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Discrimination in Hiring: the curse of motorcycle women

Loïc DU PARQUET, Emmanuel DUGUET, Yannick L'HORTY, Pascale PETIT

Abstract: The event of holding a driver's licence and listing it on a resume sends a signal of a capacity for mobility which generally increases the chances of getting a job. However, the effect of this signal can entirely be reversed in the case of a female candidate holding a motorcycle driver's licence. We demonstrate this effect by using a testing procedure carried out in the Greater Paris area for the profession of young management controllers. In that profession with a high concentration of women, the simple attribute of a female candidate mentioning a motorcycle driver's licence on her resume causes her to lose her advantage over a male candidate. The listing of a driver's licence on a resume is perceived by the employers as a gender-related characteristic. This provides a clear instance of the complexity of studying the role of stereotypes in the analysis of discrimination in hiring.

Key words: *access to employment, mobility, discrimination, testing, accounting, gender.*

JEL Classification: C93, J16, J61, J71.

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INTRODUCTION

Mobility is an individual characteristic which is generally valued by employers. This fact is confirmed by a large number of applied studies that have tried to measure the impact of having a driving licence and of having a private means of transportation on the access to employment (Raphael and Rice [2002], Ong [2002], Gurley and Bruce [2005], Ong and Miller [2005]). Therefore, it should be relevant to mention the possession of a driver's licence and of a vehicle on the resume while searching for a job.

In fact, we would like to show that matters are not that simple, and that the effect of a driving licence depends on both the class of licence as well as the gender of the driver. For a man, the event of having a motorcycle driver's licence does not necessarily increase the chances of being invited for a job interview. For a woman, the act of mentioning your motorcycle driver's licence on your resume can even decrease your chances of being invited for a job interview.

To achieve our research objective, we used the results of a testing experiment which was successfully implemented in 2009 in the greater Paris metropolitan area. Four similar applications for an in-demand, skilled profession were drafted: two consisting of a man and a woman living in the city of Paris and using public transportation; and another two consisting of a man and a woman living in Paris and having motorcycle and automobile driver's licences. These four applications which were otherwise identical were sent in response to the same 300 job offers at the Master's degree levels in the entire greater Paris metropolitan area. We selected the profession of management controller, which is a skilled profession that is also dominated by women (i.e. a 'feminized' profession). For the most part, management controller jobs require a Master's degree. Even if they are less 'feminized' than the accounting professions, the positions of management controller are nevertheless occupied predominantly by women who are salaried, especially in banks or insurance companies, which are among the largest employers of these professionals.

There exist complex forms of conditional discrimination which involve several dimensions, and the case of female motorcyclists who encounter difficulties in accessing employment is a good illustration. We aim to examine the multiple effects that have not been observed thus far in the literature, namely the effects of gender crossed with the effects of the class of driving licence that is mentioned on the resume of the job candidate. In the first part of this study, we set out and explain the empirical framework under which the data are collected. In the second part, we present the results.

1. THE DESIGN OF THE STUDY

The results of a testing procedure are sensitive to the operational modalities of the data collection process. Since the aim is to measure empirically eventual discriminations in hiring based on the capacity for mobility mentioned in the resume, and conditional on the gender, it is important to describe in detail the protocol we used to collect the data and construct the data base. That is the purpose of this section.

The testing procedure that we performed is a simple test of access to job interviews. No candidate was sent to interviews. There are two methodological reasons for this decision. First, sending candidates in person to job interviews will lead to the introduction of biases by the recruiters stemming from unobservable and uncontrollable influences related to the subjective assessment of the physical appearance and the personality of the job candidates. For the same reason, no photograph is included in the written applications. To the extent that arranging interviews generates a cost to the recruiter, he/she will invite for interviews only those candidates who actually have a chance of being hired. We therefore assume that eventual discriminatory behavior on the part of the employer is revealed through the selection of the written applications that will lead to an interview (the potential criteria for discrimination are gender, national origin, place of residence, and the capacity for mobility, all of which are factors which appear explicitly on the resume). Second, the data collection procedure is simplified so that within a given period of time (less than 5 months in our case), we are able to obtain a larger sample size.

