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A FIELD EXPERIMENT ON QUALIFIED YOUNG JOB APPLICANTS IN ILE-DE-FRANCE

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SUMMARY

The aim of this study is to evaluate hiring discrimination against young people in the Ile-de-France region on three different grounds: the reputation of the area they live in, their gender and their ethnic origin (French or Moroccan). The study is based on experimental testing data using a protocol that allows to examine the cross effects of these three dimensions, which we call "conditional discrimination". We study discrimination in a skilled occupation with a high demand - computer developers with MSc-level qualifications – and where discrimination is *a priori* very limited. For this occupation, we have constructed 12 fictional profiles of job applicants that are identical in everything except the characteristic we want to test. We examine area-based discrimination by giving these fictional candidates an address in one of three towns in the Val-d'Oise department: Enghien-les-Bains (good reputation), Sarcelles (poor reputation) and Villiers-le-Bel (poor reputation exacerbated by highly-publicised riots in 2007). Between mid-December 2008 and the end of January 2009, we sent 3684 applications in response to 307 job offers. The study consists in a statistical and econometric analysis of the replies to these applications.

We obtain three main results that all confirm the presence of conditional discrimination for an occupation with high demand. Firstly, if being from Moroccan origin is not globally discriminatory for men, it is a disadvantage for candidates living in Sarcelles: men are less likely to be invited for interview for a permanent job and women have less chance of success for any kind of job. Secondly, the applicant's gender has a distinct effect on their chances of success for candidates from Moroccan origin living in Sarcelles and for candidates from French origin living in Enghien-les-Bains. In the first case, women are penalised compared to men, while in the second case they are favoured. Thirdly, we find an area-based discrimination that affects women only. Living in a disadvantaged town (Villiers-le-Bel or Sarcelles) rather than a "well-off" town (Enghien-les-Bains) reduces a female candidate's probability of obtaining a job interview. We find a stronger discrimination against the women from French origin living in Villiers-le-Bel : they are penalised when they live in this disadvantaged town, the scene of highly publicised riots in 2007, rather than in Sarcelles, an equally disadvantaged but less "notorious" town. Our results show that women from French origin are the most highly affected by area-based discrimination.

INTRODUCTION

Place of residence can have a decisive effect on access to employment. This has been confirmed by numerous works that propose a wide variety of explanatory mechanisms. According to the spatial mismatch hypothesis, the physical distance from job opportunities explains the unemployment of the most vulnerable populations (Kain, 1968). Because of this excessive distance, transport costs become disproportionate in relation to the wages offered (Brueckner and Martin, 1997; Coulson, Laing and Wang, 2001) and the efficiency of job seeking is worsened because of the prospecting costs induced by the distance from jobs (Davids and Huff, 1972; Rogers, 1997; Immergluk, 1998). Furthermore, since housing costs are lower in zones that are distant from or poorly connected to the location of jobs, there are less incentives to look for a well-paid job (Patacchini and Zenou, 2006). In addition to this effect of distance from work, an individual living in a disadvantaged area may suffer from the consequences of residential segregation (through neighbourhood effects). Typically, the social network of an individual living in this type of district is of lower quality, and therefore less propitious to a quick return to work (Selod and Zenou, 2006). For Benabou (1993), the areas that concentrate populations in difficulty slow down the accumulation of human capital (*via* "peer effects") and ultimately impede social mobility. Moreover, in keeping with the "epidemic" theory of ghettos proposed by Crane (1991), social problems that detract from the employability of individuals are transmitted through neighbourhood interactions (O'Reagan, 1993). This socio-spatial segregation can also result in the stigmatisation of certain districts by employers. Boccard and Zenou (2000) use the concept of "redlining" to describe this practice of discriminating on the grounds of spatial zoning. We call this area-based discrimination. One last mechanism stems from the local mismatch between the skills supplied by jobseekers and the skills demanded by employers (the "skill mismatch"). In this case, it becomes difficult for companies to fill vacant posts and for jobseekers to find work, because there is no correspondence between the skills supplied and demanded locally.

Given the variety of mechanisms in operation here, empirical studies seek to measure a specific effect of the place of residence, all else being equal. The idea is to separate the specific effect of district from the effects of the physical distance from work (spatial mismatch) and of the socio-demographic composition of the population which underpin the neighbourhood effects and problems of skill mismatch mentioned above. Hellerstein, Neumark and McInerney (2008), studying the situation in Chicago, show that the physical distance from work is of little significance when one takes the problem of skill mismatch into account at a sufficiently detailed level of observation. On French data, several empirical works have proposed these neighbourhood effects and problems of spatial and skill mismatch – taken separately or together - to explain local differences in unemployment rates or durations (Bouabdallah, Cavaco and Lesueur, 2002; Gaschet and Gaussier, 2004; Dujardin, Selod and Thomas, 2007; Duguet, L'Horty and Sari, 2009; Gobillon, Magnac and Selod, 2010). Even when one controls for the structure of the workforce at a regional level, one can observe pronounced differences in duration of unemployment for neighbouring towns, as well homogeneous "clusters" of districts that cannot be explained by the socio-demographic characteristics of the unemployed, leaving room for area-specific effects (Duguet, Goujard and L'Horty, 2007).

Studies seeking to measure the specific effect of the place of residence on the access to employment use non-experimental data drawn from surveys or administrative sources. They face a classic problem of measurement: the people who live in these disadvantaged areas have particular characteristics that can influence their ability to find a job. Some of these characteristics can be observed, e.g., age, gender or level of qualification, but others cannot, e.g., the individual's intrinsic motivation and willingness to participate in the labour market. But failure to take into account the effect of these characteristics may bias our measurements. That is why existing studies use econometric strategies to try to correct this potential bias. Whatever the quality of these strategies, only a purely experimental approach can allow to control completely for the unobserved heterogeneity and to measure the effect *ceteris paribus*. But to implement this type of approach, we need to design an experiment in which the same people, living both inside and outside the disadvantaged area, apply for the same jobs. *A priori*, this appears impossible to achieve.

The aim of the present study is precisely to study an experimental measurement of the effect of the place of residence on access to employment. Our objective is not only to measure this effect *ceteris paribus*, but also to verify whether the effect is different for different sub-populations. To do so, we have conducted a testing in which we construct two fictitious applications (CVs and cover letters) for a pair of candidates. The two applications are identical in every point except for one *a priori* non-productive characteristic (e.g., the candidate's gender). We send these two applications in response to the same job offers from the same companies. We then look at whether the two candidates enjoy similar access to job interviews. A testing depends on two key elements: respect of the "*ceteris paribus*" principle and credibility of the job applications. English-speaking economists have been using this methodology for over thirty years (Riach and Rich, 2002). It is the only technique that can be used to measure hiring discrimination (Duguet, L'Horty and Petit, 2009).

