CentER

Discussion paper

No. 2001-29

DOES IT PAY TO DO WELL IN COMPETITIONS? THE CASE OF THE QUEEN ELIZABETH PIANO COMPETITION

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April 2001

ISSN 0924-7815

Does it pay to do well in competitions? The case of the Queen Elizabeth piano competition[¤]

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April 4, 2001

Abstract

Pianists who achieve high scores in the Queen Elizabeth musical competition are rewarded by subsequent success. It is not clear whether this is caused by the score itself or because those who have high scores are better pianists anyway. Since the timing and the order of appearance are good instrumental variables for the nal ranking, our data on eleven subsequent competitions make it possible to distinguish between the two alternative explanations. We find that high scores have an impact on later success.

JEL codes: J24, L82, Z10.
Keywords: Competition and success, unobserved ability, treatment effects.

[¤]We are grateful to Orley Ashenfelter for discussions in an early stage of the study, and to Marie-Paule Orban for careful collection of the data. Jaap Abbring, Marcel Kerkhofs and Bas Werker provided very useful comments on a previous version. The usual disclaimer applies.

1 Introduction

Do artists who achieve high scores in a competition get rewarded by subsequent success, or is their success due to their intrinsic quality, irrespective of their performance at the competition?

This type of problem is well known in labor economics where (cross-sectional) correlation between education and earnings does not necessarily mean that the former has an e®ect on the latter. An alternative explanation is that individuals with a greater earning capacity may have chosen for more education. If this is true, it is unobserved ability, or intrinsic quality, that explains di®erences in both education and earnings. To determine the true e®ect of education on earnings, instrumental variables which a®ect education choices, but have no direct e®ect on earnings, have to be used.[1]

We use data from eleven subsequent Queen Elizabeth piano competitions organized in Belgium, to distinguish between the two alternative explanations. This is made possible thanks to a particular feature of the competition, as the order of appearance at the competition a®ects the ¯nal ranking. Since the order is decided by a random draw, the ¯nal ranking is in°uenced by factors that are not related to the quality of the performers. Therefore ranking is not perfectly correlated with quality and we will be able to conclude that a high score in itself has a positive impact on later success.

The setup of the paper is as follows. Section 2 gives the main characteristics of the Queen Elizabeth musical competition for piano. In Section 3 we describe the indicators of success that we have been able to collect. In Section 4 we show that there is a relationship between the ¯nal ranking at the competition and subsequent success. In Section 5 we investigate the nature of this relationship in more detail. Section 6 concludes.

[1] See David Card (1999) for a survey. A similar problem arises when one investigates the e®ects of job training and job search assistance programs on the subsequent duration of unemployment of those who have participated in the programs, while ignoring those who have not participated, and who may have found a job after shorter unemployment spells. See James Heckman et al. (1999).

2 The Queen Elizabeth competition

The Queen Elizabeth musical competition is the best-known international competition for piano (and violin) organized in Belgium and is considered among the best and most demanding in the world. David Oistrakh won the ¯rst violin competition in 1937, and Emil Guilels the ¯rst one for piano in 1938. Arturo Benedetti Michelangeli was also among the twelve laureates in 1938. Among those who won the ¯rst prize since, let us single out a few well-known names: Leonid Kogan (1951), Leon Fleisher (1952), Vladimir Askenazy (1956), Malcolm Frager (1960), Eugene Moguilevsky (1964), Valery Afanassiev (1972); many others, though not ranked ¯rst, became very famous, like Lazare Berman (1956), Guidon Kremer (1967), Emmanuel Ax (1972), to cite only a few. The competition requires the candidates to perform chamber music as well as a concerto (of their choice) with a full orchestra. The most unusual characteristic is that the 12 ¯nalist are given a single week to study a contemporary concerto composed on the occasion of the competition, and thus completely unknown to them. This concerto is played by all 12 ¯nalists.

Each competition, organized in principle every 4 years, attracts some 85 pianists from many countries around the world.[1] Members of the board of examination (the jury, for short) are selected among world celebrities{ teachers and interpreters.