From the choice of a high demand profession to the designing of the resumes

We chose a skilled profession which is in high demand, meaning a profession for which the number of vacancies is high relative to the number of job seekers, namely management controllers, in order to limit the number of refusals by employers irrespective of discriminatory behaviour. This methodological precaution has proven to be particularly useful in a context of an economic recession. The high success rates of job candidates in a high-demand profession, however, have a counterpart as far as discrimination is concerned. Access to employment is less selective, and therefore it is more difficult to observe hiring discrimination for this type of profession.

In addition, management controllers can perform on-site missions of control or audits, for customers or for their own subsidiaries, outside of their own companies and their principal workplaces. This requires a

minimal capacity for mobility beyond the daily commutes between office and home and beyond the inherent difficulties that all Parisian employees face.

Management controllers constitute a skilled profession for which candidates nowadays require a Master' degree level, which corresponds to the profile of our candidates. It is also a profession for which women account for the majority of the flow of hires, and they are becoming predominant in the stock of employees (this is not the case for independent accountants, who are predominantly males). The high degree of feminization of the profession is confirmed both by the aggregated statistics across the professions of management controllers and audit accountants, as well as by more detailed statistics on specific sectors, such as banking and insurance.

The applications that were sent in response to the same job offers are similar in terms of productive characteristics. They are identical in terms of diplomas, career paths, and professional experience from both qualitative and quantitative viewpoints. The candidates have the same computer and language skills. None of them lists a period of prior unemployment, and they are all employed when they are applying for the jobs. Moreover, these applications are suitable and appear credible for the targeted professions. They have been appraised and validated by well-known professionals within the occupation whose advice was formally requested. Their expertise ensures that all applications are similar, realistic, and relevant.

Since the applications were sent simultaneously in response to the same job offers, they should include some elements of differentiation. These differences are related to the presentation of the resumes - the font type, the font size, and the lay-out - while still remaining standard in content. The candidates indicate a work experience acquired in real companies which, though different, are comparable in terms of activities, size, and market power. The hobbies of the applicants are also different, yet still very normal and impersonal (sport, movies, reading, music, etc.). The cover letters are very specific and are also written differently while remaining standard. A postal address, a mobile phone number, and an e-mail address were assigned to each fictitious candidate.

To prevent the style and the content of a particular application from influencing systematically the choice of firms for a particular candidate (despite the precautions taken during the designing of the applications), we have put in place a system of randomized permutation of the resumes between the identities of the fictitious candidates. A similar procedure involving the resume and cover letter is used alternatively for different identities of candidates while sending their applications to different companies.

Applications for the same job offer were sent the very day the offer is posted on the internet at intervals that are a few minutes apart from each other. Each application is sent by using the specific e-mail address of each fictitious candidate. We consider as a positive response the case when a recruiter invites a job applicant for an interview or asks for more information about the current job situation or the qualifications of the applicant. In contrast, the response is considered negative if the recruiter formally rejects the application or does not respond.

The profile of the four mock job candidates

Four identical resumes of young management controllers with a Master's degree were drafted. They are differentiated only by the gender of the applicant and the capacity for independent mobility revealed by the explicit mention of a motorcycle and automobile driver's licence on the resume. The four fictitious applicants are of French origin as indicated by their surnames, which are chosen among the most widespread names that sound traditionally French. Their given names are the most common ones in their year of birth, namely 1980. They all reside in the city of Paris (in the 11th and 12th districts). Two candidates (one male and one female) indicate explicitly on their resumes that they have a driver's licence that is valid for both motorcycles and automobiles. This is suggestive of intra-regional mobility, irrespective of the distance to travel, the state of traffic, or the interruptions in the public transportation network. The two other candidates (one male and one female) do not mention any capacity for independent mobility on their resumes. They do not indicate that they possess any class of driver's licence, which suggests that, given that they reside in the city of Paris, they must be using public transportation. The four job candidates indicate their age (28 years) on their resumes, their nationality (French citizenship), and their marital status (single without any dependent child).