Most of the testings carried out in France or abroad have examined the effects of gender, origin and skin colour separately. The cross effects of these characteristics have not been evaluated. In France, for example, a recent testing carried out by the International Labour Office compared the access to low-skill jobs for young French people of North African origin and those of "Franco-French" origin in a variety of sectors. Pairs of applications, in which only the candidates' origins differed, were submitted in response to job offers. Some of the pairs were women; others were men. However, the data from this testing cannot be used to evaluate gender-based hiring discrimination according to ethnic origins because the applications from men and women were not submitted to the same job offers.

To our knowledge, only one testing has examined these types of cross effects, measuring the effects of origin and of living in a town containing one or more *Zones Urbaines Sensibles* (Sensitive Urban Areas) (Duguet, Léandri, L'Horty and Petit, 2009). However, the candidates were all men, relatively low-skilled (either *baccalauréat* level or two years of college education). An additional dimension was taken into account in that study: hiring discrimination based on the French- or Moroccan-sounding

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nature of the applicants' first and last names and a combination of the two (French-sounding first name and Moroccan-sounding last name).

Compared to all the previous evaluations of discrimination, the present paper innovates in three directions. Firstly, we focus on the case of young people in the Paris region with high levels of qualification, at the Master level. Previous studies of young people in this region chose lower levels of qualification, of the types BEP, BAC or BAC+2 (Duguet and Petit, 2005; Duguet, Léandri, L'Horty and Petit, 2009). It is worth examining higher levels of qualification because, in terms of the gender wage gap, it is at these levels that women's career prospects and access to managerial positions become restricted compared to men. A similar result is obtained for employees of foreign origin (Aeberhardt and Pouget, 2009). By limiting our field of observation to people with MSc-level qualifications, we can investigate whether hiring discrimination is partly responsible for the "glass ceiling" blocking access to management jobs.[1] We have chosen a skilled occupation with high demand and where where discrimination is *a priori* less expected: computer development.

Secondly, we investigate area-based discrimination in the Ile-de-France region. We evaluate the effects of geographical location (place of residence) on the chances to access employment, all else being equal. Research in the domains of urban and spatial economics generally reveal four main types of explanation, not mutually exclusive, for local disparities in the access to employment: a mismatch in the structure of qualifications supplied and demanded locally, known as *skill mismatch;* problems of physical distance from jobs, given the existing transport infrastructures, referred to as *spatial mismatch; composition effects* in the local population, which can be amplified by *residential segregation effects*; lastly, these disparities can be the result of discriminatory behaviour against specific locations, which we call *area-based discrimination*. Sometimes these explanations are competing, and sometimes they are complementary. Some of them focus on the labour supply side (composition/segregation effects), some on the demand side (area-based discrimination) and some on both at the same time, from a quantitative or qualitative point of view (spatial and skill mismatches). It is important to distinguish between them, because they call for different policies (training policies *versus* transport policies, for example). The aim of the present study is to measure specifically the scale of area-based discrimination, using a protocol of evaluation on experimental data that enables us to neutralise the other dimensions. To our knowledge, this is the first controlled experiment to evaluate area-based discrimination using an experimental approach.

Thirdly, an innovative methodological aspect of the present work is that it allows for measuring forms of conditional discrimination, which combine several determinants. Firstly, our research examines cross effects that have hitherto been unobserved, by investigating the links between gender, place of residence and origin. For example, the idea is not only to measure the relative difficulties encountered by women in finding a job, but also to evaluate the extent to which these difficulties may vary

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[1] The metaphor of the glass ceiling is often used to illustrate the fact that specific groups (such as women or individuals of foreign origin) are less likely to obtain better paid jobs. They have the necessary skills and experience, but their promotion is impeded by "invisible" barriers.

according to the women's origins and the reputation of their place of residence. We then examine the effects of job characteristics and employer characteristics on the scale of hiring discrimination.

The present study exploits the results of a paired testing designed to evaluate the scale of hiring discrimination according to gender and according to whether the candidates live in a town in the Ile-de-France region renowned to be "well-off" (Enghien-les-Bains), in a town renowned to be disadvantaged and having recently experienced highly publicised riots (Villiers-le-Bel), or in a town renowned to be disadvantaged but "riot-free" (Sarcelles). These three towns are located in the same *département* (Val-d'Oise) and at equivalent distances from the center of Paris. In the two towns considered to be disadvantaged, more than 60 % of the inhabitants live in *Zones Urbaines Sensibles* (ZUS – Sensitive Urban Areas) and residents who are registered as unemployed have a probability of leaving unemployment far below the average of the Ile-de-France region. We located four fictional job applicants in each of these three towns (one man and one woman with French-sounding names, and with Moroccan-sounding names). In all other aspects, these 12 applications were perfectly similar. They were sent at the same time in response to the same job offers for computer developers (MSc level) throughout the Ile-de-France region.

Using this protocol, we can evaluate area-based hiring discrimination and the way it varies according to gender and ethnic origin. We can also evaluate discrimination against women according to the reputation of their place of residence and their ethnic origin. The first section of the paper describes the protocol followed for collecting the data. The second section presents the results.

1.   DATA COLLECTION

The data used in this study are experimental. They have been constructed using the paired testing method. The experiment consisted in sending a large number of fictitious applications in response to a sample of job offers available between late 2008 and early 2009. In the present section, we describe in detail how the data were collected.

Test of access to job interviews

We conducted a simple test of access to job interviews. No candidates were actually sent to the interviews. There are two methodological reasons for this choice. Firstly, actually sending candidates to job interviews introduces a bias related to the subjective appreciation by recruiters of the look or personality of the candidates. This inevitable bias is unobservable by researchers and cannot, therefore, be controlled for, potentially leading to a biased measurement of hiring discrimination. We consider that insofar as the organisation of interviews generates a cost for the recruiters, they will only invite those candidates who have a real chance of getting the job. Therefore we assume that possible discriminatory behaviours on the part of the recruiters will be expressed during the process of selecting the applications (the potential grounds for discrimination – gender, ethnic origin, place of

residence and mobility are mentioned explicitly in the applicants' CVs).[2] Notice that the written applications do not include photographs of the candidates. Secondly, this choice simplifies the data collecting process, so that in a given period (two months in this case), we can construct a larger sample (more than 300 job offers tested).

