072 observations. The results are displayed in *Table 6*.

Table 6. Correlations between GPA and university credits; students on academic track

	Credits after year 1		Credits after year 5	
Age/Group	Raw	Partial	Raw	Partial
19	0.187 (0.00)	0.257 (0.00)	0.190 (0.00)	0.169 (0.00)
20	0.171 (0.00)	0.220 (0.00)	0.210 (0.00)	0.160 (0.00)
21	0.214 (0.00)	0.254 (0.00)	0.165 (0.00)	0.144 (0.00)
22	0.122 (0.00)	0.189 (0.00)	0.103 (0.00)	0.122 (0.00)
23	0.165 (0.01)	0.210 (0.00)	0.098 (0.15)	0.085 (0.15)
24	0.185 (0.16)	0.240 (0.07)	0.005 (0.97)	-0.017 (0.90)
All	0.182 (0.00)	0.229 (0.00)	0.197 (0.00)	0.141 (0.00)

Note: p-values are given within parentheses

If upper secondary grades are not entirely comparable between students on academic track and students that graduated from other programs, we should expect that the correlation between GPA and university credits should increase if we deselect the students that are not on academic track. Indeed, the correlations are somewhat stronger when comparing *Table 6* to *Table 3*. Another difference in table 6 as compared to table 3 is that the correlations after year one are rather stable across the age groups. The correlations among the ages 22 to 24 become larger. We interpret this to mean that, at least when comparing outcomes early on in the education, school grades do not work properly as a selection instrument for students that did not participate in an academic track programme. However, when comparing age groups after year five, the results from the previous analyses remain.

6 Discussion

This paper has investigated the predictive validity of upper secondary GPA when used as selection instrument to higher education in Sweden, and how this predictive validity is affected by time. The results indicate that there is a time effect associated with the predictive validity of the GPA.

However, even though the findings seems fairly stable, they should be interpreted with some causion since there are problems attached when aiming to study the effect of time between graduation and admisson by comparing different groups of students. One problem being that the grades do not necessarily measure the same thing for different age groups; another problem is that age groups differ in characteristics that may or may not be observed by the researcher. We have tried to control for this in the design of the study, by making the groups as homogeneous as possible. We limited the study to only include students accepted into a Business and Economics programme, where the students are fairly similar over time in terms of performance and background information. The students included were also admitted during a limited period of time (1993 to 1996) which has the advantage of making the age groups more comparable in terms of student competition and external circumstances such as the situation on the job market. In times when there is a shortage, many students leave university earlier than planned. This is especially the case for successful students, which naturally complicates prediction studies were number of credits are used as criterion for academic success. Furthermore, we did separate analyses for students of different gender as we know that this is important for academic achievements, and also studied the partial correlations where we could control for certain background information. A third problem is that the correlations are generally low, implying that differences between groups are not statistically significant at conventional levels. Hence, the results should be interpreted with caution.

This study can be seen as a continuation of previous studies that have focused on studying the predictive validity of admissions instruments in a Swedish context. These studies have generally shown that there is a positive correlation between students' achievements in upper secondary school and their performance in higher education, which usually has been interpreted that the GPA seems to work fairly well as selection instrument. The main part of these previous studies have also been concerned with

comparing the predictive validity between the different selection instruments, generally concluding that it is higher for the grades than for the SweSAT, which is an admissions tests used as an alternative to the GPA. Based on such results, the benefits of using grades in the selection to higher education is often emphasised, with the main argument being that the grades are measuring things that are useful in higher education, such as motivation, indistruousness but also in terms of previous knowledge important for being equipped to perform well in academic studies. This is where most validation studies limit their investigation.

However, the field of admissions instruments' predictive validity is large and complex and with a lot still unknown. If focusing on the grades, a highly relevent question in this context is what the GPA is really measuring and if this is a constant construct or not. Since the benefit of the GPA is claimed to be that it is measuring relevant knowledge learned in school, and that this is important for its predictive validity, while we also know that knowledge learned in school is perishable, the hypothesis was that this will be visible in the predictive strenght of the GPA over time.