The four job candidates have the same academic and professional credentials; a high school diploma in the science stream, a bachelor's degree in management, and a Master's degree in management control earned at one the following universities of Ile-de-France (the greater Paris region): University of Paris II Panthéon-Assas, University of Paris X Nanterre, University of Paris XII Val-de-Marne, and University of Paris I Panthéon-Sorbonne. After their graduation, the four candidates accumulated 5 years of work experience in consulting firms since their entry into the labour market. They first held a position of an assistant management controller for 2 years, and then a position as a management controller in another consulting firm for 3 years. The duties that they performed in the course of their work experience were listed in detail on their resumes such that they list the same skills. They are currently employed and are

declaring themselves candidates for the position of management controller in a consulting firm or in a company.

The characteristics of the job offers

All of the main French internet websites were browsed on a daily basis in order to identify and respond to the job offers that fall within the scope of our testing procedure. Two types of recruiters post job offers for management controllers: the companies themselves and the recruitment agencies ('head hunters'). All full-time job offers for management controllers for either permanent or temporary contract positions located in Ile-de-France (the Greater Paris Region) were included in the study. We tested all of the offers that came to our attention between the end of October 2008 and the beginning of March 2009. A total of 300 job offers were tested, which corresponds to 1,200 applications being sent (4 x 300).

2. RESULTS OF THE MEASURES OF DISCRIMINATION

In this section we present the main results that are generated from the testing procedure. The estimation method is described in the appendix. The experimental design of the data set allows for a causal interpretation of the effects which are inferred statistically, as the job candidates, who are similar in all aspects, applied systematically to the same job offers.

A High success rate for the female candidate using public transportation

Table 1 presents the success rate of the four fictitious candidates for the same job offers. Out of all the applications submitted (1,200), 18.7% received at least one positive response. Overall, we obtain the same success rate for males and females. However, this result masks a strong compositional effect: recruiters clearly favor the female candidate who uses public transportation and are unfavorable towards the female candidate who signals a capacity for mobility by mentioning on her resume that she is licenced to drive a motorcycle in addition to an automobile. This raw result suggests that a more detailed analysis of the link between gender and the mentioning of a driving licence is warranted.

For a position of management controller in the greater Paris region, which is the occupation for which we carry out our testing procedure, the employers prefer females to the detriment of males. The application that received the most positive responses is in effect that of the female candidate who did not mention any driving licence on her resume (12.3%), followed by the male candidate who mentioned his motorcycle and automobile driver's licences (10.0%), and the male candidate who did not mention any driving licence on

his resume (9.3%). This preference for female candidate seems to be sensitive to the mention of driver's licence on the resume; the female candidate who indicated that she is licensed to drive both a motorcycle and an automobile obtains the lowest success rate (7%).

Table 1: Gross rate of success

The t-statistics and the confidence intervals are computed by using the bootstrapping¹ method on 10,000 draws;
* 10% significance level; ** : 5% significance level.

	Positive response rate	t-stat	90%Confidence Interval	
			Lower bound	Upper bound
Motorcycle and driver's licences				
Females	7.0%**	4.80	4.7%	9.3%
Males	10.0%**	5.72	7.3%	13.0%
Public Transportation				
Females	12.3%**	6.52	9.3%	15.3%
Males	9.3%**	5.58	6.7%	12.0%
Response Rate in terms of job ²	18.7%			

1. For more information about the use of bootstrapping method in this context, see Horowitz (2001).
2. Percentage of job offers for which the fictitious candidates of the testing receive a positive response.

Overall, mentioning a motorcycle and an automobile driver's licence has no effect on male job candidates but does penalize female candidates

The effect of holding driver's licences on the chances of obtaining a job interview is clearly different for men and women. For men, revealing a capacity for independent mobility by holding a licence for both classes of vehicles has no significant on the probability of obtaining a job interview (Table 2). In contrast, this signal appears to penalize women, as it reduces by 4 points the chances of getting a job interview.