Choice of an occupation with high demand

Our choice of occupation for the testing was based on the *Fichier Historique Statistique* (FHS – historic statistics files) of the *Pôle Emploi* (French Employment Agency), and more precisely on the records of jobseekers registered with the ANPE (the precursor of the *Pôle Emploi*) in 2003 and followed through to 2006. The criteria of selection were the following: we wanted a skilled occupation for which there was a large number of jobseekers in the Ile-de-France and for which the probability of leaving unemployment within twelve months was high. Choosing an occupation for which there is a large number of jobseekers reduces the risk of detection when we simultaneously send a lot of CVs. Choosing an occupation with high demand reduces the rejection rate by employers, independently of any discrimination. This methodological precaution is particularly useful in a context of economic recession. However, the high success rate of job applications for an occupation in high demand also has a disadvantage from our point of view: access to employment is less selective and it is therefore more difficult to observe hiring discrimination for this type of occupation. Following these criteria, we chose the occupation of computer development.

Similar and credible CVs checked by experts

The applications sent in response to the same job offers were similar in terms of productive characteristics. They are similar in terms of qualifications, professional career, quantitative and qualitative experience, and the candidates have the same computing and linguistic skills. None of them had been unemployed and they all had jobs at the time of application. For the targeted occupation, the applications were also credible. They were checked and approved by recognised experts in this domain, to ensure that they were similar, realistic and relevant.

Because they were sent at the same time and in response to the same job offers, these applications had to contain some elements of differentiation. These differences were introduced in the presentation of the CVs, by varying the type and size of font used and the page layout, without departing from a standard form. The candidates all declared professional experience in real companies; these companies were different but comparable in terms of activity and size. The candidates' leisure activities also differed, while remaining very standard and impersonal (sport, cinema, reading, music, etc.). The brief cover letters sent with the CVs were also worded differently, while remaining standard. A postal address, mobile telephone number and e-mail address were attributed to each candidate.

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[2] In most of the paired audit studies that have tested both stages (access to interviews followed by actual interviews with fictitious candidates), discrimination is observed during the first stage (Kenney and Wissoker, 1994; Neumark *et al.*, 1996; ILO, 2007).

Regular permutations of CVs, simultaneous responses to each job offer

To avoid the risk that the style or contents of a particular candidate's application systematically influences the employers' choice (despite the precautions taken in constructing the applications), we have introduced a system of random permutation of CVs and cover letters between the different fictitious candidates.

Applications to each job offer were sent on the same day, and the offer was posted on the Internet at a few minutes interval from each other, by e-mail sent from each candidate's mailbox.

The reply is considered positive when the recruiter invites the candidate for interview or requests more information about the candidate's present situation or qualifications. The reply is considered negative if the recruiter formally rejects the application or does not reply at all.

Individual characteristics of the 12 fictitious candidates

Twelve perfectly similar CVs of young computer developers with five years' higher education (MSc level) were constructed. They differed solely in the candidate's gender, apparent origin and place of residence.

The twelve fictitious candidates explicitly state their French nationality in their CVs; their first and last names indicate their gender and ethnic origins. The first names we chose were the most popular names given to babies at the candidates' year of birth (1983) and the last names associated with a particular origin (French or Moroccan) are among the most common.

The candidates live in Enghien-les-Bains, Villiers-le-Bel or Sarcelles. These three towns are all in the Val-d'Oise *département* (number 95), which neutralises a possible effect of signal at the *département* level, and they are located at equal distances from Paris in terms of transport time, in order to neutralize a possible effect of distance from the job (Sarcelles and Villiers-le-Bel are in fact adjacent). The choice of these towns is justified by the statistics presented in Table 1. Several indicators suggest that the towns of Sarcelles and Villiers-le-Bel can be considered disadvantaged compared to Enghien-les-Bains:

- The rates of exit from unemployment into employment are lower in Sarcelles and Villiers-le-Bel;
- The proportions of individuals without any qualifications are higher in Sarcelles and Villiers-le-Bel;
- The unemployment rates are higher in Sarcelles and Villiers-le-Bel;
- There are more residents of Sensitive Urban Areas in Sarcelles and Villiers-le-Bel, where they represent more than 60 % of the population (Sarcelles has three ZUS and Villiers-le-Bel has two, whereas Enghien-les-Bains has none);
- Individuals living in Enghien-les-Bains have higher taxable incomes.

Table 1: Statistics concerning Enghien-les-Bains, Sarcelles and Villiers-le-Bel

	Enghien-les-Bains	Sarcelles	Villiers-le-Bel
Gross exits from unemployment (return to work) in 2006*	37.36	32.85	32.31
Net exits from unemployment (return to work) in 2006*	34.92	30.50	31.78
Percentage of individuals with no qualifications in 1999**	7.84	23.74	24.95
Unemployment rate in 1999**	9.40	20.88	18.99
Total population living in ZUS	0	46,030	15,982
Percentage of the town's population living in ZUS	0	79.57	61.13
Median taxable income of households per consumption unit in 2006	26,441	11,036	11,575

Sources: * SOLSTICE estimations based on the historic statistics files of Pôle Emploi. ** 1999 Survey. *** INSEE
Interpretation: "gross exits from unemployment" corresponds to the effective rates of exit from unemployment into employment for each city. "Net exits from unemployment" are established by calculating the rates of exit from unemployment that the city would have if it had the same structure of jobseekers as the Ile-de-France region.

The distinction between Villiers-le-Bel and Sarcelles lies in the fact that Villiers-le-Bel was the scene of highly-publicised urban riots in 2007[3]. The repeated coverage of these riots on television and in the press may have damaged the signal sent to potential employers about the place of residence. It is this type of signalling effect that we wish to evaluate by comparing the rates of access to job interviews for candidates from Sarcelles and from Villiers-le-Bel.

The home addresses of the candidates living in Villiers-le-Bel and Sarcelles were located outside of the ZUS, since the aim was to test the effect of the town of residence, not the effect of living in a ZUS. Four fictitious candidates were located in each of the three towns (a man and a woman with French-sounding first and last names and a man and a woman with Moroccan-sounding first and last names, all French nationals). Table 2 presents the individual characteristics of the twelve fictitious candidates.

Table 2: individual characteristics of the 12 candidates

Candidates applying for jobs	Town of residence
Guillaume MARTIN Laëtitia ROUX Karim KHALIS Nora BELKACEM	Villiers-le-Bel
Jérôme THOMAS Delphine RICHARD Youssuf BENCHARGUI Yasmina BRAHIMI	Sarcelles
Frédéric SIMON Emilie DURAND Ahmed CHARBIT Dalila CHETTOUH	Enghien-les-Bains

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[3] The urban riots of 2007 started in Villiers-le-Bel. Between November 25th and 27th, several hundred individuals confronted the police after the deaths of two teenagers, whose minibike collided with a police car at about 5 p.m. on Sunday, November 25th. During these highly-publicised events, firearms were used by the rioters, and, 81 shots were counted. In all, 150 police officers were injured.