A pre-selection is made on the basis of the curriculum, without performance. There are three further stages. In the ¯rst one, 24 musicians are selected. This number is reduced to 12 after a second stage. The order of appearance is drawn at random before the ¯rst stage and remains unchanged for the second stage. In both stages, members of the jury, individually, grade candidates after every day of performance. The ¯rst stage may last an unde¯ned number of days, depending on the number of candidates. The second stage last 6 days, with four candidates performing every day, two in the afternoon and two in the evening. The marks are given without any discussion between the judges and cannot be changed after having been turned in.

[1] These are averages between 1951 and 1983, see Philippon (1985, Appendix 12) for details. Among the 1,800 candidates (violin and piano) between 1951 and 1983, 223 were US citizens, 130 Belgians, 87 came from France, 67 from Japan, 59 from the Soviet Union, 50 from Great Britain, etc. See Philippon (1985, Appendix 12), who quotes more than 50 countries of origin.

There is a new random draw to determine the order in which the candidates will appear in this third and last stage. Each of the candidates is given the score of the unknown concerto exactly 7 days before the public performance. At a rate of two per day, candidates must perform the unknown concerto, one piece as soloists and a concerto of their own choice, in that order.[2]

3 Data and indicators of success

Our sample consists of the twelve ¯nalists in eleven subsequent piano competitions held between 1952 and 1991.[3] For each of these 132 musicians, we collected some personal data as well as indicators of success.

The personal data consist of sex, age at the moment of the competition, time elapsed between the competition and the date at which the success indicator is observed, nationality, and, of course, order of performance during the competition and ¯nal rank (one to twelve). Appendix Table A1 gives some information on these characteristics. It shows that 26% of the ¯nalists are female, musicains are 24.5 years old at the time of the competition, Russians, Americans and Belgians count for almost 50% of the competitors.

The success indicators consist of number of records (and CDs) and opinions obtained from experts. Earnings would of course have been a much better choice, but are impossible to collect. Our indicators ignore those musicians who have devoted their carriers to teaching or to other activities, which may well be better paid than performing. Our contention, however, is that competitions should mainly lead to performing. We distinguish six indicators s_1 to s_6.

s_1 and s_2: Presence in Belgian catalogues: Number of CDs (s_1) and records (s_2) present in the catalogue of the (French region) M¶diath‡que de Belgique, a public listening library, from which records (and CDs) can be borrowed.[4] Given that the competition takes place in Belgium, the library possesses most

[2] For futher detailed information on the working of the competition, see Pierre Delhasse (1985), Charles Philippon (1985) and Programme (1991).

[3] After the 1991 competition, rules have changed. Though there are still 12 musicians selected for the third stage, only the ¯rst six are ranked.

[4] here may be some double counting if older vinyl records have been remastered and published as CDs.

of the records and CDs which have been recorded, including old ones which are not for sale anymore, and probably some which have been little sold, including those recorded during and just after the competition. Table A2 gives some information about the frequency distribution of the two indicators. As can be seen, there are 44 ¯nalists who have no CD in the catalogue, while there are 60 who have no record. But, there are also 8 ¯nalists who have more than 25 CDs and 3 with more than 25 records.

s_3 and s_4: Presence in British and French record catalogues: Number of records (and CDs) available in the British record catalogue, Gramophone Classical Catalogue in 1997 (s_3) and the French catalogue Diapason in 1995 (s_4). These indicators describe international success. Their drawback is that they do not provide CDs or records that are either out of print, or not sold anymore, because there is no demand. The Gramophone Classical Catalogue is unanimously recognized as one of the best lists. Table A2 gives an overview on the frequency distribution of the two indicators and shows that the number of ¯nalists who are absent from the catalogues is quite large. Seventy among them are not quoted in the British catalogue and 79 are missing in the French catalogue. Only few musicians have more than 25 records or CDs that are available.

s_5: An aggregate (summary) indicator for presence in catalogues. Table A2 shows that a large number of musicians is missing in one or the other catalogue. The ¯fth success indicator merely takes into account the presence of a musician in a catalogue. The values range from 0 (not present in any of the four catalogues) to 4 (present in all four catalogues). Table A3 shows the di®erent combinations of presence in the four previous catalogues. There are 29 ¯nalists who are absent from all four catalogues, while 36 are present in all four catalogues. The number of observations in the intermediate categories is evenly spread. Twenty-three ¯nalists appear in one, 24 in two and 20 in three catalogues.

s_6: As an alternative indicator of success we used the ratings given by Belgian musical critics, who were asked to rank each participants on a scale between 0 and 5 (unknown to exceptional). This information was collected in 1998, using a written survey sent to some 25 critics, of which 11 answered. As shown the number of ¯nalists for each rating is more evenly spread than was the case with our previous indicators. It appears that 12 finalists got no marks at all, while 24 among the 132 were given more than 25.[5]

Aggregate characteristics on the indicators can also be found in the second part of Appendix Table A1.