Among the job applicants signalling that they hold both classes of licence, the female candidate is significantly less likely to be invited for a job interview than the male candidate (a gap of 2.6 points). However, among the applicants indicating that they use public transportation, the male candidate is penalized relative to the female candidate (a gap of 2.7 points, Table 2).

These results show that the mention of motorcycle licence in addition to an automobile driver's licence does not seem to be interpreted in a positive sense by employers as a signal of the capacity for mobility. Another perception of the signal seems to prevail: the perception of a sex-based stereotype that could countervail the gender effect of the candidate. A man holding a motorcycle driver's licence is viewed as a typical man, but a woman holding the same licence is not viewed as normal. She is regarded in the same way as a man

in the eyes of the employer, and seems to lose all professional appeal in the sense that she loses her advantage in obtaining a job interview.

**Table 2: Gaps in the success rates for the same job offers
Adjusted discrimination coefficients**

The adjusted discrimination coefficients are calculated from the estimated ordered probit model. They are the discrimination coefficients estimated at the mid-point of the sample, and they can be compared to the unadjusted discrimination coefficients. The t-statistics and the confidence intervals are computed by using the bootstrapping¹ method on 10,000 draws.

*: 10% significance level; **: 5% significance level.

	Gaps (in % points)	t-stat	90% Confidence Interval	
			Lower bound	Upper bound
Effect of the mode of transportation by gender (Motorcycle and driver's licences minus public transportation)				
Males	0.8	0.46	-2.0%	3.5%
Females	-4.0**	2.65	-6.4%	-1.5%
Effect of gender by mobility (Male minus Female) :				
Motorcycle and driver's licences	2.6*	1.75	0.2%	5.1%
Public transportation	-2.7*	1.68	-5.3%	-0.1%
Joint effects:				
Male Motorcycle and driver's licences minus Female Public transportation	-2.0	1.34	-4.4%	0.5%
Female Motorcycle and driver's licences minus Male Public transportation	-2.3	1.51	-4.8%	0.2%

For example: females who mentioned holding motorcycle and automobile driver's licences on their resumes are less likely than males to a job interview; their success rate is 4 points lower. As for the effect of the gender by capacity for mobility, males who mentioned holding both motorcycle and automobile driver's licences on their resumes have an advantage over females who have the same types of driving licences (+2.6 points), and males who use public transportation are disadvantaged compared to females who also use public transportation (-2.7).

A female job candidate has nonetheless a greater chance if she mentions a licence for both classes for a permanent position

It is interesting to analyse these results according to the type of work contract offered by the employer. While it is the case that overall among the job candidates who use public transportation, the female candidate is more likely to obtain a job interview, the opposite is true when the employer offers a permanent job (Tables 2 and 3). In that latter case, the male candidate has a greater chance of success

than the female. This could be interpreted as a consequence of a statistical discrimination² induced by the anticipation of the recruiter that a female employee might interrupt her career in the medium term to go on maternity leave (Duguet and Petit [2005]).³ Candidates in our testing sample declare they are 28 years old, which is close to the average age of the first maternity event for women in France (29 years). A recruiter can anticipate that, sooner or later, the candidates will be involved with maternity or paternity. The organisational and the eventual financial costs (depending on the collective agreement that is in effect for the company) related to the event of maternity leave are significantly higher than those related to the event of paternity. These costs are even higher for the company when the employee occupies a permanent position involving a high level of responsibility if the company finances his or her training.

In addition, if the female candidate who suggests that she uses public transportation is more likely to obtain a job interview than the female candidate who has a motorcycle and an automobile driver's licence, this effect is much less marked and barely significant when the employer is offering a permanent contract. For permanent and stable jobs, the higher degree of mobility revealed by the motorcycle and automobile driver's licence is considered as a positive attribute by employers. Moreover, both male and female candidates who mentioned holding both types of licence on the resume have a greater chance of obtaining a job interview than those candidates who use public transportation when the travel routes involve taking the Regional Express Network (RER) (Table 3). Conversely, candidates of both genders who use public transportation have better chance than other candidates if work place is situated in a sensitive urban zone (one targeted by the government for development subsidies) (Table 3).