The 12 candidates state their age (25 years old), their nationality (French) and their family situation (single, no children) on their CVs.

Productive characteristics of the fictitious 12 candidates

The 12 candidates followed the same school and university education: a science-based *baccalauréat*, followed by a degree in computing and then a MSc in computing from one of the following universities of the Ile-de-France region: Evry-Val d'Essonne, Paris Sud, Paris VI Pierre et Marie Curie, Paris VII Diderot, Paris VIII Vincennes Saint-Denis, Paris XII Val de Marne, Paris XIII, Versailles Saint-Quentin and Marne la Vallée.

The descriptions of work experience and of the position held since entering the labour market have been chosen so as to compensate for possible differences in specialization between the different MSc achieved by the candidates. In the end, their education and experience endow all twelve candidates with equivalent and versatile skill profiles.

Within the framework of their Masters, the fictitious candidates carried out several months of work experience (during both the first year (M1) and the second year (M2)). At the end of their second year, all twelve candidates were recruited into the companies where they had done their work experience. Since then, they have been working for two years as designer-developers in these firms. They are applying for the same type of position, which often involves leading a team.

They all declare the same computing skills on their CVs:

Programming: C, C#, C++, Java, XML, SCILAB, PHP, .net, J2EE
Environments: Unix, LINUX, WINDOWS
Web development: Ajax, Web.2, HTML, Javascript, .NET, GWT, RAILS, SPIP.
Databases: SQL-Server, TSQL, MySQL
Project management: UML, MERISE, Rational Rose
Protocols: TCP/IP, SSH, FTP

The recruitment process and the recruiters' profiles

Three types of employers seek to hire Masters graduates in computing: end businesses (operating in sectors other than computing), computer engineering companies and recruitment agencies. Internet is the only medium used by these recruiters to advertise their job vacancies. The websites "monster.fr", "apec.fr", "cadremploi.fr", "lesjeudis.fr" and "pole-emploi.fr" were consulted every day to collect and reply to job offers falling within the scope of the testing.

The field of the study included all job offers for full-time computer developers, with long or fixed-term contracts, located in the Ile-de-France region. We tested all such job offers brought to our attention between mid-December 2008 and the end of January 2009. Overall, 307 job offers were tested, meaning that a total of 3684 applications were sent (12 x 307).

For each job offer tested, there are several variables that could potentially reveal the existence of conditional discrimination: those relating to the testing itself, those relating to the type of job and those relating to the company offering the job. These variables, presented in Table 3, have been evaluated on the basis of information available in the job add and by matching with administrative files.

Table 3: Potential sources of conditional discrimination

TYPE OF VARIABLES	VARIABLES	SOURCES
Variables relating To the testing	- Website hosting the job offer - Date on which the applications were sent - Recruiter's reply - CV used (see permutations)	Job offer
Variables relating to the job offered	- Type of contract (long or fixed-term) - Experience required - Diploma required - Indicator specifying whether the salary is negotiable - Level of salary offered - Location of the job	
Characteristics of the company offering the job	- Gender of the recruiter - size of the workforce - Subsidiary of a large company or not - Turnover - Line of business	SIREN database of the INSEE
Characteristics of the town in which the job is located	- Percentage of non-EU foreigners - Age structure of the population - Number of ZUS - Percentage of the town's active population living in ZUS - Probability of leaving unemployment in the town - Deciles of taxable income in the town - Percentage of inhabitants who pay income tax - Percentage of inhabitants who pay social taxes	1999 census INSEE Solstice Ministry of Finance
Transport characteristics and commuting times	- Public transport lines used to commute - Public transport line on which the job is located - Commuting time by road	- Ratp.fr (rush-hour train times) - Mappy.fr (rush-hour times) - Ministry of Transportation.

2. RESULTS

This section presents the main statistical results obtained from the testing. The additional tables concerning conditional discrimination are included in Appendix 1. The statistical and econometric methods are described in Appendix 2.

Women from Moroccan origin living in Sarcelles and Villiers-le-Bel have the lowest success rate

Table 4 shows the success rates for each candidate profile on the same job offers. Out of all the applications sent, more than one half (52.1%) have received at least one positive response, reflecting the strong demand in this occupation (MSc-level computer specialists).

Among the candidates from French origin, the men living in Sarcelles and the women living in Enghien or Sarcelles had the highest success rates (19.9%, 22.5% and 22.1% respectively). Conversely, men living in Enghien or Villiers-le-Bel had lower success rates (16.9% and 18.6% respectively), as did women living in Villiers-le-Bel (17.9%). Among the candidates from Moroccan origin, women living in Enghien had the highest success rate (19.5%), together with men living in Enghien or Sarcelles (18.6% and 19.2% respectively). The candidates from Moroccan origin who received the lowest numbers of invitations to interviews were the men living in Villiers-le-Bel (17.3%) and the women living in Sarcelles (13.7%) or Villiers-le-Bel (15%).

Table 4: Gross success rates for the same job offers

The Student's t-statistics and confidence intervals were calculated by the bootstrap with 10,000 repetitions. *: significant at the 10% level; **: significant at the 5% level.

	Success rate	Student	Confidence interval at the 90% level	
			Lower bound	Upper bound
French origin				
Women:				
Enghien	22.5%**	9.39	18.6%	26.4%
Sarcelles	22.1%**	9.31	18.2%	26.1%
Villiers-le-Bel	17.9%**	8.23	14.3%	21.5%
Men:				
Enghien	16.9%**	7.95	13.4%	20.5%
Sarcelles	19.9%**	8.76	16.3%	23.8%
Villiers-le-Bel	18.6%**	8.40	15.0%	22.1%
Moroccan origin				
Women:				
Enghien	19.5%**	8.71	16.0%	23.1%
Sarcelles	13.7%**	6.96	10.4%	16.9%
Villiers-le-Bel	15.0%**	7.31	11.7%	18.2%
Men:				
Enghien	18.6%**	8.45	15.0%	22.1%
Sarcelles	19.2%**	8.58	15.6%	23.1%
Villiers-le-Bel	17.3%**	7.96	13.7%	20.8%
Overall positive reply rate[1]	**52.1%**			

1. Percentage of job offers for which the candidates received at least one positive reply.

Men from Moroccan origin are not systematically discriminated against

For most locations, being from Moroccan origin is not systematically discriminated against for men (Table 5). In Table 4, we saw that being from French origin increased the chances of success for all profiles except men living in Enghien. We can now see that none of these differences are statistically significant: no significant discrimination appears for men. It should be recalled that we have chosen an occupation where the demand for labour is very strong, and discrimination is *a priori* unlikely, because it can be very costly for an employer to discriminate on a market where candidates are scarce relative to the number of job offers. We have deliberately chosen a field that is *a priori* rather unfavourable to hiring discrimination.