4 Does ranking affect success?

In our econometric analysis we use the following simple equation to relate final ranking to success, which is specified as a latent variable s_i^*:

$$s_i^* = \gamma_0 + \gamma_1 r_i + u_i \tag{1}$$

where r_i is the final ranking obtained by musician i at oneof the 11 competitions.[6]. The γ_k $(k = 0; 1)$ are the parameters of interest and u_i is an error term that we assume to be normally distributed. We do not observe s_i^*, but $s_{j;i;}$ $(j = 1; 2; ...6)$; i.e. the six different success indicator described earlier.

The discussion made clear that many observations have value zero (no record or CD in a catalogue, or no marks given by the critics). Therefore, we are led to estimate Tobit models specified as:

$$\begin{aligned} s_{j;i} &= 0 + \text{ if } s_i^* \leq 0 \\ s_{j;i} &= s_{j;i}^* \text{ if } s_i^* > 0 \end{aligned} \tag{2}$$

The estimation results are presented in the first row of Table 1. As shown, ranking has a positive effect for all success indicators except, though the coefficients are not significantly different from zero for s_3 and s_4 (the indicators which are probably the most important, since they give the number of records and CDs available on international markets). This means that a high ranking seems to lead to more success.

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[5] It would obviously have been preferable to base such results on a sample of international music critics. We felt that it would have been very difficult, both to select the critics, and get their reactions on a large number of musicians about whom most knew very little, if anything. We thought that Belgian music critics should feel more involved in the results of the survey than their foreign colleagues, and therefore, more prone to answer. They are probably also better informed, since the competition is held in Belgium.

[6] o make interpretation of the parameters easier, the winner gets rank 12, the second gets rank 11, etc. This implies that a "good" ranking coincides with a high rank-number.

We also investigated whether other characteristics than ranking contributed to the success of the finalist. We fould that neither gender, nor age at the finals, nationality, year of the competiton (which measures the time elapsed between the competition and the time at which success is measured) influence success.[7]

Next, we estimate the parameters of (1) using a Probit specification, for the first five success indicators. This means that we only take into account of the presence in a catalogue, and ignore the number of records or CDs. The Probit model is specified as:

$$
\begin{aligned}
s_{j;i} &= 0 \text{ if } s_i^* \leq 0 \\
s_{j;i} &= 1 \text{ if } s_i^* > 0
\end{aligned}
\tag{3}
$$

The results appear in the second part of Table 1. The effect of ranking on success is again positive, and all parameter estimates are significantly different from zero at a 5% probability level, except for the coefficient on s_3 which is significant at a 10%-level only.

For the fifth success indicator, s_5 we estimated an Ordered Probit model, which accounts for the ordering in the success without imposing a strict relationship between the ordering. The Ordered Probit model is specified as follows:

$$
\begin{aligned}
s_{j;i} &= 0 \text{ if } s_i^* \leq 0 \\
s_{j;i} &= 1 \text{ if } 0 < s_i^* \leq \mu_1 \\
s_{j;i} &= 2 \text{ if } u_1 < s_i^* \leq \mu_2 \\
s_{j;i} &= 3 \text{ if } u_2 < s_i^* \leq \mu_3 \\
s_{j;i} &= 4 \text{ if } \mu_3 < s_i^*
\end{aligned}
\tag{4}
$$

where the threshold parameters μ_1 to μ_3 are estimated jointly with the other parameters of the model. The estimation results in Table 1 show that also in this case, we find that a better ranking has a significant positive effect on further success.

Finally, for s_6 , we simply applied OLS since this indicator seems to be quite evenly spread across all observations. Again, we find a high ranking

[7]It is of course quite surprising that the last variable has no effect, since this implies that if "fame" comes along after the competition, it comes very quickly.

to increase later success. The estimated coefficient hardly differs from the Tobit-coefficient, which indicates that the zero-observations do not seem to contribute in an important way.