Employers are less favorable towards candidates who use public transportation when they have to take the Regional Express Network (RER) in order to travel to their workplace. In that case, the male and the female candidates who mentioned being licensed for both classes of vehicles are more successful in obtaining a job interview than their counterparts who take public transportation. Taking the bus, however, which often involves shorter trips, increases the chances of obtaining a job interview. In this respect the female

² Statistical discrimination occurs when the discrimination arises from imperfect information about the candidate. In that situation, the employer uses information regarding the group to which the job candidate belongs, such as the probability of maternity, and attributes some characteristics which do not necessarily fit the candidate.

³ This study, which was carried out in the banking sector, shows that only 25 year-old, childless females are subjected to discrimination in hiring, which is contrary to the case of 37 year- old females with or without children.

candidate who uses public transportation is more likely to obtain a job interview than the male candidate who mentions both types of driver's licences when the commuting mode is the bus (Table 3).

Table 3: Conditional discrimination
Ordered probit regressions

Dependent variable: difference in response between the two candidates

Regressions are used to estimate the adjusted coefficients of discrimination. We carry out a progressive exclusion of regressors until all of the included regressors are significant at 10% level. The variables are introduced in levels and in differences (whenever it makes sense). They are: mode of transportation, time spent in transit, type of resume, application date, source of the advertisement, type of job contract (permanent/fixed term), number of years in business, principal activity, size of the staff, export rate, salary, gender of the recruiter, type of position (management controller or other: general manager, administrative manager, etc.), county, median income, inter-decile ratio, and situated in a Sensitive Urban Zone (ZUS).

Sample	Males		Females		Motorcycle and automobile driver's licences		Public Transportation		Joint effect		Joint effect	
Candidates	Driver's licences vs Public Transportation		Driver's licences vs Public Transportation		Males vs Females		Males vs Females		Males Driver's licences vs Females Public Transportation		Females Driver's licence vs Males Public Transportation	
Variable	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Constant 0 (α_0)	-1.664	13.14	-2.168	12.33	-1.647	13.01	-1.954	12.84	-1.943	12.59	-1.969	12.58
Constant 1 (α_1)	1.746	13.11	1.601	12.63	1.989	12.61	1.624	13.28	1.686	12.97	1.668	13.35
<i>Variables in differences:</i>												
RER line	0.822	2.31										
Train line			-1.147	1.84								
Métro line											-0.417	1.79
Time spent travelling			-0.030	1.83								
<i>Variables in levels:</i>												
Line of business : missing					0.450	2.10						
ZUS	-0.461	1.97	-0.604	2.50	0.578	1.85			-0.429	1.79		
Management controller position	0.389	2.04			0.366	1.78						
RER line	0.471	2.20	0.799	3.04					0.774	3.22		
Bus line									-0.906	1.66		
Permanent Contract			0.901	3.21			0.645	2.27	0.716	2.52		
Median Income					4.21E-05	2.60						
Income D9/D1					-0.110	2.04						
Vuong Logit-Probit	4.86E-03	0.47	-1.41E-03	1.00	1.15E-02	0.85	1.11E-02	1.01	3.70E-03	0.61	-8.78E-05	-0.64

We present in Table 4 a synthesis of the different results and the formal inference tests. It appears that mentioning a motorcycle driver's licence has no effect on obtaining a job interview for male candidates irrespective of the type of contract. In the case of women, however, it induces a negative effect on the access to employment, but only in the case of fixed or limited-term contract jobs. Therefore, if there is discrimination in favor of women in the profession of management controller, it does not occur for the limited-term contract jobs or for women who mentioned holding a motorcycle driver's licence on their resumes.

Table 4: Difference-in-differences Analysis of the type de contract

The standard deviations are computed by using the bootstrapping¹ method on 10,000 draws.