But being from Moroccan origin does lower the chances of success for people living in Sarcelles

So overall, being from Moroccan origin is not a factor of discrimination for men, whether they live in Sarcelles, Villiers-le-Bel or Enghien-les-Bains. However, this average result conceals a composition effect: among the male candidates living in Sarcelles, those from Moroccan origin are less likely to obtain interviews for a job with a long-term contract (Appendix, Table A3). Among the female candidates living in Sarcelles, those from Moroccan origin are also at a disadvantage compared to the candidates from French origin: they are significantly less likely to be invited at an interview (-8.5 points).

Discrimination *against* women from Moroccan origin living in Sarcelles and *in favour* of women from French origin living in Enghien

We compare the access to job interviews between men and women, for a given place of residence and origin. Women from French origin living in Enghien enjoy a *positive* discrimination compared to the men from the same origin. The difference in their favour is +5.5 points. On the contrary, women from Moroccan origin living in Sarcelles are less likely to obtain interviews than the men from the same origin (-5.5 points).

Area-based discrimination affects women only

We examine the effect of the place of residence on the same job offers, taking the situation of Enghien as reference. We find significant effects of the place of residence, but only for women. More precisely, we find three significant effects: there is discrimination against women from French origin living in Villiers-le-Bel (-4.6 points), and against women from Moroccan origin living in either Sarcelles (-5.9 points) or Villiers-le-Bel (-4.6 points). Therefore, only the women appear to be discriminated against when they live in Villiers-le-Bel or Sarcelles rather than in Enghien.

A "Villiers-le-Bel" effect against women from French origin

Lastly, we compare discrimination against the candidates from Villiers-le-Bel compared to those living in Sarcelles. We find that the women from French origin are the only candidates to suffer from this area-based discrimination. The chances of being invited to a job interview for the French origin women living in Villiers-le-Bel are 4.2 points lower than for the French origin women living in Sarcelles.

Table 5: Differences in success rates for the same job offers

The Student's t-statistics and confidence intervals were calculated by the bootstrap with 10,000 repetitions.
* significant at 10%; ** significant at 5%.

Pairwise comparisons for the same job offers	Difference in success rates (in %)	Student	Confidence interval at the 90% level	
			Lower bound	Upper bound
Effect of origin by gender and place of residence (France-Morocco)				
Women:				
Enghien	2.9	1.25	-1.0	6.8
Sarcelles	8.5	3.66**	4.6	12.4
Villiers-le-Bel	2.9	1.28	-1.0	6.5
Men:				
Enghien	-1.6	0.69	-5.5	2.3
Sarcelles	0.7	0.24	-3.9	5.2
Villiers-le-Bel	1.3	0.54	-2.6	5.2
Effect of gender by origin and place of residence (Men-Women)				
France:				
Enghien	-5.5	2.24**	-9.8	-1.6
Sarcelles	-2.3	0.84	-6.8	2.3
Villiers-le-Bel	0.7	0.29	-2.9	4.2
Morocco:				
Enghien	-1.0	0.42	-4.9	2.9
Sarcelles	5.5	2.33**	1.6	9.4
Villiers-le-Bel	2.3	0.90	-2.0	6.5
Effect of living in a disadvantaged city by origin and gender (Enghien-Sarcelles)				
France, Women	0.3	0.13	-3.9	4.2
France, Men	-2.9	1.26	-6.8	0.7
Morocco, Women	5.9**	2.55	2.0	9.8
Morocco, Men	-0.7	0.28	-4.6	3.3
Effect of media coverage for a disadvantaged city by origin and gender (Sarcelles-Villiers-le-Bel)				
France, Women	4.2**	1.98	0.7	7.8
France, Men	1.3	0.60	-2.3	4.9
Morocco, Women	-1.3	0.55	-5.2	2.6
Morocco, Men	2.0	0.83	-2.0	5.9
Combined effect of media coverage and of living in a disadvantaged city by origin and gender (Enghien-Villiers-le-Bel)				
France, Women	4.6*	1.83	0.3	8.8
France, Men	-1.6	0.74	-5.2	2.0
Morocco, Women	4.6*	1.86	0.7	8.5
Morocco, Men	1.3	0.54	-2.6	5.2

Example: Women from French origin living in Sarcelles have a higher success rate than women from Moroccan origin living in the same city (+8.5%). The difference is significant at the 5% level (Student's *t*: 3.66).

Table 6: Corrected discrimination coefficients

The coefficients of discrimination are calculated from the ordered Probit regressions presented in Appendix 1. They represent the coefficients of discrimination at the average point of the sample, and they can be interpreted as in Table 5. * significant at 10%; ** significant at 5%.

Pairwise comparisons on the same job offers	Difference (% points)	Student
Effect of origin by gender and place of residence (France-Morocco)		
Women:		
Enghien	2.9%	1.27
Sarcelles	7.7%	3.76**
Villiers-le-Bel	2.9%	1.39
Men:		
Enghien	-1.3%	0.59
Sarcelles	0.6%	0.29
Villiers-le-Bel	1.1%	0.55
Effect of gender by origin and place of residence (Men-Women)		
France :		
Enghien	-5.3%	2.20**
Sarcelles	-2.3%	1.03
Villiers-le-Bel	0.4%	0.20
Morocco		
Enghien	-0.8%	0.42
Sarcelles	5.2%	2.32**
Villiers-le-Bel	2.5%	1.11
Effect of living in a disadvantaged city by origin and gender (Enghien-Sarcelles)		
France, Women	0.3%	0.16
France, Men	-2.3%	1.27
Morocco, Women	6.0%	2.81**
Morocco, Men	-0.6%	0.32
Effect of media coverage for a disadvantaged city by origin and gender (Sarcelles-Villiers-le-Bel)		
France, Women	3.9%	2.12**
France, Men	1.2%	0.57
Morocco, Women	-1.1%	0.54
Morocco, Men	1.8%	0.78
Combined effect of media coverage and of living in a disadvantaged city by origin and gender (Enghien-Villiers-le-Bel)		
France, Women	4.3%	1.88*
France, Men	-1.1%	0.57
Morocco, Women	4.3%	2.12**
Morocco, Men	1.2%	0.56

Table 7: Exact Binomial test of discrimination

The analysis is limited to the job offers for which the candidates of the two groups have obtained different answers (1st group accepted and 2nd group rejected or *vice versa*). Exact binomial test of equal treatment. * Significant at 10%; ** significant at 5%.