5 Why is ranking important?

5.1 The determinants of ranking

From previous research it is clear that the ranking of the finalists is affected by the way the QE musical competition is organized. Renato Flôres and Victor Ginsburgh (1996) find that those musicians who appear in the beginning of the competition have a lower probability of being ranked among the top, whereas those who perform during the fifth day have a better chance of being ranked among the first. Herbert Glejser and Bruno Heyndels (2000) find that those who perform later in the week or later on a given evening (two musicians compete every evening) obtain a better rank. They also point out that men are better ranked than women.

To investigate the relationship between ranking and order of appearance, we estimated the following equation (using OLS) :

$$r_i = \beta_0 + \beta_1 female_i + \beta_2 first_i + \beta_3 late_i + v_i \qquad (5)$$

where r_i is the final ranking of pianist i, $female$, $first$ and late are three dummy varaibles; the first is equal to one if the pianist is female (and 0 otherwise); $first$ is equal to one if i was first in the order of appearance at a given competition (and 0 otherwise) and the last one, late, is equal to one if i was second to play in a particular evening (and 0 otherwise). The β's are parameters and v_i is the error term assumed to be i.i.d. The parameter estimates (and the t-values which appear between brackets) are:

$\beta_1 = -1.86$ (2.9)
$\beta_2 = -2.96$ (3.1)
$\beta_3 = 1.13$ (1.9)

with $\overline{R}^2$ is equal to 0.13.[8]

[8] As an alternative to the OLS estimate we also ran an Ordered Probit with 12 values,

The parameters show that female ¯nalists are ranked almost two positions below male ¯nalists.[9] It also appears that those who perform during the ¯rst evening have a rank that is almost three positions lower than that of other candidates. Finally, those who perform second during an evening are ranked about one position higher than those who perform early in the evening. Therefore, similarly to previous researchers, we ¯nd that, though random in itself, the order of appearance does a®ect the ¯nal ranking.[10] This implies that it is not only the quality of the pianists that determines the ranking, but also the pecularities of the ranking procedure.

5.2 Ranking and success reconsidered

The fact that peculiarities of the competition a®ect the ¯nal ranking allows us to investigate the relationship between ranking and success in more detail. If (unobserved) quality in°uences both ranking and success then there should be a positive correlation between the errors u_i and v_i of equations (1) and (5). To check for this, we proceed in the following way. We assume that u_i and v_i are i.i.d. drawings from a bivariate distribution with correlation ½. Success is again speci¯ed as a Tobit (for indicators s_1 to s_6), a Probit (indicators s_1 to s_4), an ordered Probit (indicator s_5) or a linear model (indicator s_6). We reestimated all models to investigate to what extent the correlation between the error terms drives the relationship between success and ranking. The di®erent likelihood speci¯cations are presented in Appendix 2.

Table 2 gives an overview of the estimation results. The ¯rst two rows of the table give the outcome for the case in which the success equation has a Tobit-speci¯cation. It appears that the coe±cients °$_1$ remain positive and

which generated the following estimates: ¯$_1$ = -0.55 (2.7), ¯$_2$ = -0.91 (2.9) and ¯$_3$ = 0.32 (1.6), showing that the estimation results are qualitatively similar to those obtained when OLS are used.

[9] See Claudia Goldin and Cecilia Rouse (2000) who ¯nd that female musicians are more likely to be hired if the hiring committee is not aware of the gender of the musician (blind auditions).

[10] We also ¯nd that pianists from the USSR and from the USA are ranked higher than other pianists. This, however, may re°ect a di®erence in quality rather than a characteristic of the ranking due to the QE-competition. Belgian pianists are not ranked di®erently from other pianists. Since there may be di®erences in the average quality of the 11 competitions, we also added 10 competition-speci¯c dummy varaibles. This did not a®ect the parameter estimates.

become even larger than in the previous estimates. The reason for this is that the correlation coefficient between the errors of the two equations is negative in all cases. This suggests that the quality as determined by the jury through the ranking is not in line with the preferences of the audiences who buy records and CDs. The third row of Table 2 shows estimates of the correlation coefficient, after imposing that ranking does not affect success (γ_1 is set to zero). Then, it is only the correlation between the error terms that is responsible for the variation in success; in other words, it is only the unobserved quality that accounts for differences in success. Now, the correlation coefficient is positive for all success indicators, though in the case of s_3 it is significantly different from zero at a 10% level only.