Group A	Male Motorcycle	Female Motorcycle	Male transport	Male Motorcycle	Male Motorcycle	Female Motorcycle
Group B	Male Public transport.	Female Public transport.	Femme transport	Female Motorcycle	Femme transport	Male transport
Effect A-B	Mobility for Males	Mobility for Females	Gender if Public transport.	Gender if Motorcycle	Cumulative	Cumulative
PERMANENT CONTRACTS						
Difference (A-B Permanent)	0,7%	-3,0%	-1,5%	2,2%	-0,7%	-1,5%
t-stat	0,39	1,71*	0,95	1,33	0,41	0,95
FIXED-TERM CONTRACTS						
Difference (A-B Fixed-term)	0,0%	-24,2%	-15,2%	9,1%	-15,2%	-9,1%
t-stat	0,00	3,26**	2,01**	1,16	2,43**	1,36
DIFFERENCES						
Difference in differences (A-B Permanent)-(A-B Fixed-term)	0,7%	21,2%	13,7%	-6,8%	14,4%	7,6%
t-stat	0,10	2,78**	1,77*	0,86	2,22**	1,11

** 5% significant level; * 10% significant level

CONCLUSION

This study assesses the effects of gender crossed with the effects of the capacity for mobility from home to workplace (as signalled by the possession of both a motorcycle and an automobile driver's licence) on discrimination in hiring. We employed experimental data collected via a testing procedure carried out between October 2008 and April 2009 in the Greater Paris region that targeted the profession of management controller at the Master degree level. Four similar resumes were simultaneously sent in response to 300 jobs offers in the entire Greater Paris Region.

The first set of results deals with the signal related to the capacity for independent mobility (licenced for both classes of vehicles). This signal has no significant effect on the chances of men obtaining a job interview. It does have a negative effect, however, for women; overall mentioning a licence for both classes of vehicles on a resume reduces their chances of obtaining a job interview. This result is reversed, however, when the position consists of a permanent job. In this latter case, a female candidate has a greater chance of being invited for a job interview when she mentioned on her resume that she has a motorcycle and an automobile driver's licence.

A second set of results involves the effect of gender on the access to a job interview. Among job candidates who mentioned on their resume that they were licensed to drive both classes of vehicles, the female candidate has less chance than the male to be invited for a job interview. The opposite pattern applies to candidates who indicate that they take public transportation; nonetheless, among these candidates, a male has a greater chance than a female to obtain a job interview when it is a permanent position.

Finally our results show that the type of public transportation that the job candidate takes to travel to his or her workplace has an effect on the chances of obtaining a job interview. Employers are less favorable towards candidates who use public transportation when they take the Regional Express Network (RER), while they are more favorable towards candidates who take the bus, as that involves shorter trips.

Is it useful to mention on the resume that one has a motorcycle driver's licence when the candidate does indeed possess one? The answer is clearly no; for a man, it will not increase his chances of being invited to a job interview. It does not improve the access to employment among men, irrespective of the type of job contract. For a woman, mentioning a motorcycle driver's licence on a resume reduces the chances of being invited for a job interview, and this negative impact of holding a motorcycle driver's licence is even more

marked in the case of fixed-term contract positions. A permanent contract helps a female candidate to reduce the penalty associated with mentioning the motorcycle driver's licence.

The act of mentioning on a resume that one has a motorcycle and an automobile driver's licences is not always perceived by employers as a positive signal. This finding could be linked to the fact that we examine access to employment in the Greater Paris Area, which is a region where there are dense public transportation networks. It might also be linked to the fact that the employer of a junior management controller, whose duties do not involve much mobility, does not always value greatly the capacity for mobility in the recruitment process. This might be the reason why mentioning a motorcycle driver's licence on a resume does not increase the chances for men to obtain employment. .

In fact, another perception of the signal seems to prevail, namely one of a sex-based stereotype, which for instance might reveal the aptitudes of autonomy and independence, which are likely to counterbalance the effect of the gender of the job candidate. A man who has a motorcycle driver's licence is a typical man like any other irrespective of the type of job contract. On the other hand, a woman with a motorcycle driver's licence is no longer typical in this sense. She is viewed as a man in the eyes of employers, and loses all professional attractiveness, especially in the case of unstable, fixed-term contract positions for which firms often hope to recruit a woman. The curse of the motorcycle woman illustrates the existence of complex forms of conditional discrimination that combine several interacted dimensions. The perception of the potential employer of the signal of the capacity for mobility is conditioned on the gender of the job candidate and the type of driver's licence that is mentioned in the resume.