Pairwise comparisons on the same job offers	1st group preferred (N1)	2nd group preferred (N2)	P1=N1/(N1+N2)	Null hypothesis: P1 = 1/2		
					P- values	
				Alternative P1 < 1/2	Alternative P1 > 1/2	Alternative P1 ≠ 1/2
Origin	**France**	**Morocco**				
Women:						
Enghien	30	21	0.588	0.920	0.131	0.262
Sarcelles	39	13	0.750	1.000	2.1E-04**	4.1E-04**
Villiers-le-Bel	29	20	0.592	0.924	0.126	0.253
Men:						
Enghien	24	29	0.453	0.292	0.795	0.583
Sarcelles	36	34	0.514	0.640	0.452	0.905
Villiers-le-Bel	29	25	0.537	0.752	0.342	0.683
Gender	**Men**	**Women**				
France:						
Enghien	20	37	0.351	0.017**	0.992	0.033**
Sarcelles	31	38	0.449	0.235	0.832	0.470
Villiers-le-Bel	24	22	0.522	0.671	0.441	0.883
Morocco:						
Enghien	24	27	0.471	0.390	0.712	0.780
Sarcelles	36	19	0.655	0.993	0.015**	0.030**
Villiers-le-Bel	34	27	0.557	0.847	0.221	0.443
Disadvantaged area	**Enghien**	**Sarcelles**				
France – Women	30	29	0.508	0.603	0.500	1.000
France – Men	21	30	0.412	0.131	0.920	0.262
Morocco – Women	34	16	0.680	0.997	0.008**	0.015**
Morocco – Men	24	26	0.480	0.444	0.664	0.888
Media coverage	**Sarcelles**	**Villiers-le-Bel**				
France - Women	28	15	0.651	0.984	0.033**	0.066*
France – Men	25	21	0.543	0.769	0.329	0.659
Morocco – Women	24	28	0.462	0.339	0.756	0.678
Morocco – Men	29	23	0.558	0.834	0.244	0.488
Disadvantaged area and media coverage	**Enghien**	**Villiers-le-Bel**				
France - Women	37	23	0.617	0.974	0.046**	0.092*
France – Men	21	26	0.447	0.280	0.809	0.560
Morocco – Women	35	21	0.625	0.978	0.041**	0.081*
Morocco - Men	29	25	0.537	0.752	0.342	0.683

Example: Among the female candidates living in Sarcelles, those from French origin were preferred to those from Moroccan origin in 39 out of 52 cases (=39+13), and those from Moroccan origin were preferred in the other 13 cases. Thus, women from French origin were preferred in 75% of the cases. This proportion is significantly different from ½ at the 5% level, so that there is discrimination against women from Moroccan origin living in Sarcelles.

The study conducted in Table 5 controls for the characteristics of the candidates but not for those of the recruiting companies or the jobs offered. We have therefore carried out further regressions in order to correct the gaps in Table 5 for the job and company characteristics, as explained in Appendix 2. This allows us to calculate corrected discrimination coefficients, which are presented in Table 6. All the previous results remain valid. The most pronounced correction concerns discrimination against women from Moroccan origin living in Sarcelles: it falls from 8.5% to 7.7% after correction, without any important effect on our results.

Lastly, we have used a third method for measuring discrimination: the exact binomial test of equal treatment, which is valid on small samples. According to this approach, we restrict the analysis at those job offers where one candidate was preferred to the other (unequal treatment), since these are the only offers that can contribute to the measurement of discrimination. Then, we calculate the proportion of such offers where the candidate from the first group was strictly preferred to the candidate of the second group and test whether this proportion is equal to ½, since it corresponds to the case of equal treatment of both candidates. This test has the advantage of being exact (i.e., valid for small samples) rather than asymptotic (i.e., valid for large samples only). The results are presented in Table 7, and are qualitatively identical to those of the two previous methods.

CONCLUSION

This study examines the cross effects of gender, origin and the place of residence on hiring discrimination. The evaluations are based on experimental data obtained from paired testing conducted between December 2008 and January 2009 and targeting the occupation of computer specialists with MSc-level qualifications in the Ile-de-France region. 12 comparable CVs were constructed and sent in response to 307 job offers throughout the Ile-de-France.

We find three main results. Firstly, as a general rule, there is no systematic discrimination against men from Moroccan origin in access to job interviews in this high-demand occupation, whatever their place of residence. However, those who live in Sarcelles are less likely than the men from French origin to obtain an interview for a job with a long-term contract. Origin also has a negative effect on the access to job interviews for women living in Sarcelles. Secondly, the candidate's gender has a clear effect on the chances of success for the candidates from Moroccan origin living in Sarcelles, and for the candidates from French origin living in Enghien-les-Bains. In the first case, women are penalized compared to men, whereas in the second case they are advantaged. Thirdly, we find area-based discrimination that affects women only. Female applicants living in a disadvantaged area (Villiers-le-Bel or Sarcelles) rather than in a well-off town (Enghien-les-Bains) are less likely to be invited to job interviews. We find that living in Villiers-le-Bel is more highly discriminated against: female candidates from French origin are penalized when they live in this disadvantaged town, the scene of highly-publicised urban riots in 2007, rather than in Sarcelles, an equally disadvantaged but less "notorious" town.

These results confirm the existence of hiring discrimination, based on origin, gender and place of residence. Even in an occupation *a priori* unfavourable to discrimination – a qualified occupation with a high demand where hiring discrimination may be excessively costly to employers, we find multiple statistical proofs of the existence of conditional discrimination. Our results are robust; they persist even when we diversify the statistical methods and intensify the controls, by taking into consideration the variables characterizing the nature of the job offers. They lead us to the conclusion that there is a specific and substantial effect of the place of residence on access to employment, independently of the individual characteristics of the candidates, which are controlled for by the experimental approach.

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APPENDIX 1: Estimations of conditional discrimination

Table A-1: Effects of origin – ordered Probit regressions used to calculate the corrected coefficients of discrimination

Dependent variable: -1: Moroccan origin preferred; 0: identical treatment; 1: French origin preferred. Result of backward selection at the 10% level. The following variables have been included in the initial regressions: recruiter's gender, source of job offer (APEC, les jeudis, others), type of job contract (permanent, fixed-term), type of CV, date of application (December, January), salary proposed, public transport used (metro, RER, bus, tramway, train), commuting time, location of job (existence of ZUS, median income, interdecile ratio, percentage of taxable households), variables of the company (age, size, export rate).