To test whether either of the restrictions $\rho = 0$ or $\gamma_1 = 0$ can be supported by the data, we compute Likelihood Ratio tests, the results of which are also shown in Table 2. It appears that we cannot reject $H_0 : \rho = 0$, which means that there is no significant influence from unobserved quality on success and that, therefore, it is the ranking itself which causes the variation in success. We cannot reject $H_0 : \gamma_1 > 0$ either, which confirms the previous result. Note however, that we cannot reject $H_0 : \gamma_1 = 0$ for success indicator s_3, which is probably the most important one (no. of records and CDs in the Gramophone Classical Catalogue).

The lower part of Table 2 shows the results for alternative specifications of the success equation. For s_1 to s_4, we estimate a bivariate model in which success has a Probit specification, while for s_5 success is specified as an ordered Probit and for s_6 we estimate a bivariate normal specification. The alternative estimates basically confirm our previous results. We can reject neither $H_0 : \rho = 0$ nor $H_0 : \gamma_1 > 0$ (though this is at the 1% probability level for s_5 and s_6 only, and at the 10% level for the other specifications).

6 Conclusions

Musicians who are successful in the Queen Elizabeth competition seem to be rewarded by subsequent success also. However, this could be so because those who are better ranked in the competition are better musicians anyway, and the success in the competition adds nothing. From an analytical point of view the question is whether the competition is a "treatment" or an indicator of inherent musical quality. We find that the order and timing of appearance at the competition is a good predictor of the ¯nal ranking. This means that not only unobserved quality matters but also the characteristics of the competition. Since the order and timing of appearance are randomly set before the competition starts, they cannot a®ect subsequent success. Because of this, order and timing are unique instrumental variables for the ¯nal ranking, which we ¯nd to have a signi¯cant impact on later success, irrespective of the quality of the ¯nalist. Pianists who score high are more likely to get their work recorded later on. It is also remarkable that even the opinion of experts is more in°uenced by the ranking at the competition than by the quality of the performers. The conclusion is obvious and strongly supported by the data: it pays to do well in the Queen Elizabeth piano competition.

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8 Appendix 1 Information on the data used

Table A1
Characteristics of the dataset

Variable	Mean	Min.	Max.	St.dev.
Musicians				
Female	0.26	0	1	0.44
Age	24.53	16	31	3.51
Russians	0.16	0	1	0.37
Americans	0.23	0	1	0.42
Belgians	0.08	0	1	0.28
Success indicators				
s_1	6.62	0	125	13.44
s_2	4.23	0	99	10.34
s_3	3.72	0	115	11.13
s_4	2.77	0	94	8.87
s_5	2.08	0	4	1.52
s_6	13.64	0	48	12.05

Table A2
Frequency distribution of success indicators s_1 to s_6

No. of records, CDs or ratings[a]	No. of pianists s_1	s_2	s_3	s_4	s_5	s_6
0	44	60	70	79	29	12
1	17	16	15	14	23	11
2	11	7	8	5	24	10
3	10	11	8	5	20	6
4	4	7	5	2	36	4
5	4	4	3	4	-	5
6	4	4	2	6	-	6
7	3	3	1	5	-	1
8	2	4	3	2	-	1
9	1	3	1	2	-	5
10	3	0	3	1	-	3
11	2	0	2	2	-	4
12	4	0	2	0	-	3
13	2	2	1	1	-	1
14	4	0	1	1	-	2
15	0	2	1	0	-	3
16	3	0	0	0	-	5
17	1	0	0	0	-	2
18	1	1	0	0	-	5
19	1	1	1	1	-	4
20	1	1	1	0	-	2
21	1	1	1	1	-	2
22	0	0	1	0	-	1
23	0	1	0	0	-	4
24	0	1	1	0	-	6
25	1	0	1	0	-	0
>25	8	3	2	1	-	24
Total	132	132	132	132	132	132

[a] Indicators s_1 to s_5 are records and CDs; indicator s_6 represents ratings by musical journalists.