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APPENDIX

Computation of the adjusted discrimination coefficients

In order to adjust the discrimination coefficients according to the explanatory variables of the testing experiment, we estimate an ordered probit model. The explained variable is the difference between the responses obtained by the two candidates coded in a binary way (0 for NO, and 1 for YES). The explained variable is equal to -1 when the second candidate is preferred to the first (difference 0 minus 1). It takes a value of 0 when both candidates obtained the same response, and it is equal to 1 when the first candidate is preferred to the second (difference 1 minus 0).

We assume that the result of the testing experiment is generated by a simple utility maximization model for the employer, which is a function of the objective characteristics (differences in the distance between the home and the workplace, etc.) as well as the subjective characteristics (preferences for certain candidates). Let $U_i(1)$ and $U_i(2)$ be the utilities associated with the first and the second candidates, respectively. The difference in the recruiter's utilities derived from the two candidates is $y_i^* = U_i(1) - U_i(2)$. The ordered probit implies a modeling of the previous difference as follows:

$$y_i^* = b_0 + X_i b_1 + u_i$$

where X is the vector of explanatory variables, and u is a normally distributed and standardised disturbance term which captures the influences of the unobservable variables (uncorrelated with X) that influences the utilities. The observable variable is defined as follows.

$$y_i = \begin{cases} -1 & \text{if } y_i^* < a_0 \\ 0 & \text{if } a_0 \leq y_i^* < a_1 \\ 1 & \text{if } y_i^* \geq a_1 \end{cases}$$

where (a_0, a_1) are two unknown thresholds. If the difference in the utilities is large, then only one candidate will be chosen.

The probability that the first candidate is chosen is equal to:

$$\Pr[y_i = 1] = \Pr[y_i^* \geq a_1] = 1 - \Phi(a_1 - b_0 - X_i b_1) = 1 - \Phi(\alpha_1 - X_i b_1),$$

Where Φ is the standard normal cumulative distribution function, and $\alpha_1 = a_1 - b_0$ is the first constant term of the ordered probit model. The probability of the second candidate to be chosen is equal to:

$$\Pr[y_i = -1] = \Pr[y_i^* < a_0] = \Phi(a_0 - b_0 - X_i b_1) = \Phi(\alpha_0 - X_i b_1)$$

Where $\alpha_0 = a_0 - b_0$ is the second constant term of the ordered probit model.

The coefficient of discrimination at mean point of the sample is thus equal to:

$$D = \Pr[y_i = 1|\bar{X}] - \Pr[y_i = -1|\bar{X}] = 1 - \Phi(\alpha_1 - \bar{X}b_1) - \Phi(\alpha_0 - \bar{X}b_1).$$

So that by including centered explanatory variables ($\bar{X} = 0$) in the regression equation, we obtain the following simplified formula :

$$D = 1 - \Phi(\alpha_1) - \Phi(\alpha_0),$$

which we estimate by:

$$\hat{D} = 1 - \Phi(\hat{\alpha}_1) - \Phi(\hat{\alpha}_0),$$

Where $(\hat{\alpha}_0, \hat{\alpha}_1)$ are the maximum likelihood estimators of the two constants of the ordered probit model. The computation of the asymptotic variance of \hat{D} is derived from the Slutsky method. Letting $\alpha' = (\alpha_0, \alpha_1)$, we have the following expression:

$$\hat{V}(\hat{D}) = (\varphi(\hat{\alpha}_0), \varphi(\hat{\alpha}_1)) \hat{V}(\hat{\alpha}) \begin{pmatrix} \varphi(\hat{\alpha}_0) \\ \varphi(\hat{\alpha}_1) \end{pmatrix}$$

where φ is the density of the standard normal distribution.

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