	Women						Men					
City	**Enghien**		**Sarcelles**		**Villiers-le-Bel**		**Enghien**		**Sarcelles**		**Villiers-le-Bel**	
Variables	**Coeff**	**Student**	**Coeff**	**Student**	**Coeff**	**Student**	**Coeff**	**Student**	**Coeff**	**Student**	**Coeff**	**Student**
1st constant	-1.46	12.99	-1.86	13.11	-1.51	13.64	-1.50	13.09	-1.60	13.49	-1.50	13.15
2nd constant	1.44	13.08	1.23	12.48	1.31	13.25	1.57	13.05	1.24	12.74	1.33	12.89
B-type CV									0.49	3.12	0.52	3.28
RER	-0.54	2.38	1.26	3.17								
Train	-0.40	1.90	-0.73	1.71			0.75	4.12				
Car *vs.* publ. trans. commuting time			-0.01	1.78								
Source: Les Jeudis											0.38	2.37
Job in ZUS			-0.46	1.83								
Size: 1-9	0.77	3.09	-0.60	2.25								
Size: 10-19												
Size: 20-49	0.50	2.09										
Size: 50-99	0.63	2.33	-0.65	2.28								
Size: 100-249												
Size: 250 and more									-0.64	2.50	-0.54	1.92
Export rate: less than 5%			-0.59	1.70								
Export rate: between 5% and 50%			-1.19	2.30								
Age of the company							0.01	1.78			0.02	2.15
Recruiter: male							-0.36	1.92				
Permanent contract							-0.78	2.81			0.66	2.54

Dependent variable: -1: woman preferred; 0: identical treatment; 1: man preferred. Result of backward selection at the 10% level. The following variables have been included in the initial regressions: recruiter's gender, source of job offer (APEC, les jeudis, others), type of job contract (permanent, fixed-term), type of CV, date of application (December, January), salary proposed, public transport used (metro, RER, bus, tramway, train), commuting time, location of job (existence of ZUS, median income, interdecile ratio, percentage of taxable households), variables of the company (age, size, export rate).

	French origin						Moroccan origin					
City	Enghien		Sarcelles		Villiers-le-Bel		Enghien		Sarcelles		Villiers-le-Bel	
Variables	**Coeff**	**Student**	**Coeff**	**Student**	**Coeff**	**Student**	**Coeff**	**Student**	**Coeff**	**Student**	**Coeff**	**Student**
1st constant	-1.19	12.68	-1.35	12.45	-1.61	13.29	-1.50	13.09	-1.60	13.49	-1.50	13.15
2nd constant	1.52	13.61	1.51	13.15	1.58	13.11	1.57	13.05	1.24	12.74	1.33	12.89
B-type CV			-0.59	3.62					0.49	3.12	0.52	3.28
January			-0.43	2.64	-0.47	2.41						
RER			-2.28	3.91	-0.72	3.94						
Train							0.75	4.12				
Commuting time by car			0.02	2.68								
Source: Les Jeudis											0.38	2.37
Source: APEC					0.57	2.52						
% taxable households	4,10E-03	2.02										
Size: 1-9			0.61	2.46	0.52	1.95						
Size: 10-19												
Size: 20-49												
Size: 50-99					0.66	2.31						
Size: 100-249												
Size: 250 and more			-0.62	2.21					-0.64	2.50	-0.54	1.92
Export rate: less than 5%			0.64	1.87	0.90	2.58						
Export rate: between 5% and 50%												
Age of the company			0.02	1.98			0.01	1.78			0.02	2.15
Recruiter: male							-0.36	1.92				
Permanent contract							-0.78	2.81			0.66	2.54

Table A-3: Effects of living in a disadvantaged city - ordered probit regressions used to calculate the corrected coefficients of discrimination

Dependent variable: -1: Sarcelles preferred; 0: identical treatment; 1: Enghien preferred. Result of backward selection at the 10% level. The following variables have been included in the initial regressions: recruiter's gender, source of job offer (APEC, les jeudis, others), type of job contract (permanent, fixed-term), type of CV, date of application (December, January), salary proposed, public transport used (metro, RER, bus, tramway, train), commuting time, location of job (existence of ZUS, median income, interdecile ratio, percentage of taxable households), variables of the company (age, size, export rate). Variables in differences are also included but do not measure discrimination.

Origin	French				Moroccan			
Gender	Women		Men		Women		Men	
Variables	Coeff	Student	Coeff	Student	Coeff	Student	Coeff	Student
1st constant	-1.46	12.99	-1.50	12.85	-1.72	13.24	-1.53	13.23
2nd constant	1.44	13.08	1.71	13.02	1.27	12.93	1.58	13.16
Metro					-0.69	1.96		
RER	-0.54	2.38	1.49	2.69			0.51	1.95
Train	-0.40	1.90						
Bus							1.02	2.17
Source: APEC			-0.63	2.79			-0.57	2.85
type B CV			0.62	3.49			-0.50	2.98
January			0.56	2.82				
Commuting time by car			-0.01	2.15			-0.02	2.57
Car *vs.* publ. trans. commuting time							0.02	2.35
Size: 1-9	0.77	3.09						
Size: 10-19								
Size: 20-49	0.50	2.09						
Size: 50-99	0.63	2.33						
Size: 100-249								
Size: 250 and more								
Export rate: less than 5%								
Export rate: between 5% and 50%					-0.87	1.80		
Age of the company			-0.01	1.81			0.02	2.04
Job in ZUS					-0.60	2.67		
Median income							2.78E-05	1.65
Variables in differences:								
Metro			0.85	2.04				
RER			-1.92	3.40	-0.73	1.94		
Bus			-1.45	1.72				

Table A-4: Effects of media coverage for a disadvantaged city - ordered Probit regressions used to calculate the corrected coefficients of discrimination

Dependent variable: -1: Villiers-le-Bel preferred; 0: identical treatment; 1: Sarcelles preferred. Result of backward selection at the 10% level. The following variables have been included in the initial regressions: recruiter's gender, source of job offer (APEC, les jeudis, others), type of job contract (permanent, fixed-term), type of CV, date of application (December, January), salary proposed, public transport used (metro, RER, bus, tramway, train), commuting time, location of job (existence of ZUS, median income, interdecile ratio, percentage of taxable households), variables of the company (age, size, export rate). Variables in differences are also included but do not measure discrimination.