Table A3
Presence or absence in catalogues

Presence in catalogue MB (CD)	MB (rec)	GCC	Diap	No. of pianists
No catalogue				
0	0	0	0	29
One catalogue				
1	0	0	0	10
0	1	0	0	13
0	0	1	0	0
0	0	0	1	0
Two catalogues				
1	1	0	0	10
1	0	1	0	10
1	0	0	1	2
0	1	1	0	0
0	1	0	1	1
0	0	1	1	1
Three catalogues				
1	1	1	0	7
1	1	0	1	5
1	0	1	1	8
0	1	1	1	0
All catalogues				
1	1	1	1	36

MB (CD): Belgian listening library, CDs
MB (rec): Belgian listening library, records
GCC: Gramophone Classical Catalogue, CDs and records
Diap: Diapason Catalogue, CDs and records

9 Appendix 2 Likelihood specifications

In the specification of the likelihoods we use the fact that $f(s_i, r_i) = f(s_i \mid r_i) \cdot f(r_i)$. Now, the conditional distribution of s_i given r_i is normal with mean $\gamma_0 + \gamma_1 r_i + \rho v_i \sigma_u / \sigma_v$ and standard deviation $\sigma_u \sqrt{1-\rho^2}$. See Amemiya (1985). From this we derive the following specifications for the likelihood functions.

Tobit specification for success–linear for ranking

$$L = \prod_{s_i=0} \Phi\left(\frac{-\gamma_0 - \gamma_1 r_i - \rho v_i \sigma_u/\sigma_v}{\sigma_u\sqrt{1-\rho^2}}\right) \prod_{s_i>0} \frac{1}{\sigma_u\sqrt{1-\rho^2}}\phi\left(\frac{u_i - \rho v_i \sigma_u/\sigma_v}{\sigma_u\sqrt{1-\rho^2}}\right) \prod_i \frac{1}{\sigma_v}\phi\left(\frac{v_i}{\sigma_v}\right),$$

where $\Phi(\cdot)$ is the normal distribution and $\phi(\cdot)$ the related density function.

Probit specification for success–linear for ranking

For the probit specification we have $(\epsilon_i, u_i) \sim$ bivariate normal $[0, 0, \sigma^2, 1, \rho]$. From this we derive the likelihood for the Probit model:

$$L = \prod_{s_i=0} \Phi\left(\frac{-\gamma_0 - \gamma_1 r_i - \rho v_i/\sigma_v}{\sqrt{1-\rho^2}}\right) \prod_{s_i>0} \Phi\left(\frac{\gamma_0 + \gamma_1 r_i + \rho v_i/\sigma_v}{\sqrt{1-\rho^2}}\right) \prod_i \frac{1}{\sigma_v}\phi\left(\frac{v_i}{\sigma_v}\right).$$

Ordered probit specification for success–linear for ranking

In the same way we derive the likelihood for the estimates in which the success equation is specified as an ordered probit:

$$\begin{aligned} L = & \prod_{s_i=0} \Phi\left(\frac{-\gamma_0 - \gamma_1 r_i - \rho v_i/\sigma_v}{\sqrt{1-\rho^2}}\right) \\ & \prod_{s_i=1} \left\{ \Phi\left(\mu_1 - \frac{\gamma_0 + \gamma_1 r_i + \rho v_i/\sigma_v}{\sqrt{1-\rho^2}}\right) - \Phi\left(\frac{-\gamma_0 - \gamma_1 r_i - \rho v_i/\sigma_v}{\sqrt{1-\rho^2}}\right) \right\} \\ & \prod_{s_i=2} \left\{ \Phi\left(\mu_2 - \frac{\gamma_0 + \gamma_1 r_i + \rho v_i/\sigma_v}{\sqrt{1-\rho^2}}\right) - \Phi\left(\mu_1 - \frac{\gamma_0 + \gamma_1 r_i + \rho v_i/\sigma_v}{\sqrt{1-\rho^2}}\right) \right\} \end{aligned}$$

$$\prod_{s_i=3}\left\{\Phi\left(\mu_3-\frac{\gamma_0+\gamma_1 r_i+\rho v_i/\sigma_v}{\sqrt{1-\rho^2}}\right)-\Phi\left(\mu_2-\frac{\gamma_0+\gamma_1 r_i+\rho v_i/\sigma_v}{\sqrt{1-\rho^2}}\right)\right\}$$
$$\prod_{s_i=4}\left\{1-\Phi\left(\mu_3-\frac{\gamma_0+\gamma_1 r_i+\rho v_i/\sigma_v}{\sqrt{1-\rho^2}}\right)\right\}\prod_i\frac{1}{\sigma_v}\phi\left(\frac{v_i}{\sigma_v}\right).$$