To study this, we used a similar design as most other predictive validity studies, i.e. studying correlations between upper secondary GPA and academic achievement, where university credits serve as criterion for academic performance. However, in order to observe the effect of time we focused on different age groups and how their GPAs are associated with the number of credits obtained at the university after the first year in higher education but also after five years. There are advantages and disadvantages of this approach: the advantage being that long term performance should be more interesting in terms of prediction since the idea of entering a university education is to perform throughout the whole programme and not only the first year. The disadvantage of this approach is that there may be students who will take time off due to sabbaticals, childbirth etc, hence being labelled as unsuccessful students. This was also the reason for studying the performance after five years instead of the three to four years that normally is sufficient for finishing a full programme.

There does not seem to be a conspicuous difference in how students in the different age groups performed. When studying the different age groups at admission there are small differences in terms of the credits they are taking after the first year, but some differences after year five, where the younger age groups have been slightly more

productive. However, when studying the correlations between how the students in the age groups were ranked in the admissions process and how they performed in higher education, there is a pattern. These results show a difference, where the predictive validity of the grades is fairly good (in relative terms) for young entrants, but small and statistically insignificant when the GPA gets older. The finding that the partial correlations are stronger after year one than after year five, and especially for the younger students may be that there is a strong link between the final year in upper secondary school and the first year at university, especially in terms of how education is being carried out. In later years the nature of the studies will differ considerably, by giving the students more freedom and own responsibilities etc, aspects that may not be so common in earlier years. It may also be the case that there are other things that matter for how productive the older students are, that will "overrule" the importance of previous school performance and such knowledge. The question of course remains how well the different instruments predict outcomes for students that are at the age 25 and above at admission and a future study should investigate effects in a more long term perspective.

These results are not controversial to previous research, but add some new information. This information is important in an admissions system where the selection not only is to be perceived as fair, but also has to be efficient from an economic point of view, where the students who are likely to be successful will be accepted before students who will not perform well. Currently, students applying with grades that differ ten years or more will be put in the same admissions group. This is a matter of concern for the fairness to the applicants and for the transparency of the system.

Finally, one should note that the results cannot necessarily be generalized to hold for the entire student body. The demands for previous knowledge vary between academic areas and university programmes. A student aiming to be an engineer, will need a certain degree of previous knowledge in mathematics, while a student aiming for a degree in law or social science will need more of other skills. We also know that learning goes on also after school, especially since research on the admissions test shows that time between school and when the test is taken will have different effect on different subtests. For this reason, it would be interesting and also important to compare the results from this study with similar studies of other educational programmes.

Appendix

Table A 1. Variable definitions

Variable	Definition
Credits	The number of credits obtained within a business and economics programme after year one and five
Admission age	The age of the individual at admission calculated as the difference between admission year and birth year
Female	Dummy variable taking the value one if the individual is a female
Non-native	Dummy variable taking the value one if the individual is born outside of Sweden
Social group	A social characterisation based on the parents' education and earnings. Individuals are placed in three different categories, where social group one is the highest social group.
Academic track	A dummy variable taking the value one if the individual graduated from a three- or four-year theoretically oriented programme in upper secondary school
GPA upper secondary school	The grade point average from upper secondary education. GPA is measured on a scale one to five, where one is the lowest grade and five is the highest grade.
Year of registration	The year when the student was first registered coded as dummy variables.
University/college	The university or college where the student was registered coded as dummy variables.

Table A 2. Individual and background characteristics

Age/Group	Variable					
	Female	Social grp 1	Social grp 2	Non-native	Acad. track	NOBS
19	0.58	0.38	0.47	0.06	0.90	1222
20	0.51	0.41	0.47	0.05	0.89	1777
21	0.39	0.42	0.47	0.04	0.87	1673
22	0.36	0.41	0.48	0.03	0.80	818
23	0.36	0.35	0.50	0.04	0.70	320
24	0.43	0.23	0.60	0.04	0.56	105
All	0.46	0.40	0.47	0.05	0.86	5915

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