Origin	French				Moroccan			
Gender	Women		Men		Women		Men	
Variables	Coeff	Student	Coeff	Student	Coeff	Student	Coeff	Student
1st constant	-1.80	13.28	-1.50	13.62	-1.44	13.23	-1.46	13.53
2nd constant	1.44	12.94	1.41	13.44	1.53	13.26	1.34	13.20
Metro								
RER								
Train								
Bus								
Source: APEC	0.52	2.60					0.35	1.87
Type 2 CV	0.49	2.79			0.28	1.77		
January								
Permanent contract					0.56	2.16	-0.55	2.13
Commuting time by car								
Car *vs.* publ. trans. commuting time								
Size: 1-9					0.46	1.81		
Size: 10-19								
Size: 20-49								
Size: 50-99					0.71	2.57		
Size: 100-249								
Size: 250 and more								
Export rate: less than 5%								
Export rate: between 5% and 50%					0.94	1.93		
Age of the company			0.01	1.69				
Job in ZUS								
Median income					-3.20E-05	2.31		
Variables in differences:								
Commuting time by car	-0.16	2.96			-0.24	2.23		

Table A-5: Combined effects of media coverage and living in a disadvantaged area - ordered Probit regressions used to calculate the corrected coefficients of discrimination

Dependent variable: -1: Villiers-le-Bel preferred; 0: identical treatment; 1: Enghien preferred. Result of gradual elimination at 10% level. The following variables have been included in the initial regressions: recruiter's gender, source of job offer (APEC, les jeudis, others), type of job contract (permanent, fixed-term), type of CV, date of application (December, January), salary proposed, public transport used (metro, RER, bus, tramway, train), commuting time, location of job (existence of ZUS, median income, interdecile ratio, percentage of taxable households), variables of the company (age, size, export rate). Variables in differences are also included but do not measure discrimination.

Origin	French				Moroccan			
Gender	Women		Men		Women		Men	
Variables	Coeff	Student	Coeff	Student	Coeff	Student	Coeff	Student
1st constant	-1.53	13.41	-1.49	13.30	-1.67	13.09	-1.50	13.36
2nd constant	1.25	12.66	1.58	13.21	1.34	12.73	1.42	13.08
RER	-0.34	2.17					1.25	1.81
Train					0.84	1.91		
Source: APEC					0.53	2.39		
Source: Les Jeudis					0.68	3.42		
B type CV			0.35	2.10	0.38	2.36	-0.32	2.00
Permanent contract	0.62	2.41			0.66	2.37	-0.55	2.13
Commuting time by car					-0.01	3.27		
Car *vs.* publ. trans. commuting time					0.02	2.78		
Size: 1-9	0.48	1.97						
Size: 10-19								
Size: 20-49	0.55	2.34						
Size: 50-99	0.53	1.99						
Size: 100-249								
Size: 250 and more								
Median income			2.53E-05	3.70			6.62E-05	2.60
% taxable households							-0.04	2.85
Variables in differences:								
Metro			0.68	1.77				
RER							0.72	2.74
Train							0.68	2.10

1. Descriptive statistics and bootstrapped standard errors

The data we use are experimental. For that reason, the descriptive statistics provide a good measurement of discrimination. We therefore compare the success rates, for the same job offers, between applications that differ only in terms of gender, origin or place of residence. We use the bootstrap method to determine whether these differences in success rates are significant or not. By using this method, we avoid making strong hypotheses about the distribution of the data. We proceed by constructing ten thousand random samples with replacement from our dataset, and then we calculate the statistics of interest for each of these ten thousand samples. The ten thousand statistics thus obtained give us an approximation of the distribution of the statistic of interest. We calculate a Student's *t* by dividing the difference by its standard deviation, and calculate a confidence interval by taking the corresponding percentiles of this distribution.

2. Corrected discrimination coefficients

The descriptive statistics allow us to measure overall discrimination. However, it may be that specific characteristics of the candidates, or of the job, affect the intensity of discrimination. If the discrimination appears only when an independent variable takes a specific value, we call it "conditional discrimination". In the current practise of testing, the experimenter can control the characteristics of the applications, but not those of the recruiting companies, since (s)he replies to all the relevant job offers. It is therefore possible that the employers' characteristics reveal conditional discrimination. The aim of the Probit regressions is firstly, to check whether the characteristics of the candidate or the job have a significant influence on the measurement of discrimination, and secondly, to produce a corrected measurement of discrimination when a problem is detected.

In each of the testings we have carried out, we compare two applications. There are three possible results: the first candidate is chosen only, the second candidate is chosen only, or they both receive the same response. This is equivalent to studying the difference between the replies they receive. By coding 1 for a positive response and 0 for a negative response, we obtain: 0-1=-1 when the second candidate is accepted but not the first, 0-0=0 or 1-1=0 when the two candidates receive the same response, and 1-0=1 when only the first candidate is accepted. Therefore, the difference in replies provides a measurement of discrimination against the second candidate (-1: he/she is favoured; 0: equal treatment; 1: he/she is discriminated against). This is an ordered qualitative variable, which we explain in terms of the independent variables available. In order to estimate this type of relation, the most widely-used models are the ordered Logit and ordered Probit models, which are based on different distributional assumptions (logistic and normal, respectively). We estimate these models by maximum likelihood, and use the Vuong test to determine which model has the best fit. In most cases,

the Vuong test concludes that they are equivalent, and in some cases that the ordered Probit model provides a better fit. For this reason, we report the results of the ordered probit model only.

We estimate an ordered Probit model in order to correct the discrimination coefficients by the control variables available in the dataset. The left hand variable is defined by the difference of answers to the two candidates, which are binary variables (1 for yes, 0 for no). The left hand variable equals -1 when the second candidate is preferred to the first candidate, 0 when the candidates have the same treatment (both accepted or both rejected) and 1 when the first candidate is preferred to the second candidate.

The response variable y is assumed to be generated by a simple employer utility model: let $U_i(1)$ the utility associated to the first candidate and $U_i(2)$ the one associated to the second candidate. The difference of utilities between the two alternatives is equal to:

$$y_i^* = U_i(1) - U_i(2)$$

The ordered Probit model assumes that:

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

where X is a vector of control variables and u a standard normal disturbance representing the unobservable factors affecting the utilities (uncorrelated with X). The response variable is defined by :

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

where (a_0, a_1) are two unknown thresholds. If the difference of utilities is high, one candidate will be taken only. 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 cdf of the standard normal distribution and $\alpha_1 = a_1 - b_0$ is the first intercept of the ordered Probit model.

The probability that the second candidate is 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 intercept of the ordered Probit model. The discrimination coefficient at the mean point of the sample is therefore :

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

If we use centered variables ($\overline{X} = 0$) when running the regression, this definition simplifies to:

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

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 estimates of the two intercepts of the ordered Probit model. The computation of the asymptotic variance is straightforward using the delta method :

$$\hat{V}\text{as}(\hat{D}) = \frac{\partial D}{\partial \alpha}(\hat{\alpha}) V\text{as}(\hat{\alpha}) \frac{\partial D}{\partial \alpha'}(\hat{\alpha})$$

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