Bivariate normal specification for success and ranking

Finally, we specify the likelihood of the bivariate normal distribution as:

$$L=\prod_i\frac{1}{\sigma_u\sqrt{1-\rho^2}}\left\{\phi\left(\frac{u_i-\rho v_i\sigma_u/\sigma_v}{\sigma_u\sqrt{1-\rho^2}}\right)\right\}\frac{1}{\sigma_v}\phi\left(\frac{v_i}{\sigma_v}\right).$$

Table 1
Estimates of parameter $°_1$ in success equation (1)

Parameters	Success indicators					
	s_1	s_2	s_3	s_4	s_5	s_6
Tobit	1.26	1.45	1.09	1.32	0.18	1.64
	(2.1)	(2.0)	(1.3)	(1.7)	(3.7)	(5.5)
Probit¤	0.94	1.11	0.62	0.81	0.15	-
	(2.8)	(3.4)	(1.9)	(2.5)	3.8	-
Ordered Probit¤	-	-	-	-	0.10y	-
-	-	-	-	-	(3.6)	-
OLS¤¤	-	-	-	-	-	1.48
	-	-	-	-	-	(5.4)

Intercepts are not reported. t-values, based on heteroskedastic-consistent standard errors, are given between brackets under each coe±cient.
¤Coe±cients are multiplied by 10.
¤¤We also tried a linear speci¯cation with $\ln(s_6 + 1)$ as a dependent variable, which led to an estimate of 0.14 (5.6), showing that here also, ranking has a signi¯cant positive e®ect on success.
yIn the Ordered Probit model, $¹_1$ = 0.54 (5.3); $¹_2$ = 1.02 (8.1); $¹_3$ = 1.45 (10.3).

Table 2

Additional estimates for paramater $°_1$ (and for ½) in model (1)-(5)

Parameters	Success indicators s_1	s_2	s_3	s_4	s_5	s_6
Tobit model						
$°_1$	2.55	2.29	2.12	2.31	0.32	2.63
	(1.5)	(2.2)	(1.4)	(1.7)	(2.3)	(3.1)
½	-0.27	-0.21	-0.21	-0.23	-0.29	-0.30
	(0.9)	0.9)	(0.8)	(0.9)	(1.2)	(1.4)
Tobit model, imposing the restriction $°_1 = 0$						
½	0.20	0.27	0.17	0.24	0.27	0.40
	(1.9)	(2.9)	(1.6)	(2.3)	(3.1)	(4.9)
Likelihood ratio tests for the Tobit model						
½ = 0	1.24	0.66	0.56	0.70	1.62	1.72
$°_1 = 0$	4.02¤¤	4.00¤¤	2.04	3.18¤	6.38¤¤	8.88¤¤¤
Other speci¯cationsy						
$°_1$	1.55	1.49	1.42	1.63	0.18	0.42
	(2.0)	(1.8)	(1.9)	(2.2)	(3.0)	(3.3)
½	-0.24	-0.15	-0.31	-0.32	-0.31	-0.31
	(0.9)	(0.5)	(1.1)	(1.1)	(1.3)	(1.5)
Other speci¯cations, imposing the restriction $°_1 = 0$						
½	0.26	0.32	0.15	0.21	0.28	0.38
	(2.4)	(3.2)	(1.4)	(2.0)	(3.0)	(4.6)
Likelihood ratio tests for other speci¯cations						
½ = 0	0.70	0.26	1.20	1.28	1.74	1.92
$°_1 = 0$	3.40¤	3.00¤	3.00¤	3.82¤	6.66¤¤¤	9.16¤¤¤

Intercepts in the success equation and other parameters (female, ¯rst, last) in the ranking equation are not reported. t-values, based on heteroskedastic-consistent standard errors, are given between brackets under each coe±cient.

y Bivariate Probit-linear model for s_1 to s_4; Bivariate Ordered Probit for s_5; Bivariate Normal for s_6.

¤, ¤¤ and ¤¤¤ mean signi¯cant at the 10%, 5% and 1% level, respectively. Critical $Â^2$-values for the LR-test statistic are respectively 2.71, 3.84 and 6.63.